British Society for Geomorphology Annual Conference

Edinburgh, 4-6th September 2023

John McIntyre Conference Centre at the University of Edinburgh's Pollock Halls

Old Harry Rocks, Dorset. Photo by Edwin Baynes, all rights reserved. Runner up in the 2022 BSG Photo Competition

BSG British Society for Geomorphology

Earth Surface Processes and Landforms

THE UNIVERSITY of EDINBURGH

Contents

Welcome to the British Society for Geomorphology Annual Conference 2023

We are delighted to welcome you to Edinburgh for the BSG annual conference. We have an exciting programme for you, which includes three field trips, a mix of oral and poster presentations delivered by geomorphologists from all career stages, and for the first time the **Cuchlaine King Symposium.** We will also have dedicated workshops for early career and professional geomorphologists, and, if you are interested in the healthy governance of the society, you are invited to the Annual General Meeting after the conclusion of the scientific programme.

Registration costs have been kept to a minimum to promote participation, and thanks to the generous financial support of the BSG and its associated journal, *Earth Surface Processes and Landforms*, edited by Wiley.

What is included in your registration

Registration fees include access to conference, buffet lunches, tea/coffee breaks and snacks, welcome reception on Monday night, plus retrospective access to recordings.

Online attendance to the conference is free ***but you still need to register***. Information about online attendance to talks (synchronous) and posters (asynchronous) will be provided to registrants shortly before the conference (Zoom link to talks, and link to platform where posters will be displayed).

Still haven't registered?

Registration will remain open until the conference begins:
https://www.efdelegates.ed.ac.uk/BSGregistration

Ceilidh Dancing

Interested in **Ceilidh dancing** on Tuesday 5th September, 8pm, at Summerhall? Tickets are available for £10 at https://tickets.summerhall.co.uk/event/26:5109/26:67895/ Note that this is just a good old fashioned Ceilidh and not exclusive to BSG conference attendees.

Any questions?

For registration-related queries: BSGregistration@ed.ac.uk

For other matters, contact Mikael Attal or Simon Mudd: mikael.attal@ed.ac.uk or simon.m.mudd@ed.ac.uk.

M. Attal and S. Mudd, August 2023

Location

The conference will take place at the John McIntyre Conference Centre at the University of Edinburgh's Pollock Halls (https://www.uoecollection.com/conferences-events/venue-hubs/pollock-estate/john-mcintyre-conference-centre/), at the foot of Arthur's Seat (Edinburgh's extinct volcano). Attendees will have access to the University's accommodation with a 10-15% discount using the promo code EVENT (https://www.uoecollection.com/hotels/), but may also find suitable hotels and B&B in the nearby vibrant city centre. Pollock Halls is located to the south of Edinburgh Waverley railway station, adjacent to Holyrood Park and Arthur's Seat. It is approximately a 30-minute walk from the Waverley station to the conference venue.

Public transport

Edinburgh has a locally owned bus service (Lothian Buses) that covers the entire city. You can pay by tapping a bank card, and fares are capped after 3 trips (£2 per journey, daily capped fare of £5). The buses are a great way to explore the city, and the Lothian Buses app has bus times, routes, journey planner, and GPS locations of buses.

The most direct routes to the conference centre from Waverley Railway Station are the 5, 14, 30, and 33.

From the airport

A taxi to the conference centre is ~£50. From the airport you can also take with a tram. There is a tram that stops in the city centre at St Andrews Square (£7.50 one way, 35 minutes) or the 100 Airport Bus (£5.50 one way, 35 minutes). The bus stops near Waverley Station. The latter is more convenient for making connections to buses headed towards the conference centre.

Driving

There are limited parking spaces at the conference centre that are available on a first come, first served basis. Parking in Edinburgh is restricted so if you cannot find a parking space in Pollack Halls you will need to either pay for street parking or park outside the controlled area. The best uncontrolled are to park is in the Blackford Neighbourhood just north of the University of Edinburgh's King's Buildings. Here is a map:
https://www.edinburgh.gov.uk/parking-permits/parking-permit-address-search/1

Location Maps

The train station and John McIntyre Conference Centre are highlighted in red. Red arrow shows entrance of Pollock Halls; pick-up for the field trips will take place there. The red star shows the location of the Institute of Geography on Drummond Street where the Monday morning workshops will take place.

Field trips

We are running three field trips. You must have already registered to take part. Logistics details will be sent to participants who have registered.

NOTE: REGISTRATION TO THE EDDLESTON WATER TRIP WILL REMAIN OPEN UNTIL 30th AUGUST. TO REGISTER: https://www.efdelegates.ed.ac.uk/BSGregistration. If you have already registered to the conference, select the attendee type "Add On Package", complete the details as normal, and select the field trip on the next page.

- **1-day trip, East Lothian Sunday 3rd September**

An East Lothian coastal field trip looking at markers of postglacial isostatic rebound (raised beaches, knickpoints) and Storegga tsunami deposits.

- **1-day trip, Eddleston Water Sunday 3rd September**

Visit of the Eddleston Water which has just been designated a UNESCO global Ecohydrology demonstration site (https://www.dundee.ac.uk/stories/environmental-project-gains-unesco-recognition).

- **2-day trip, Glencoe / Cairngorms, with one overnight stay, Saturday 2nd - Sunday 3rd September**

Post-glacial geomorphology trip. The aim of the trip is to visit key locations that illustrate the glacial imprint on landscapes, and the processes involved in post-glacial readjustment. Provisional locations include Rannoch Mohr (where the ice cap was focused during the Loch Lommond / Younger Dryas readvance), Glen Coe, the parallel roads of Glen Roy (https://www.scottishgeology.com/best-places/parallel-roads-glen-roy/), and the Cairngorms.

Scientific Programme

We have an exciting scientific programme with many new innovations and discoveries in geomorphology. All sessions will be plenary. We have 4 time periods for poster sessions, all posters will be up throughout the conference. This will allow authors to both host their posters and visit other posters at the conference: we look forward to exciting discussions around the poster sessions that will serve as a centrepiece of the conference. The poster sessions will bracket three oral sessions of one hour each. Oral sessions will be complemented with invited seminars (Cuchlaine King Symposium) and award lectures.

This year will see the launch of the **Cuchlaine King Symposium**, named after the first female UK professor of geomorphology: https://www.theguardian.com/science/2020/feb/17/cuchlaine-king-obituary. You can learn more about Cuchlaine Audrey Muriel King by reading the piece written by W. Brian Whalley at the end of this programme. The half-day symposium focuses on a timely geomorphology-related topic, with keynote speakers and lively discussion on the Monday afternoon (4th September), that will lead to a special issue in *Earth Surface Processes and Landforms*. The general theme this year is "***Novel approaches to quantify landscape changes***".

Programme timetable

Monday 4th September	
9:30-12:15	Publication & Professional Geomorphology workshops (Drummond Street)
12:00-13:30	Registration
13:30-13:45	*Welcome and introduction (M. Attal, S. Mudd, L. Dingle for ESP&L)*
Cuchlaine King Symposium - part 1	
13:45-14:15	**Fluvial factory for buttes, mesas, and tablelands**
	Goren, L., Harel, E., Porat, O., Qu, T., Crouvi, O., Porat, N., Ginat, H., Shelef, E.
14:15-14:45	**The grain-size signal**
	Guerit, L.
14:45-15:15	*Break, tea, coffee*
Cuchlaine King Symposium - part 2	
15:15-15:45	**Quantifying long-term landslide activity with in-situ 10Be and 14C**
	Roda-Boluda, D.C.; Schildgen, T.; Lupker, M.; Bufe, A.; Søndergaard, A-S.; Haghipour, N.; Prancevic, J.; Tofelde, S.; Wittmann-Oelze, H.; Hovius, N.
15:45-16:15	**Beyond beryllium-10 – Using cosmogenic nuclides to their fullest potential**
	Marrero, S.
16:15-16:45	*Break*
Cuchlaine King Symposium - part 3	
16:45-17:15	**Climatic Control on Soil-Landscape Development in Tropical Volcanic Islands**
	Vanacker, V.
17:15-17:45	**Landslides and their legacy in the Pacific Northwest, USA – new tools applied to an old problem**
	Duvall, A., Herzig, E., LaHusen, S., Booth, A., Grant, A., Stone, I., Wirth, E., Wartman, J., Struble, W., Roering, J., Mishkin, B., Montgomery, D.
18:00-20:00	*Drinks reception, canapes and awards*

Tuesday 5th September	
9:00-9:30	*Welcome, tea, coffee, pastries*
Oral session 1	
9:30-9:45	**Landscape response to the Mid-Pleistocene Transition (MPT) and higher frequency climate change in the Central Andes**
	Orr, E., Schildgen, T., Tofelde, S., Wittmann-Oelze, H.
9:45-10:00	**An inverse approach to apportioning tracers and pollutant sources in drainage networks from point observations**
	Lipp, A.G., Barnes, R., Roberts, G.G., Whittaker, A.C., Fernandes, V.M.
10:00-10:15	**Reflections on how to navigate the academic ladder in geomorphology and how success is defined in a changing academic landscape**
	Clarke, L., Alderson, D., Schillereff, D., Shuttleworth, E.
10:15-10:30	**Geomorphology and the Law**
	Slattery, M.C.
10:30-11:30	*Break, tea, coffee, snacks, poster session*
11:30-12:00	Warwick Award Lecture
	Predicting contemporary fluvial landscapes with large-sample computational geomorphology and machine learning
	Slater, L.
12:00-12:30	Chorley Award Lecture
	Title tbc
	Donatelli, C.
12:30-14:00	*Lunch, poster session*
Oral session 2	
14:00-14:15	**Waipaoa River, Aotearoa New Zealand: Changing connectivity, catchment-scale response times and prospective river futures**
	Fuller, I.C., Brierley, G.J., Rosser, B., Brasington, J., Tunnicliffe, J., Marden, M.
14:15-14:30	**Exploring network-based approaches to quantify patterns of water and sediment connectivity in drylands**
	Tiwari, S., Turnbull, L., Wainwright, J.
14:30-14:45	**Plastic as sediment in rivers, riverbeds, and landscapes**
	Russell, C.E., Fernandez, F., Pohl, F., Mahon, R., Parsons, D.
14:45-15:00	**Achieving environmental sustainability in the Anthropocene by including humans in Critical Zone Science**
	Naylor, L.A., Dungait, J., Zheng, Y., Buckerfield, S., Green, S.M., Oliver, D.M., Liu, H., Peng, J., Tu, C., Zhang, G., Zhang, X., Quine, T.A., Waldron, S., Hallett, P.D.
15:00-16:45	*Break, tea, coffee, snacks, poster session*
16:45-17:00	Sweeting Award Lecture
	Assessing the response of proglacial channel morphology to glacier retreat at Kötlujökull, Iceland
	Carpenter, T.
17:00-17:30	Kirkby Award Lecture
	Experimental Insights into Bedrock River Erosion: Dynamic bedrock channel width during knickpoint retreat enhances undercutting of coupled hillslopes
	Baynes, E.

Wednesday 6th September	
9:00-9:30	*Welcome, tea, coffee, pastries*
Oral session 3	
9:30-9:45	**One million years of climate-driven rock uplift rate variation on the Wasatch Fault revealed by fluvial topography**
	Smith, A.G.G., Fox, M., Moore, J.R., Miller, S.R., Goren, L., Morriss, M.C., Carter, A.
9:45-10:00	**Dynamic ridges in front of the Rif Belt, Northern Morocco: insights from morphotectonic indices and field data**
	Amine, A., El Ouardi, H., Saadi, M., Taher, M.
10:00-10:15	**Evaluating the Impact of an Extreme Flood Event on Channel Morphology and Floodplain Sedimentation.**
	Dawson, M., Lewin, J.
10:15-10:30	**Sediment matters: integrating recent advances into catchment decision making processes**
	Richardson, J.C.
10:30-11:15	*Break, tea, coffee, snacks, last chance to see posters!*
11:15-12:00	Linton Award Lecture
	Changing Coasts: a biogeomorphological perspective
	Woodroffe, C.
12:00-12:45	*Closing of the conference activities, lunch*
12:45-14:30	AGM

Posters

Posters will be displayed in the Prestonfield Suite throughout the conference, and we have four dedicated time slots during which poster discussions and viewings can occur. You can find the posters using the poster number. Abstracts are provided at the end of this programme.

Posters should be A0 Portrait.

Poster Topic: Novel approaches to quantify landscape changes (in support of the Cuchlaine King Symposium)

Poster Number	*Title*	*Author(s)*
1	**Extending landscape hypsometry to incorporate terrain roughness characteristics**	Keylock, CJ; Singh, A; Passalacqua, P; Foufoula-Georgiou, E
2	**Identifying (Dis)Equilibrium Channels: Theory to Application**	Whitfield, D; Baynes, E; Rice, S; Jeffries, R
3	**Morphometric parameters as a measure of geomorphological diversity on archaeological sites - Nairn valley case study (Scotland)**	Szmańda J; Luc M; Kittel P; Banaszek Ł; Maleszka-Ritchie M; Oleś K
4	**Creating geomorphological landscapes: fields, landsystems and storytelling models via open-data**	W. Brian Whalley
5	**Seismic and hydroacoustic monitoring of bedload transport in the River Feshie, Scotland**	Matthews, B; Naylor, M; Sinclair, H; Black, A; Williams, R; Cuthill, C; Gervais, M; Dietze, M; Smith, A
6	**A new branch of geomorphology: assessing large wood fragmentation using terrestrial LiDAR and cylinder modelling**	Milan, D.J; Hortobágyi, B; Bourgeau, F; Piégay, H
7	**Optimal transport-based methods for inverse modelling of landscapes**	Morris, M. J; Lipp, AG; Roberts, GG
8	**Cosmogenic nuclides for geomorphology applications: NEIF Cosmogenic Nuclides (NEIF-CN)**	Carracedo, A; Gheorghiu, D; Davidson, A; Miguens-Rodriquez, M; Shanks, R; Fabel, D
9	**DUNEMINDS - A Deep Learning Framework to Map and Analyse Linear Dunefields**	Nowatzki, M; Bailey, R; Thomas, D

Poster Topic: Coastal Geomorphology

Poster Number	*Title*	*Author(s)*
10	**Fine-Grained Sediment Movement on Shore Platforms**	Horton, S
11	**Dynamic changes in mangroves of the largest delta in northern Beibu Gulf, China: Reasons and causes**	Long, C; Dai, Z
12	**Biogeomorphology on Coastal Built Heritage: Practical conservation outcomes of wildlife-heritage interactions.**	Baxter, TI; Coombes, MA; Viles, HA
13	**Quantifying coastal change and exploring coastal processes via satellite-derived vegetation edges**	Muir, FME; Hurst, MD; Richardson-Foulger, L; Naylor, LA; Rennie, AF
14	**Erosion estimation in coastal historic landfills using terrestrial laser scanning**	Xue, S; Spencer, K; Grieve, S
15	**Grain size characterisation of anthropogenic beaches: a study of Granton Beach in Edinburgh**	Wang, Y; Hurst, MD; Naylor, LA
16	**Mangrove Seaward Extent Changes in Mary River, Northern Territory, Australia (ONLINE)**	Mollick, P; Woodroffe, C; Rogers, K
17	**Channel Incision and Interaction with Erosion Resistant Delta Substrates**	Johnson, JE; Parsons, DR; Hackney, CR; Coulthard, TJ; Best, JL; Edmonds, D

Poster Topic: Fluvial Geomorphology

Poster Number	Title	Author(s)
18	**An opportunity to improve channel hydromorphology and biodiversity net gains within a larger commercial infrastructure project**	Lavarini, C., Preston, J.
19	**Turbulent flow over dunes: the significance of curvature in the three-dimensional morphology in determining flow**	Hardy, RJ; Best, JL; Marjoribank, TI
20	**How river embankments affect sediment transport, river morphology, and conveyance capacity in the Kathmandu Basin, Nepal**	Thapa S; Sinclair HD; Creed MJ; Mudd SM; Attal M; Borthwick AGL; Ghimire BN.
21	**Power and politics: urbanization and river channel change**	Ashmore, P
22	**Is riparian vegetation affecting flood modelling?**	Guo, Y; Nones, M
23	**Connectivity changes in a large tropical river basin after damming and deforestation**	Yi, CX; Gibbins, CN; Vericat, D; Batalla RJ; Cavalli, M; Crema, S; Yenn, TF; Lee Suan Ping, K
24	**Discerning the hydrological controls on the behaviour of water surface area variations in oxbow lakes**	Ahmed, J
25	**Quantifying land use intensity and its effects on river water quality in New Zealand**	Julian, JP; deBeurs, KM
26	**Investigating bedrock exposure controls in mixed bedrock-alluvial river systems**	Oliveira-Guirro, M; Hodge, R; Clubb, F; Laura Turnbull, LT
27	**How sequences of flood modify river morphology? Insights from the Evoflood experimental work.**	Delorme, P; McLelland, S; Parsons, D; Darby, S; Leylan, J; Liu, Y; Wortmann, M; Slater, L; Hawker, L; Neal, J; Boothroyd, R; Griffith, H; Cloke, H; Vahidi, E; Nicholas, A; Gebrechorkos, S; Bennett, G; Ashworth, P; Sambrook-Smith, G; Tatem, A
28	**Morphology and surface roughness of rough-bed rivers**	Houseago, RC; Hodge, RA; Hackney, CR; Ferguson, RI; Hardy, RJ; Rice, SP; Johnson, JPL; Yager, EM
29	**The formation of mountain fluvial anthropospheres from a socio-hydrological perspective**	Witkowski, K
30	**Monsoon-driven changes to river bifurcations in Nepal**	Cload, C; Dingle, E; Creed, M
31	**Assessment of river habitat monitoring for delivering multiple benefits of nature-based solutions**	Clarke, L; Harrison, A; Andrews, K; Robson, H

32	**Decadal-scale river bed incision in the Red River Delta, Vietnam driven by intense and widespread sediment extraction**	Runeckles, H; Hackney, C; Đỗ Thu Nga; Lê Thị Vân Huệ; Large, A
33	**The long-term dynamics of invasive signal crayfish forcing of fluvial sediment supply via river bank burrowing**	Sanders, CH; Mathers, KL; Rice, SP; Wood, PJ

Poster Topic: Glacial Geomorphology

Poster Number	*Title*	*Author(s)*
34	**Multi-model ensemble analysis of frost weathering risks across East Asia (1850-2100)**	Richards, J; Brimblecombe, P
35	**Withdrawn**	
36	**The Importance of Icefalls in Alpine Landscapes**	Wenban, WJ; Swift, DA
37	**The Last Glacial Termination in southernmost Patagonia**	Huynh, C; Hein, A; McCulloch, R; Garcia, J; Bingham, R; Fabel, D
38	**Ice buttressing controlled rock slope failure on a cirque headwall, English Lake District**	Carling, PA; Jansen, JD; Su, T; Andersen, JL; Knudsen, MF
39	**The Long-term Dynamics of the Glacially-fed River Systems in Patagonia**	Skirrow, G; Smedley, R; Chiverrell, R; Hooke, J
40	**From summits to cirques: Deciphering the nature and rate of ice loss from the last Welsh Ice Cap using high-resolution glacial geochronology.**	Thomas, O; Hughes, P; Darvill, C; Ryan, P
41	**Reconstructing the glacial history of the Salto del Olivares (33°S), Central Chile**	Curry, CS; Rowan, AV; Livingstone, SJ; Diemont, CR; Bravo, C; Antinao, JL

Poster Topic: Hazards

Poster Number	Title	Author(s)
42	**What controls shallow landslide size and why does it matter?**	Milledge, DG
43	**Reconstructing the Late Holocene Flood History of the River Ribble Catchment, North West England**	Haigh, A; Jones, AF; Moses, C
44	**Filed validation of the first recorded historical strong earthquake in China based on the age of rock avalanche-dammed lake**	Shi, W; Xu, W; Yin, J; Zheng, Y
45	**Catastrophic debris flows from the last two glacial cycles in the High Atlas of Morocco**	Hann MG; Woodward JC; Hughes PD; Rhodes EJ
46	**Evolution of landslide activity and persistence following the Gorkha earthquake**	Harvey, EL; Shrestha, R; Kincey, ME; Rosser, NJ; Van Wyk de Vries, M; Basyal, GK; Jimee, G; Densmore AL
47	**Modelling catchment scale hydrological effects of rewilding**	Hartley, AT
48	**A 21st century geomorphological reassessment of the Dolgarrog flood disaster of 1925**	Warburton, J; Woodward, J; Tooth, S; Griffiths, H; Lewin, J
49	**Monitoring of landslide hazards with wireless sensor networks and machine learning**	Newby, K; Bennett, G; Roskilly, K; Luo, C
50	**Hydro-Geomorphology of Río Simpson, Patagonia-Aysén, Chile**	Dussaillant, A.R.; Reid, B.L.; Aguilar, F.; Jullian, A; Quezada, P.; Ancan, J.; González, C.; Fortini, F.; Chávez, P.; Sepúlveda, N.; Quezada, G.; Uribe, L.; Russell, A.; Perks, M.; Buytaert, W.;, Meier, C

Poster Topic: Sediment transport and landscape evolution

Poster Number	Title	Author(s)
51	**The sedimentological control on knickpoint form and retreat rate**	Norriss, WJ; Baynes, ERC; Hillier, JK; Lague, D; Steer, P
52	**The morphometry, age and origin of the South Hams landscape, Devon**	Verplancke, O; Murton, JB; Hales, TC
53	**Linkage between sediment transport and heavy metals dispersal in catchments affected by legacy mines.**	Yao, Z
54	**Intermontane basins formed by tectonics and river capture; the Kathmandu Basin of central Nepal**	Pokhrel, P; Sinclair, H; Mudd, SM; Attal, M
55	**Soil erosion: Direct and indirect effects of hydrophobicity**	Fallah, M; Holtzman, R; Van De Wiel, M
56	**Reach-Scale Morphological Control on Extreme Flood Sediment Production and Export**	Baynes ERC; Kincey, ME; Warburton, J
57	**Landscape evolution along the Main Gulf Escarpment in the southern sector of the Baja California Peninsula**	Arturo, GT; Esperanza, MS; Castillo, M
58	**Jurassic paleoclimate in north Guizhou from Paleosol characteristics**	Li, Q; Luo, Y; Wen, X; Wu, P; Holtzman, R; Bogush, A; Van De Wiel, M;
59	**Alligators and Kites – Wind erosion of Bare Peat Surfaces**	Warburton, J; Zang, Y; Gan, L; Hardy, R
60	**Quantifying the Importance of Wind Characteristics on the Erosion of Bare Peat: Initial Insights from Field Measurements and Wind Tunnel Modelling**	Zang,Y; Warburton,J; Gan,L; Hardy,R
61	**Fingerprinting geomorphic process through hillslope morphology in Coprates Chasma, Mars**	Baternay, SA; Wharton, G; Grieve SWD
62	**Detecting a Signal of Drainage Capture in Catchment-Averaged Erosion Rates**	Hoskins, AM; Attal, M; Mudd, SM; Castillo, M
63	**A catchment scale investigation into the climatic, tectonic and topographical drivers of fluvial terrace preservation in the Nepal Himalaya**	Weir, EF; Clubb, FJ; Densmore, AL Hurst, MD
64	**Discerning the efficacy of intervention measures on contaminant sequestration in the Salmons Brook Catchment**	Swallow, A; Ahmed, J; Richardson, S; Thomas, R
65	**Alluvial fan morphometric relationships: a planetary perspective**	Woor, S

Talks

We will have three sessions of oral presentations between poster sessions. These will take place in the main lecture hall. Oral sessions, with talk titles and schedule, are listed above in the overall scientific programme. Abstracts are provided at the end of this programme.

Workshops

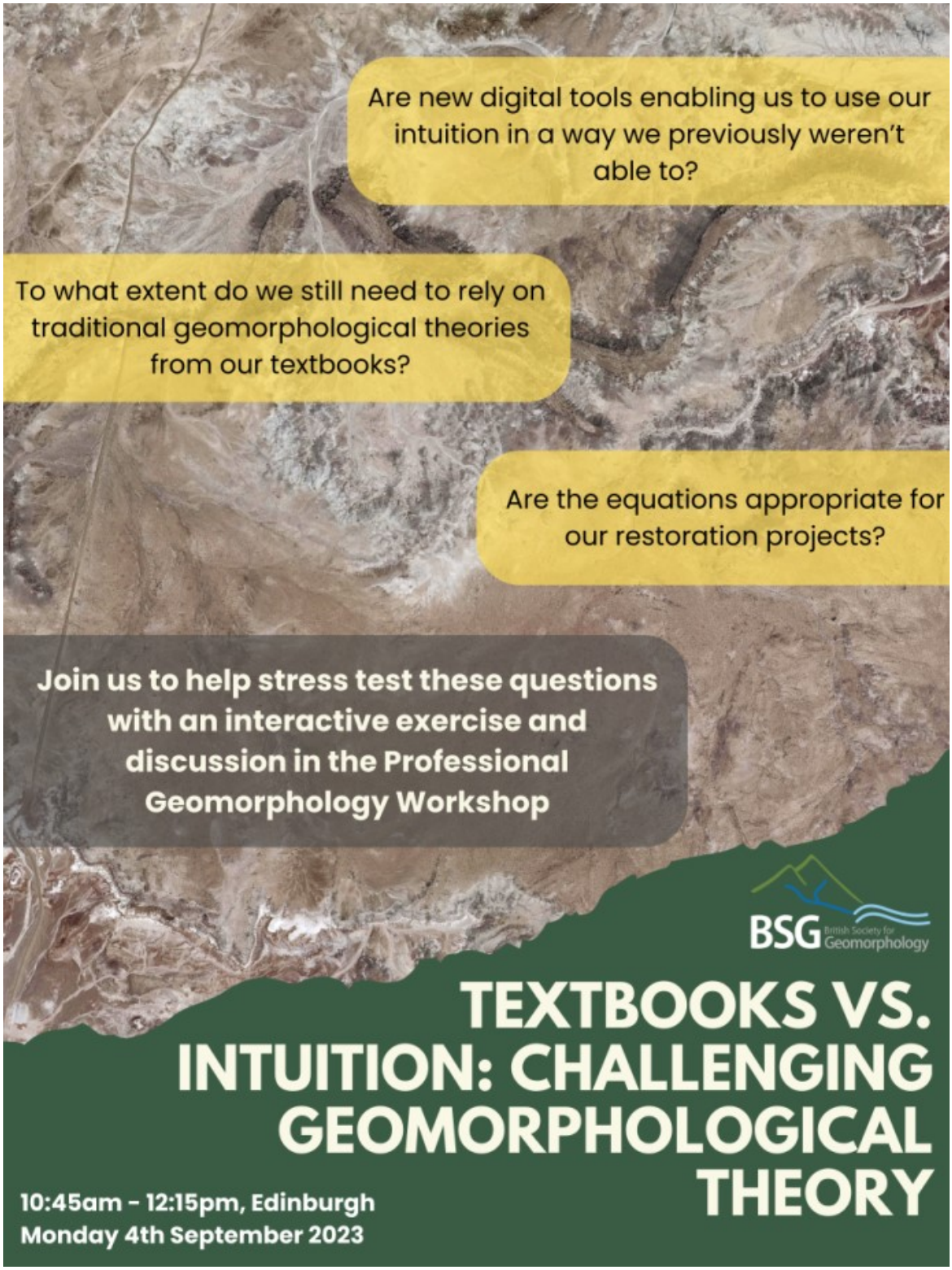
On the morning of Monday the 4th, two workshops are organised, that will take place at the Institute of Geography, Drummond Street, EH8 9XP, room 2.01. The workshops are detailed below. To register: https://forms.office.com/e/jAJt9qYQaz. Note that spaces are limited so hurry up to secure your spot!

Publication Workshop

Publication workshop organised by the postgraduate committee: come and join researchers and journal editors to learn tips about writing papers and getting them published. The workshop will run 9:30-10:30 am and is open to all.

Professional Geomorphology Workshop

Professional geomorphology workshop (open to all, and participation from all sectors encouraged): join us for an interactive session to help us stress-test the traditional geomorphological theories and equations from our textbooks using open-source digital tools. The workshop will run 10:45-12:15.



Awards

Rounding out our schedule of talks, we will have five award lectures:

David Linton Award

The David Linton Award is given to a geomorphologist who has made a leading contribution to the discipline over a sustained period.

The 2023 Linton Award lecture is presented by Professor Colin Woodroffe.

Described in 2021 by Professor Ted Spencer, Director of the Coastal Research Unit at Cambridge University, as "...the world's leading coastal geomorphologist", Colin Woodroffe has published over 265 refereed published papers and published 12 books and monographs including "Coasts: form, process and evolution" (2003), the leading textbook globally in coastal geomorphology (~950 citations, held in 320 UK/USA libraries), "Quaternary sea-level change" (Murray-Wallace and Woodroffe, 2012) and, the widely used, "Coastal evolution" (1994) (Carter and Woodroffe, eds). His diverse research includes barrier islands, volcanic islands, estuaries, mangrove forests, temperate wetlands and coral reefs over globally diverse locations including the Caribbean (the focus of his PhD), Australasia, SE Asia, and Pacific and Indian Oceans, with sea level rise reconstructions over Quaternary and contemporary timescales. His foci have been on northern Australian Holocene 'big swamps', mangrove environments, carbon sequestration in wetlands, 'micro-atolls' on coral reef platforms for reconstructing recent sea level changes, also leading oceanographic cruises in the Tasman Sea. Following a near-fatal accident in 1994, he reskilled in RS, GIS, LiDAR and UAVs of coastal environments. Colin is also one of only a few geomorphologists to engage with the IPCC directly as a lead author for IPCC AR4, thereby sharing the 2007 Nobel Peace Prize (with Al Gore and the rest of the IPCC members). Awarded the prestigious R.J. Russell Award (for excellence in coastal geomorphology by the Association of American Geographers in 2012) he is currently Chair of the IGU Commission on Coastal Systems and was on the Scientific Steering Committee of Land-Ocean Interactions in the Coastal zone (LOICZ), a core project of the IGBP. Now a member of the Future Earth Coasts Academy and has convened contributions to the United Nations World Ocean Assessment. Colin has made a sustained and enormous contribution towards the science of coastal geomorphology and is a highly deserving recipient of the Linton Award.

Gordon Warwick Award

The Gordon Warwick Award is made annually for excellence in geomorphological research by someone within 15 years of being awarded their doctorate.

The 2023 Warwick Award lecture is presented by Dr Louise Slater

Citation: Dr Slater is an outstanding researcher who has made an outstanding and sustained contribution to the field of geomorphology, revolutionizing our understanding of the critical role of geomorphology in changing flood hazard and risk across rivers in the UK, Europe and the continental United States. As such her work has placed geomorphology 'on the map' and has reach that extends beyond geomorphology into hydrology also. Her research focuses on understanding and predicting changes in floods and fluvial systems in the context of shifts in climate and land cover. Her work combines statistical and computational methods in a highly rigorous manner, using

data-driven methods to disentangle the different drivers of flooding and fluvial change across a variety of climates and land use types. Using Earth Observation and ensemble Climate Model predictions Louise also develops probabilistic forecasts to assess how floods and fluvial systems change over daily to decadal timescales. She has a keen interest in data science and in developing new, interdisciplinary methods for understanding and projecting fluvial and hydro-climatic change.

Louise would be a worthy recipient of the Warwick Award based only on the outstanding quality of her research, which has real impact in addressing issues facing society today, but she is also an outwards-facing and collegial individual who is also helping to shape her discipline through a number of service roles. She has been the Editor of 'Hydrology and Earth System Sciences' since 2017 and was the Outreach Secretary for our British Society for Geomorphology from 2017 to 2020. Louise is also highly regarded for her work as an academic mentor and as a great role model and advocate for women in science. She makes her students feel interested, capable, and appreciated, and always finds time to help others, giving thoughtful, thorough, and insightful feedback.

She serves as an outstanding example of someone who conducts research to the highest standards while simultaneously ensuring that she 'pays forward' through her outstanding mentorship of individuals within her group and, as such, is a model recipient of the Warwick Award.

Dick Chorley Award

The Dick Chorley award is made for a published paper based on PhD research, where the nominee is expected to be the first author. Nominees should be within 4 years of their PhD award at the time of nomination.

The 2023 Chorley Award lecture is presented by Carmine Donatelli

Donatelli, C., Zhang, X., Ganju, N.K., Aretxabaleta, A.L., Fagherazzi, S. and Leonardi, N. (2020), A nonlinear relationship between marsh size and sediment trapping capacity compromises salt marshes' stability, *Geology*, 48, 966-970. (DOI: 10.1130/G47131.1)

Citation: Carmine Donatelli's paper addresses the important issue of the relationship between marsh size, sediment trapping capacity and marsh stability. Salt marshes offer sustainable coastal protection solutions and several ecosystem co-benefits including carbon sequestration and are increasingly recognized as important environments for the sheltering of coastal communities from storms. A key issue of concern is whether or not salt marshes will survive accelerated sea-level rise with current levels of sediment supply from rivers and the coastal ocean. Unfortunately, previous work considering this issue has not considered the potential feedback between salt marsh extent and the overall sediment availability in back-barrier estuaries, a limitation that is addressed by this work. Dr Donatelli's work shows the existence of a positive feedback between marsh size and the ability of the whole tidal system to trap sediment inputs, suggesting previous studies overestimate marsh ability to actively resist the deleterious effects of sea-level rise. To make this breakthrough, Dr Donatelli employed a numerical model across six tidal inlet/basin systems in US and an exploratory model approach to unravel the largescale effects induced by salt marsh loss in shallow estuaries.

Marjorie Sweeting Award

The Marjorie Sweeting Dissertation Prize is awarded annually for the best undergraduate geomorphological dissertation (no higher than Level 6) undertaken at a UK university.

The 2023 Sweeting Award Lecture is presented by Tamsin Carpenter

Citation: This dissertation, exploring the downstream effects of the Kötlujökull glacier, South Iceland, involved a rigorous and detailed combination of mapping, remote sensing, and geospatial statistics. It gathered a timeseries of channel morphologies, mapped at very high resolution using aerial and satellite imagery, and compared these to the retreating glacier. The creativity of the analysis and level of detail are both outstanding.

Mike Kirkby Award

The Mike Kirkby award is given to the best paper published in the BSG's Journal Earth Surface Processes and Landforms, as decided by the ESPL editorial board. The paper is selected from the volume of the journal for the given year of the Award.

The 2023 Kirkby Award Lecture is presented by Edwin Baynes

Citation: The Michael J Kirkby Award 2022 for the best paper published in Volume 47 of Earth Surface Processes and Landforms is made to Dr. Edwin Baynes and colleagues for the paper entitled: " Dynamic bedrock channel width during knickpoint retreat enhances undercutting of coupled hillslopes ». The coupling between rivers and hillslopes has been a thematic that has long interested geomorphologists. This paper designs and applies a suite of novel physical experiments to show that lateral channel erosion in response to the passage of knickpoints, and not only vertical elevation changes, is a crucial driver of hillslope instability. As such the paper makes a major contribution to our understanding of transience geomorphic response to climate change and tectonics, especially in the context of how feedbacks between hillslopes and rivers moderate the transmission of the signals of external drivers from source to sink.

Annual General Meeting

Following the conclusion of the meeting, the annual general meeting will be held (Wednesday 6th, 12:45-14:30). All BSG members are invited and encouraged to attend. The agenda will include a report on research projects, activities, management, and finances.

Abstracts

Cuchlaine King Symposium

Title: Fluvial factory for buttes, mesas, and tablelands

Author/s: Goren, L., Harel, E., Porat, O., Qu, T., Crouvi, O., Porat, N., Ginat, H., Shelef, E.

Abstract: How do buttes, mesas, and tablelands form? These globally abundant landforms are rarely predicted by landscape evolution models, making their formation enigmatic. We hypothesize that these elevated flat-topped surfaces could form by processes of drainage reversal toward escarpments and cliffs and the associated emergent feedback between divide migration and waterfall retreat. These processes embay linear cliffs, increase their sinuosity, and, depending on the antecedent drainage pattern, can fully isolate and form low-relief highland surfaces. We explore these processes along two natural laboratories in the Negev Desert, Israel, where tens of highland channels are documented to have reversed their flow direction toward tectonic escarpments and erosional cliffs.

Field observations and morphometric analysis of these sites reveal a new, structurally-independent mechanism for inducing flow reversals. According to this mechanism, reversal is linked to local divide migration away from the cliff and along antecedent valleys with more erodible lithologies. Some reversed drainages hold unique clues for the rates of divide migration. Rates are inferred by dating abandoned terraces that grade opposite to the active flow direction and are interpreted as the valley floor of the antecedent drainage. We find that divide migration occurred episodically and is likely linked to global mid- and late-Pleistocene climate oscillations. Finally, we identify the geometric and lithologic controls over the feedback that links divide migration to waterfall retreat. This feedback can sustain cliff embayment over long timescales and large length scales, potentially forming buttes, mesas, and tablelands.

Title: The grain-size signal

Author/s: Guerit, L.

Abstract: The size of bedload sediment in rivers holds a lot of information about grain production, transport and deposition. These processes are closely linked to climate and tectonics, so that grain size trends have been used for decades as markers of climatic and/or tectonic changes. Yet, it is still difficult to univocally unravel the grain-size signal. I propose that this lack of uniqueness is partly related first, to the scarcity of dedicated field data on the relationship between grain size, climate and tectonics. To overcome this issue, 3D point cloud analyses show to significantly improve and ease grain-size measurements in the field. It is now possible to consider sampling multiple areas in different climatic and tectonic contexts to better constrain the impact of these forcings on grain sizes. I will show an example of field campaign in the south of France. Second, the limited integration of source-to-sink dynamics in fluvial systems restrains our understanding of signal propagation and records. To tackle this fascinating challenge, I am developing a source-to-sink experimental setup simulating a catchment and its coupled alluvial fan. I use multi-size sediment to generate bedload transport and sorting. The setup is designed to explore how environmental signals are transmitted though the fluvial system, and recorded by the grain size in the depositional area. The setup is being build this summer so hopefully, I will present some runs during the meeting.

Title: Quantifying long-term landslide activity with in-situ 10Be and 14C

Author/s: Roda-Boluda, D.C.; Schildgen, T.; Lupker, M.; Bufe, A.; Søndergaard, A-S.; Haghipour, N.; Prancevic, J.; Tofelde, S.; Wittmann-Oelze, H.; Hovius, N.

Abstract: Landslides are a major erosional mechanism in mountain landscapes, play a crucial role in source-to-sink systems by delivering coarse sediment fluxes, and constitute a major geohazard. Their activity is very sensitive to both tectonic and climatic perturbations, but characterizing this sensitivity is challenging because their long-term activity and sediment fluxes are hard to quantify: remote sensing offers high-resolution constraints but only over the last few years or decades, while landslide scars and landslide deposits are often obliterated in $<10^2$ yrs. In this talk, I will present two novel ways in which we can use cosmogenic radionuclides to quantify landslide activity over 10^2-10^3 year timescales. First, I will show ^{10}Be concentrations from 17 recent landslides on the Southern Alps of New Zealand and Fiordland, and how, in combination with photogrammetry surveys of the landslide scars, these data can be used to infer long-term landslide frequency. By comparing these ^{10}Be-based, long-term landslide frequencies with aerial imagery-based landslide inventories over the 1935-2014 period from below the tree line, we can infer potential spatial and temporal changes in landslide activity. Second, I will show how deeper, bigger landslides deliver material with higher in-situ ^{14}C/^{10}Be ratios, and hence paired ^{14}C-^{10}Be measurements can be used to trace bedrock depth-provenance, and hence, landslide-sourced sediment. Finally, I'll combine these observations with 10Be and 14C concentrations measured on fluvial sediment to explore if these cosmogenic radionuclide signatures of landsliding are transmitted effectively at the catchment-scale and detectable in the fluvial sediment export.

Title: Beyond beryllium-10 – Using cosmogenic nuclides to their fullest potential

Author/s: Marrero, S.

Abstract: Cosmogenic nuclides are now a staple in the geomorphology community, providing key quantitative information on rates of processes and also by dating features. Although there are six nuclide options, beryllium-10 (^{10}Be) is the most commonly used. With precise measurements on relatively small samples, it is a logical choice. However, the other less commonly used nuclides can be used to complement ^{10}Be measurements (e.g. burial dating) or to allow measurements in lithologies that do not contain quartz (e.g. carbonates, volcanics). Although these options can be powerful tools, they are less frequently used because they each have suffered from at least one significant disadvantage compared to ^{10}Be (e.g. more difficult to measure, more complicated to model). Luckily, many of these issues have been tackled in recent years meaning that many of these issues are trivial, despite the lingering poor reputation. Relying on modelling and case studies, this talk aims to highlight some benefits of looking beyond 10Be to other nuclides (^{26}Al, ^{14}C, ^{36}Cl, ^{3}He, ^{21}Ne), with special consideration of ^{36}Cl. This talk will also include practical aspects (e.g. limitations, timescales, availability) as well as a glimpse to future.

Title: Climatic Control on Soil-Landscape Development in Tropical Volcanic Islands

Author/s: Vanacker, V.

Abstract: Tropical volcanic islands are global hotspots of chemical weathering. In the tropics, the elevated temperatures and moisture availability facilitate weathering and CO2 drawdown, solute and nutrient fluxes, and volcanic landforms are often characterized by steep slopes and rapid erosion rates exposing fresh mineral surfaces to weathering agents. Weathering of volcanic rocks such as basalt may account for as much as 30 to 35% of global atmospheric CO2 consumption by chemical weathering, even though the areal proportion of volcanic rocks is only about 6% of the total exorheic land area. Volcanic soil systems evolve over time through interactions between climate, parent material, topography and biota. Our mechanistic understanding of these interactions, and their role in basalt weathering is far from complete. By working in the Galapagos Islands, we have the opportunity to better constrain soil-landscape development over millennial timescales based on empirical data from pristine soil ecosystems. In this talk, I will present data on basalt weathering from Santa Cruz Island, located in the central part of the Galapagos Archipelago, and illustrate how novel approaches contribute to obtain quantitative measures of soil weathering, physical erosion, topography and vegetation development. The monitoring sites cover a 10-fold increase in median annual precipitation which enabled us to quantify the (hydro)climate effects on soil-landscape development.

Title: Landslides and their legacy in the Pacific Northwest, USA – new tools applied to an old problem

Author/s: Duvall, A., Herzig, E., LaHusen, S., Booth, A., Grant, A., Stone, I., Wirth, E., Wartman, J., Struble, W., Roering, J., Mishkin, B., Montgomery, D.

Abstract: Landslides saturate the landscape of the Pacific Northwest (PNW), USA due to steep topography, a wet climate, proximity to earthquake faults, and weak geologic units. Despite their ubiquity, deciphering cause, frequency, and the geomorphic legacy of PNW landslides remains a long-standing problem in need of new approaches. Several issues have historically limited our progress. First, although we know of numerous potential earthquake source faults, long recurrence intervals mean that no large magnitude events (+7 Mw) have been recorded in modern times. Moreover, precipitation-driven landslides happen with each storm and wet season, outpacing and obscuring coseismic slides. Finally, landslide mapping and dating, two fundamental means to probe the landscape record, presents a formidable challenge across Cascadia. In this presentation, I will highlight how novel advancements enable progress for two case studies: one from Oregon, adjacent the Cascadia subduction zone, and one from the Puget Lowland, adjacent the Seattle crustal fault. In both locations, we use a surface-roughness dating approach to date thousands of deep-seated landslides. In the Puget Lowland, we combine the landslide inventory with new earthquake simulation modeling. Our results indicate relatively few deep-seated landslides in proximity to the Cascadia megathrust and that most deep-seated landslides in the Oregon Coast Range originated from rainfall. In contrast, we find evidence of increased landsliding around the time of the last major Seattle Fault earthquake. Landslide clustering also reveals evidence of earlier earthquakes. Taken together, these new approaches offer a means to investigate drivers of past landsliding, even many thousands of years later.

Oral Session 1

Title: Landscape response to the Mid-Pleistocene Transition (MPT) and higher frequency climate change in the Central Andes

Author/s: Orr, E., Schildgen, T., Tofelde, S., Wittmann-Oelze, H.

Abstract: Theory suggests that the response time of alluvial-channel systems to perturbations in climate can be related to the magnitude and direction of the forcing, and the length of the system; shorter systems may record a higher frequency of forcing compared to longer systems. The Toro Basin in the Eastern Cordillera has preserved a suite of alluvial-fan deposits along the flanks of the Pascha Range. Farther downstream, a series of cut-and-fill terraces have been linked to 100-kyr climate cycles since ca. 500 ka. The cosmogenic radionuclide dating of the fan sequence presents an opportunity to explore (1) how climate-induced channel responses may or may not propagate downstream, and (2) the differences in landscape response to forcing frequency as a function of stream length when comparing the fan and terrace sequences. The first (G1) and second (G2) fan generations record surface activity and abandonment between ca. 700 and 500 ka, and within the last 100 kyr, respectively. G1 fans record a significant phase of net incision, which has been recognised throughout the Central Andes, and was likely triggered by prolonged and enhanced global glacial cycles following the Mid-Pleistocene Transition. Relative fan surface stability followed, while 100-kyr cut-and-fill cycles persisted downstream, suggesting a disconnect in behaviour between the two reaches. G2 fans record higher frequency climate forcing, possibly the result of precessional forcing of climate (ca. 20-kyr timescales). The lack of a high-frequency signal farther downstream provides field support for theoretical predictions of a filtering of high-frequency climate forcing with increasing channel length.

Title: An inverse approach to apportioning tracers and pollutant sources in drainage networks from point observations

Author/s: Lipp, A.G., Barnes, R., Roberts, G.G., Whittaker, A.C., Fernandes, V.M.

Abstract: River waters and sediments transport minerals, dissolved ions and contaminants such as microplastics, pathogens and pharmaceuticals through river networks. As geomorphologists we frequently would like to use point observations of these concentrations to determine where and how much of these tracers are entering the drainage network. However, downstream samples are mixtures of all the potential upstream sources. Separating out the contribution of an individual source requires "unmixing" the network's waters or sediments. Here, we describe an approach to perform such an unmixing, identifying the contribution from each nested sub-catchment in a drainage basin. First, we abstract the sub-catchments into a directed acyclic graph. Each node (sub-catchment) in the graph is characterised by an upstream area, which we know, and a tracer source concentration, whose value we want to find. We assume that when two rivers meet their tracers' fluxes are combined conservatively and so downstream concentrations are the mixture of all upstream concentrations, weighted by upstream area. To solve for the source concentration of each sub-catchment we define an optimisation problem, minimising the relative difference in the predicted and observed tracer concentration at each sample site. We present an open-source, Python implementation of this algorithm which requires as input: sample site locations, observed tracer concentrations and a flow-direction raster map. We describe a case-study in NE Scotland where we determine source region geochemistry from downstream observations of fine-grained sediment chemistry. This is a powerful approach for locating and quantifying the sources of conservatively mixed tracers or pollutants in drainage networks.

Title: Reflections on how to navigate the academic ladder in geomorphology and how success is defined in a changing academic landscape

Author/s: Clarke, L., Alderson, D., Schillereff, D., Shuttleworth, E.

Abstract: There is growing concern in Higher Education around job security, work–life balance and inequalities, and early career researchers (ECRs) must make difficult trade-offs and life choices; with literature confirming women navigating academia face additional challenges compared to their male counterparts. Additionally, how one individual characterises another successful individual varies widely. At a time when work-life balance and the use of metrics are key concerns within the academic landscape, ECRs are voicing particular worries about the opacity with which we discuss and define success in academia, which influences recruitment and progression in unseen ways. In this research we present the results from two surveys: (1) exploring the experience of ECRs navigating the academic ladder in geomorphology to connect contractual circumstances, employment priorities and their impacts on the life choices of individual academics; (2) a survey of geomorphologists and textual analysis of job advertisements for early career positions at UK institutions spanning 2010-2021. We evidence the multidirectional pressures that have materially negative effects on individuals' life choices, including concern that academic employment is a barrier to living where and with whom one may want to, and the high level of precarity for ECRs. Additionally, we posit that there is a divergence between the perceptions, expectations and realities of academic success and that this has widened over the last decade. We put forward a set of key considerations and recommendations associated with these findings which we feel the academic community should reflect on at both a personal, departmental and institutional level.

Title: Geomorphology and the law

Author/s: Slattery, M.C.

Abstract: In 2005, Stan Schumm penned a commentary in GSA Today titled 'Forensic Geomorphology,' in which he encouraged his friends and colleagues to become involved as experts in geomorphic litigation. Schumm noted that, in several instances, he found highly qualified geomorphologists reluctant to be involved in cases in which they clearly could contribute to an appropriate outcome, for example, relating to river boundary disputes, causes of bank erosion, and the effect of diversions on channel morphology. Schumm pointed out that some geomorphologists are reluctant to be an expert witness because they might be made to look foolish by smart lawyers during cross-examination. I have been an expert witness in a variety of settings over the past 20 years and have had the opportunity to work with several excellent lawyers. This paper focuses on my personal experiences as an expert in several cases in Texas. I discuss the do's and don'ts of the various phases of litigation, from hearings and discovery through to depositions and the trial itself.

Warwick Award Lecture

Title: Predicting contemporary fluvial landscapes with large-sample computational geomorphology and machine learning

Author/s: Slater, L.

Abstract: Large sample computational geomorphology (LSG) is a rapidly developing field that combines a wide range of data sources, including field observations, topography, climate reanalysis, and satellite imagery, using open-source programming, statistics, and machine learning (ML). LSG provides a systematic approach to understand the spatial and temporal diversity of fluvial landscapes and how they might evolve in the future. This talk will focus on the use of LSG to decipher spatial differences and temporal changes in river channels and fluvial flooding. It will draw upon examples from our group's research, including the development of a global high-resolution bifurcating river network to predict river channel conveyance and channel variability across different climates of the globe; prediction of channel erosion from satellite imagery using hydrograph metrics; and the use of ML-based simulations to understand why catchments respond differently to changes in climate and land cover. The talk will emphasize the importance of using machine learning and LSG for enhancing our comprehension of spatial differences in fluvial landscapes, and the potential of these approaches for generating predictions of future change.

Chorley Award Lecture

Title: TBC

Author/s: Donatelli, C.

Abstract: TBC

Oral Session 2

Title: Waipaoa River, Aotearoa New Zealand: Changing connectivity, catchment-scale response times and prospective river futures

Author/s: Fuller, I.C., Brierley, G.J., Rosser, B., Brasington, J., Tunnicliffe, J., Marden, M.

Abstract: High rates of erosion in the 2208 km² Waipaoa River catchment have been the defining management issue since the mid-twentieth century. Erosion was dramatically enhanced by forest clearance for pastoral agriculture in the late nineteenth and early twentieth century, primed by a combination of highly erodible lithologies, steepland terrain, regular intense storm events, and slopes undercut during postglacial river incision. Catchment connectivity relationships in the Waipaoa have been profoundly altered. Simultaneous sediment inputs from deforested slopes deliver sediment directly into tributary and trunk stream channels, causing significant bed aggradation and channel infilling. Gullies initiated mid-twentieth century overwhelm receiving streams, forming alluvial fans and represent the single largest long-term sediment source to the system. In the upper catchment, widening of aggraded channels contributes more sediment, particularly through bank and valley-side erosion. The fine-grained nature of sediment supplied by lithologies in the upper catchment accentuates downstream delivery of materials, resulting in channel contraction and floodplain accretion in the lower Waipaoa. Efforts to mitigate erosion by afforestation have been successful in some headwater tributaries, with channel degradation beginning, but this process generates additional sediment that is conveyed downstream. We use a combination of LiDAR and river channel cross-sections to demonstrate contemporary longitudinal patterns of connectivity in the Waipaoa River and assess the prospective river futures of this anthropogenically altered system. We also report initial findings on the impacts of Cyclone Gabrielle in February 2023.

Title: Exploring network-based approaches to quantify patterns of water and sediment connectivity in drylands

Author/s: Tiwari, S., Turnbull, L., Wainwright, J.

Abstract: This study delves into the development and application of a network-based approach for understanding water-mediated connectivity in dryland ecosystems. We bring together knowledge from exogeomorphology and network science, cantering our investigations on a case study involving grass and shrub-dominated dryland hillslopes. The study introduces key parameters for designing Structural Connectivity (SC) and Functional Connectivity (FC) networks, aiming to quantify the resulting patterns of connectivity. It employs seven parameters to determine the connectivity patterns at network and node levels, with specific emphasis on the influence of weights and directionality. Notably, Link Density, Betweenness Centrality, and Page Rank Centrality show high sensitivity to directionality while Global Efficiency and Degree Centrality are influenced by weights. Relative Node Efficiency remains unaffected by weights and directions. Using our case study, we illuminate the network metrics of hydrological and sediment connectivity under varying rainfall and soil moisture conditions. We detail the significant contrast in connectivity characteristics at global and local scales, resulting from the transition from grassland to shrubland. It is found that changes in whole-system characteristics are less pronounced than those at the local node scale. The presented network science tools demonstrate their potential in revealing the nuanced effects of weights and directionality on water-mediated connectivity at network and node levels. Collectively, these insights underscore the importance of integrating both structural and functional connectivity in managing and conserving ecosystems more effectively. Future endeavors should aim to extrapolate this knowledge to other ecosystems for better management and conservation strategies.

Title: Plastic as sediment in rivers, riverbeds, and landscapes

Author/s: Russell, C.E., Fernandez, F., Pohl, F., Mahon, R., Parsons, D.

Abstract: Plastic is ubiquitous in the landscape and rivers are increasingly important vectors for its transport. Some riverbeds exhibit bedforms including ripples and dunes, which are well understood, but understanding of plastic in bedforms is in its infancy. In this study, flume tank experiments show that when plastic particles are introduced to sandy riverbeds, bedforms change character and behaviour. We detail i) mechanisms of plastic incorporation and transport in riverbed dunes, ii) the topographic changes that occur on the riverbed, and iii) quantify plastic-induced changes in sand transport downstream. We find that plastic directly affects bed topography and locally increases the proportion of sand suspended in the water column, even at very low concentrations in the sand. In the wider environment, such changes have the potential to impact river ecosystems and wider landscapes. Different plastic types and shapes have different impacts, therefore the classification of plastic ought to be consistent and comparable to sediment. Considering plastic as a sediment, we present a classification scheme, to enable better comparison of plastic to sediment such that we can better understand their interaction with sediment as a sedimentary particle, and therefore why plastics accumulate where they do. This is importantly not just another classification scheme, but a philosophically grounded solution to a long-standing challenge that is set to be of increasing significance in increasingly contaminated contemporary settings. We set the framework to a suite of questions that will aid understanding of plastic routing and accumulation in the rivers and the wider landscape.

Title: Achieving environmental sustainability in the Anthropocene by including humans in Critical Zone Science

Author/s: Naylor, L.A., Dungait, J., Zheng, Y., Buckerfield, S., Green, S.M., Oliver, D.M., Liu, H., Peng, J., Tu, C., Zhang, G., Zhang, X., Quine, T.A., Waldron, S., Hallett, P.D.

Abstract: Critical Zone Science (CZS) explores the deep evolution of landscapes from the base of the groundwater to the top of vegetation, the zone that supports all terrestrial life. Here we propose a framework for CZS to evolve further, building on 1st generation Critical Zone Observatories (CZOs) in natural systems and 2nd generation CZOs in human-modified systems, to incorporate human behaviour for more holistic understanding in a 3rd generation of CZOs. This concept was tested in the China-UK CZO programme (2016-2020) that established four CZOs across China on different lithologies. Beyond conventional CZO insights into soil, biogeochemical cycling and hydrology across scales, surveys of farmers and local government led to insights into human-environment interactions and key pressures affecting local livelihoods. When combined with the CZS data knowledge exchange opportunities to unravel diverse factors within the Land-Water-Food Nexus were identified, such as reduction in fertilizer use that could directly improve local livelihoods and environmental conditions, contributing towards Sustainable Development Goals (SDGs). Through two-way local knowledge exchange, the local cultural context and socio-economic considerations were more readily apparent. Seeking solutions to understand and remediate CZ degradation caused by human-decision making requires the co-design of CZS that foregrounds human behaviour and the opinions of those living in human modified CZOs. We show how a new transdisciplinary CZO approach for sustainable Earth futures can improve alignment of research with the practical needs of communities in stressed environments and their governments, supporting social-ecological and planetary health research agendas and improving capacity to achieve SDGs. [NB. Paper in press in AGU Earth's Future]

Sweeting Award Lecture

Title: Assessing the response of proglacial channel morphology to glacier retreat at Kötlujökull, Iceland

Author/s: Carpenter, T.

Abstract: This dissertation evaluates the influence of retreat at Kötlujökull glacier, South Iceland, on morphological evolution of the proximal Sandvatn and Múlakvísl rivers from 1984-2021. Terminus and elevation change of Kötlujökull was measured using arial imagery and google earth engine. Corresponding river morphological change was documented. This allowed the construction of maps, conceptual models and statistical analysis to determine the importance of geomorphological, glaciological and artificial factors on a proglacial river system. The study found significant decreases of active channels and braided morphology in correspondence with glacier retreat. This indicated the importance of increasing meltwater volume, sediment exposure and associated incisional power; channel transport capacity and distal deposition from Kötlujökull on proglacial channel planform. However, glacier driven planform changes occurred within the confinements of primary controls on the Sandvatn and Múlakvísl Rivers. These included rocky outcrops and artificial structures, preventing lateral expansion of the proglacial river system. Previous studies indicate these confinements can only be exceeded by high magnitude, jökulhlaup scale flows. Jökulhlaups were also found to form major confining terraces and bars, with reworking only possible by discharges of similar magnitude to formation flows. Furthermore, the construction of artificial levees or agricultural land in 2014 exacerbated morphological changes in combination with glacier driven flux changes. These changes included channel abandonment, incision and bar formation from 2014-2021. Yet overall, rapid rates of morphological adjustment (312.7 m/yr) emphasise the rapid impact contemporary deglaciation has on paraglacial transitions. This has important implications for landscape management, flood mitigation and sediment supply to marine ecosystems.

Kirkby Award Lecture

Title: Experimental Insights into Bedrock River Erosion: Dynamic bedrock channel width during knickpoint retreat enhances undercutting of coupled hillslopes

Author/s: Baynes, E.

Abstract: Mountain landscapes respond to transient tectonic and climate forcing through a bottom-up response of enhanced bedrock river incision that undermines adjoining hillslopes, thus propagating the signal from the valley bottom to the valley ridges. As a result, understanding the mechanisms that set the pace and pattern of bedrock river incision is a critical first step for predicting the wider mechanisms of landscape evolution. Typically, the focus has been on the impact of channel bed lowering by the upstream migration of knickpoints on the angle, length and relief of adjoining hillslopes, with limited attention on the role of dynamic channel width. Here, we present a suite of physical model experiments that show the direct impact of knickpoint retreat on the reach-scale channel width, across a range of flow discharges (8.3 to 50 $cm^3 s^{-1}$) and two sediment discharges (0 and 0.00666 g cm^{-3}). During knickpoint retreat, the channel width narrows to as little as 10% of the equilibrium channel width, while the bed shear stress is >100% higher immediately upstream of a knickpoint compared to equilibrium conditions. We show that only a fraction of the channel narrowing can be explained by existing hydraulic theory. Following the passage of a knickpoint, the channel width returns to equilibrium through lateral erosion and widening. For the tested knickpoint height, we demonstrate that the lateral adjustment process can be more significant for hillslope stability than the bed elevation change, highlighting the importance of considering both vertical and lateral incision in landscape evolution models. It is therefore important to understand the key processes that drive the migration of knickpoints, as the localized channel geometry response has ongoing implications for the stability of adjoining hillslopes and the supply of sediment to the channel network and export from landscapes onto neighbouring depositional plains.

Oral Session 3

Title: One million years of climate-driven rock uplift rate variation on the Wasatch Fault revealed by fluvial topography

Author/s: Smith, A.G.G., Fox, M., Moore, J.R., Miller, S.R., Goren, L., Morriss, M.C., Carter, A.

Abstract: The Wasatch fault on the eastern edge of the Basin and Range has been the subject of extensive study, owing to its variable rock uplift rate history. Both climatic and tectonic mechanisms have been suggested to drive this variation, depending on the timescale over which rock uplift can be measured. Presently, the rock uplift rate history of the Wasatch has been well defined on short 10 - 100 year timescales, important for seismic hazard, and is also well defined on the 10 million year timescale owing to its importance in inferring the history of extension in the western US. However, little data exists that bridges the gap between these two timescales. Our study addresses this by inferring an approximately 1 Ma rock uplift rate history from analysis of three river networks located in the center of the range. Field data and previously published cosmogenic ^{10}Be erosion rate data are used to constrain the parameters of the stream power incision model. We consider spatial variation in erodibility, and show that by doing so, estimates of erodibility from a number of methodologies can be reconciled. We also use a novel approach to suggest an appropriate value for the slope exponent, n. We show that the rock uplift rate histories recovered from three different river networks all exhibit similar variations, coinciding with climate driven filling and emptying of lakes in the adjacent Bonnneville Basin.

Title: Dynamic ridges in front of the Rif Belt, Northern Morocco: insights from morphotectonic indices and field data

Author/s: Amine, A., El Ouardi, H., Saadi, M., Taher, M.

Abstract: The geomorphological and tectonic processes responsible for the control of the mountain ranges geometry are feasible to be assessed through geomorphological and morphotectonic indices. Through the application of a series of geomorphic indices related to the drainage network disequilibrium and combined with fieldwork, we investigated the variations in tectonic activity and evaluated its influence on the landscape evolution; in the South Rifian Ridges. These Ramp anticlines are located in the front of the Moroccan Rif Belt (a southern branch of the Arc of Gibraltar) and in the northern limit of Meknes City (Morocco). They have accommodated the tectonic escape of this Alpine chain as an active edge, in response to the converging Eurasian and African plates. Nevertheless, recent tectonic activity remains poorly defined. The outcomes of the geomorphometric and morphotectonic investigation such as the mountain front sinuosity, valley floor width-to-height ratio, drainage basin asymmetry factor, hypsometric curves, normalized steepness index, longitudinal river profile, and χ factor, highlight the presence of differential uplift and tectonic activity across the main fault zones, which exert a strong influence on the doming process. The methodological framework of this study could be developed into a low-cost technique for assessing seismic hazards, offering a valuable tool for assessing disaster risk reduction activities.

Title: Evaluating the Impact of an Extreme Flood Event on Channel Morphology and Floodplain Sedimentation.

Author/s: Dawson, M., Lewin, J.

Abstract: Storm Dennis on Saturday 15 and Sunday 16 February 2020 resulted in extensive flooding along the River Teme, Herefordshire, with discharges matching the previously recorded maximum. Using a combination of several sources of remote sensing data, drone footage and field observations we have been able to assess the combined impact of this flood event and two large antecedent events in October and November 2019 in terms of in-channel pattern development, incision and aggradation, lateral bank migration, overbank sedimentation and scour by out-of-channel flows. Geomorphological effects along the 16km length of the river studied proved to be highly variable spatially, with reach-scale detrimental changes, such as the reworking, remobilisation and redeposition of exposed and partially vegetated sediments, becoming superimposed on more expectable year-on-year incremental meandering activity through lateral bank erosion. The study also highlighted the role of continuous riparian vegetation in maintaining bank stability and constraining lateral channel migration and the potential influence of floodplain vegetation. The role of 'Open Data' and public domain sources of observation enabling the study are discussed.

Title: Sediment matters: integrating recent advances into catchment decision making processes

Author/s: Richardson, J.C.

Abstract: Sediment is an integral part of catchment functioning, however generally there is a lack of detailed information in our catchments in relation to sediment. This is further complicated by the balance needed for sediment – too much and ecology can suffer, treatment costs escalate and flood risk may increase, too little and erosion can occur, undermining infrastructure. In recent years there has been a move to more holistic catchment management, with catchment management interventions aiming to gain multiple benefits, including a reduction in fine grained sediment as a diffuse pollutant. I will showcase a NERC Knowledge Exchange fellowship (KEF) and lessons learnt in translating research to a range stakeholders to generate impact. Knowledge Exchange is a two-way process and the KEF is being co-designed by multiple stakeholders to ensure outputs are tangible and useful for decision making within catchments. The pathways to impact will be explored, highlighting routes of engagement and processes to achieve impact. Sediment is framed in terms of water quality, natural flood management and payment for outcomes, and the KEF contains interlocking themes of modelling, monitoring and cost and value of sediment. I will showcase case studies of projects to demonstrate advances in sedimentological research and how this can be used by stakeholders. The major challenge identified with partners is the need to establish a valuation for sediment to help unlock investments across a catchment, and potentially into coastal areas.

Kirkby Award Lecture

Title: Changing Coasts: a biogeomorphological perspective

Author/s: Woodroffe, C.D.

Abstract: Coasts are some of the most dynamic environments on Earth. Coastlines in the tropics, many heavily populated, are threatened by natural and anthropogenic stresses. Geomorphological understanding of coasts has evolved over the past century. Recognition of former shorelines enabled palaeogeographical reconstructions; coral reefs, in particular, have played a prominent role in deciphering the trajectory of past sea-level change. The stratigraphy of reef and mangrove environments provides not only evidence of past sea level, but also insights into how these coastal systems respond to relative sea-level changes. The sustainability of coastal environments depends on understanding coastal systems and the interactions of both their physical and biological components. Sea-level rise will impact coastlines, with considerable geographical variability, reflecting in part the legacy of their geomorphological evolution. The sediment budget, including the biogenic component, is a major constraint on coastal behaviour. Low-lying reef islands on atolls are composed entirely of skeletal sands and gravel. Coastal ecosystems, such as mangrove forests, are now valued for the 'blue carbon' they sequester within their substrate. Whereas the present is the key to the past, the past also sets the stage on which future changes will play out. The pressures that intense human use brings are exacerbated by climate change, particularly observed and anticipated sea-level rise. Ongoing studies, many utilising a range of sophisticated remote-sensing and other modern technologies, are attempting to discriminate natural patterns of change from trends that result from the impact of human activities.

Posters

Poster Number: 1

Title: EXTENDING LANDSCAPE HYPSOMETRY TO INCORPORATE TERRAIN ROUGHNESS CHARACTERISTICS

Author/s: Keylock, C.J., Singh, A., Passalacqua, P., Foufoula-Georgiou, E.

Abstract: Perhaps one of the better known quantitative methods that has been used for seventy years to characterise landscape is the hypsometric integral (Strahler, 1952). The method has been widely used with, for example, a classic study applying it to landscape evolution being the work of Strahler (1964) who classified landscapes into different Davisian stages using this method. However, the method is relatively insensitive to the detail of the landscape and studies of contemporary landscape evolution need a more sensitive measure of terrain characteristics to couple to the hypsometric properties. In this work, we propose a method based on the joint characteristics of landscape area and terrain roughness as a function of elevation (Keylock et al., Water Resources Research, 2020). Hence, depending on the axis where we take a slice through the joint distribution we either obtain an hypsometry conditioned on a given roughness value or the roughness distribution as a function of the proportion of catchment area for a given elevation. We formulate a variety of metrics to characterise different aspects of these curves and find for a range of terrains in the USA that, assuming one wishes to adopt the conventional hypsometric integral as one such metric, then the best accompanying metrics are the standard deviation of the differences between the conditional hypsometric integrals and the classic hypsometric integral, and the trend in these differences. These three metrics distinguish effectively between different catchments all with a "mature" value for the hypsometric integral (values between 0.40 and 0.55).

Poster Number: 2

Title: Identifying (Dis)Equilibrium Channels: Theory to Application

Author/s: Whitfield, D., Baynes, E., Rice, S., Jeffries, R.

Abstract: Gravel-bedded channels alter their geometries in response to short-term perturbations in the balance between sediment supply and transport capacity, for example, during a flood event or sediment pulse. In quasi-stable channels, this adjustment remains within a zone of dynamic equilibrium, where a channel maintains its equilibrium dimensions by conserving the balance between sediment supply and transport rates. Longer term (or sequenced) perturbations can exacerbate disequilibrium, tipping a channel into an aggradation/degradational state, consequently increasing the susceptibility to geohazards. Identifying these 'tipping point' channels, is therefore important in river management. However, identifying (dis)equilibrium in the field is subjective and difficult to evaluate, particularly for near-equilibrium channels exhibiting complex spatial patterns of aggradation and degradation. We explore three approaches towards quantifying channel (dis)equilibrium; (1) Parker Hydraulic Geometry Relations, (2) Lacey's Law, and (3) Dimensionless Shear Stress Ratio, τ^*bf/τ^*c. These theories originate from hydraulic geometry of unmanaged North American streams, and/or experimental channels. We offer the first UK-wide critical assessment of these theories, and explore their effectiveness at identifying (dis)equilibrium channels, particularly when applied to semi-managed streams. Degradational channels ($\tau^*bf >> 1.2\tau^*c$) are consistently narrower and shallower than their expected equilibrium dimensions. Conversely, the identification of aggradational channels ($\tau^*bf >> 1.2\tau^*c$) are more inconsistent across theories, particularly in high sediment supply reaches. We proceed to explore channel characteristics (bank reinforcement, vegetation type and confinement) that limit the efficacy of hydraulic geometry theory in identifying tipping point channels.

Poster Number: 3

Title: Morphometric parameters as a measure of geomorphological diversity on archaeological sites - Nairn valley case study (Scotland)

Author/s: Szmańda J., Luc M., Kittel P., Banaszek Ł., Maleszka-Ritchie M., Oleś K.

Abstract: River valleys have always had a significant importance for settlement due to the access to drinking water and the possibility of an easy transport. From the side of geomorphological research, relief of the river valley bottom and slopes as well as the channel pattern were the main factors affecting the settlement location there. Although the influence of these features on the development of settlement in river valleys in the past is known, they have not been parameterized so far. Therefore, the aim of the research is to calculate values of morphometric indices of the settlement sites surroundings. This morphological features determines their location but on the other hand, the environmental components (including relief) is a subject to strong anthropopressure caused by its inhabitants. The methodology of the analyses is divided into two steps: (i) determination of an equidistant position in the vicinity of the centre of the settlement site with a radius of 500 m (a range of horticultural crops) and 1000 m (a range of the production profitability barrier in farming communities); (ii) measuring the relative height, inclination and exposure of slopes in these areas. Shown in the presentation morphometric studies are carried out in the River Nairn valley (in Scotland) and are a part of a project where we study the impact of a relief and lithology on location of settlements in the river valleys from the Late Neolithic to Medieval Ages, in relation to global and local changes in the geographical environment in the Holocene.

Poster Number: 4

Title: Creating geomorphological landscapes: fields, landsystems and storytelling models via open-data

Author/s: W. Brian Whalley

Abstract: Most geomorphological investigations are detailed, often case-based, process studies. Reports and papers are published and added to compilations of information in books or, 'the cloud'. Physical landscapes may be considered as information (in a general sense) related to long-term geological, structural and climatic controls. Results are often displayed as maps as well as 'in the literature'. One problem is co-ordinating a proliferation of information to produce coherent 'storytelling' to communicate, via open data, with other scientists and the public at large. At (UK) A-level, the current specifications (and textbooks) invoke 'landform spotting' (or 'I-spy') with poor appreciation of process-based landscapes. Earth science knowledge and understanding is incomplete and uncertain – providing an impetus for research. So how can we better co-ordinate this research and our findings? AI and Machine learning (ML) will be important but human ingenuity can help direct research scenarios and investigations. The concept of a 'field' can be extended to develop geomorphological 'information fields'. Information (not restricted to numeric data) organized at a point can be specified by decimal latitude-longitude (dLL) geolocation and accumulated from many sources. Past results at dLL locations in the cloud, act as prior information (informative, weakly informative and diffuse priors) and can be used to accumulate 'landscape knowledge' models. Transects between dLL points help show landsystem connectivity approaches to mapping. Geomorphological knowledge can be made to matter if information in the cloud is co-ordinated to answer meaningful questions and communicate results as storytelling; with other scientists, educators, policy-makers and the public.

Poster Number: 5

Title: Seismic and hydroacoustic monitoring of bedload transport in the River Feshie, Scotland

Author/s: Matthews, B, Naylor, M, Sinclair, H, Black, A, Williams, R, Cuthill, C, Gervais, M, Dietze, M, Smith, A

Abstract: Seismological observations offer a non-intrusive and continuous method to indirectly measure the transportation of coarse granular materials in rivers, known as fluvial bedload transport. However, distinguishing the seismic signal of bedload from other sources like turbulence remains a challenge. We present a unique dataset obtained from the alluvial River Feshie in Scotland that includes seismic and hydroacoustic measurements, to analyse bedload transport during three successive high flow events that occurred within 2022. Previous research suggested a hysteretic relationship between seismic power and water level as indicative of bedload transport. Our study observed hysteresis in seismic versus water level data, linked to the magnitude and timing of high flows events. However, independent classification of bedload transport using hydroacoustic measurements revealed that hysteresis was not always observed when bedload was being transported. Interestingly, bedload transport occurred in all three events, but hysteresis was only observed in the largest event. Examining successive events allowed us to also evaluate the consistency of bedload transport thresholds and the influence of previous transport events. We observed that the threshold for sediment entrainment was affected by antecedent high flow events, with material becoming more easily mobilised following the largest event. Our findings suggest that hysteresis alone is insufficient for identifying the occurrence of bedload transport and that there is greater richness in the data than has previously been recognised. This is crucial for effective river and land-use management in a changing climate that may experience impacted high flow events.

Poster Number: 6

Title: A new branch of geomorphology: assessing large wood fragmentation using terrestrial LiDAR and cylinder modelling

Author/s: Milan, D.J., Hortobágyi, B., Bourgeau, F., & Piégay, H.

Abstract: Wood forms an important component of fluvial ecosystems, creating ecological niches for a variety of species, influencing fluvial dynamics, and presenting significant carbon stores. Wood also causes management issues, for example blocking bridges and inducing local flooding often resulting in its removal by river managers. Removing wood has deleterious effects to ecosystems and river processes, so understanding whether wood can be left alone within a river system to degrade naturally is of use. Understanding the nature and rate of large wood fragmentation may allow rivers to be managed more effectively for flooding, without damaging habitat or removing carbon. We report on a new approach to characterise wood fragmentation using terrestrial LiDAR, based on information gathered for 10 trees on the Allier river, France, between November 2020 and June 2022. We were able to scan the same trees on ~3 occasions, and RFID tagging of the trees allowed us to identify the same tree as they changed over time, even after some trees had been transported considerable distances downstream. We created cylinder models of trees from the point clouds, that allowed us to derive several useful metrics of tree complexity (branch order, reverse branch order), as well as cylinder radius, total length and volume changes. Cloud to model comparisons show point clouds to fit the cylinder models very well, with points usually within 0.02m of the cylinder surface. However, trees scanned on their sides on bar surfaces, lack of data from underneath the tree leading to occlusion issues with missing points. We demonstrate 1) a shift to coarser tree radius populations over the duration of the study, indicating the initial loss of small branches, 2) rapid reductions in both rates and nature of fragmentation quantified through volume and total branch length, slowing over time. One tree that was scanned whilst still standing and growing on the bank edge, lost all of its branches within the timeframe of the study. Wood fragmentation occurs after fluvial transport and also when the tree remains in situ. Good relationships were also found between field-derived and LiDAR-derived complexity metrics.

Poster Number: 7

Title: Optimal transport-based methods for inverse modelling of landscapes

Author/s: Morris, M. J., Lipp, A. G., Roberts, G. G.

Abstract: The topography of planetary surfaces is generated and moderated by processes of uplift and erosion operating across a broad range of spatial and temporal scales. A challenge within the earth sciences is to extricate histories of such uplift and erosion. This goal is attractive for a suite of reasons; constraining landscape evolution histories can provide crucial information about, for example, seismic hazard, mantle convective processes, biological evolution, natural resource distribution, and palaeoclimate modelling. One objective method to calculate such histories is to identify calibrated models that minimise misfit between observations (e.g. topography) and predictions (e.g. synthetic landscapes). A challenge with this approach is to make use of entire landscapes to identify optimal models. In the presence of natural or computational noise, for example arbitrary noise introduced to force channelisation for fluvial development (a requirement within many computational landscape evolution models), the widely used Euclidean measures of similarity (e.g. root mean square differences between elevations) can have very complicated objective functions. Such complexity obscures the search for optimal models. Instead, we introduce the Wasserstein distance as a means to measure misfit between observed and theoretical landscapes. We first show how it can be used to identify best-fitting uplift histories from synthetic landscapes in the presence of noise. We then demonstrate how use of the Wasserstein distance can be incorporated into an optimised scheme to efficiently minimise misfit between landscapes.

Poster Number: 8

Title: Cosmogenic nuclides for geomorphology applications: NEIF Cosmogenic Nuclides (NEIF-CN)

Author/s: A. CARRACEDO*, D. GHEORGHIU, A. DAVIDSON, M. MIGUENS-RODRIGUEZ, RICHARD SHANKS, D. FABEL

Abstract: Cosmogenic nuclides are extremely rare nuclides that are produced at the Earth's surface when high energy secondary cosmic rays interact with the atoms that constitute the Earth. Since the late 1980s in-situ produced cosmogenic nuclides have been widely used to address scientific questions in Earth surface science. The NERC funded NEIF Cosmogenic Nuclide Facility (NEIF-CN) is part of SUERC-Cosmo (www.suerc-cosmo.co.uk) based at the Scottish Universities Environmental Research Centre (SUERC), East Kilbride, Scotland, UK. SUERC-Cosmo uses Be-10, Ne-21, Al-26, and Cl-36 in different mineral systems to address a wide range of first order problems in geomorphology, glaciology, palaeoclimatology, palaeoseismology, volcanology, geohazard research, soil science, and archaeology. The build-up of cosmogenic nuclides in minerals exposed to cosmic rays is used to quantify surface exposure ages as well as erosion rates of surfaces and entire catchments. In contrast, the differential decay of cosmogenic radionuclides is used to determine the time of burial of previously exposed surfaces or sediments. NEIF-CN provides the UK science community direct access to state-of-the-art nuclide geochemistry, noble gas and accelerator mass spectrometry, and modelling capabilities. As a NERC facility, NEIF-CN not only supports a breadth of science but also a wide range of activities, including pilot studies to demonstrate feasibility, student training and analyses, through to large research grants and programmes. SUERC-Cosmo and NEIF-CN are in constant development to improve the quality and reliability of the results using the latest analytical techniques. Information about the NEIF-CN and how to apply can be found at www.isotopesuk.org/apply If you have any queries or are seeking help we are happy to assist you on your specific proposal and for eligibility advice.

Poster Number: 9

Title: DUNEMINDS - A Deep Learning Framework to Map and Analyse Linear Dunefields

Author/s: Nowatzki, M, Bailey, R, Thomas, D

Abstract: Morphological patterns reflect climatic and geomorphic influences throughout a dunefield's history and can thus be a valuable source for information about past and present environmental and climatic conditions. However, the quantitative assessment and interpretation of these patterns require precise dune maps. Over time, satellite data has evolved into an essential tool for mapping dunes, especially for extensive areas, where manual approaches are inefficient.

To address this, we introduce a deep learning framework called DUNEMINDS (DUNE Mapping and analysis INtegrating Deep learning and Satellite data). This framework utilizes semantic segmentation techniques on optical satellite imagery and medium resolution digital elevation models to map linear dunefields. The workflow includes all steps from accessing and pre-processing data to the training and prediction of a U-Net Neural Network to identify dune crests.

To test and validate the effectiveness of DUNEMINDS, we conducted a case study on the linear dunes of the Kalahari Desert. Additionally, we explored the framework's universality by applying transfer learning techniques and utilizing it on linear dunefields in other locations such as the Simpson Desert in Australia. The resulting dune maps can be used to quantify various dune patterns and may provide valuable insights into their relationship with environmental and climatic factors.

Poster Number: 10

Title: Fine-Grained Sediment Movement on Shore Platforms

Author/s: Horton, S

Abstract: An important but often overlooked consideration of shore platform degradation is that of fine-grained sediment movement. In this experiment, a series of 4 sets of bi-directional time integrated mass sediment samplers were used to collect material over 4 tide cycles on a sub-horizontal shore platform to quantify the directional flux of sediment being transported in a shore normal direction. Two types of samplers were used in the experiment, to ascertain whether there was also a difference in the sediment transport pathways, with one set designed to collect suspended material, and the other saltating and creeping material closer to the platform surface. Sediment traps showed that the overall directional flux of sediment varied across the platform. Under quiescent conditions the greatest flux of sediment was in a seaward direction i.e., away from the pocket beaches that have formed at the landward margin of the shore platform. Sediment traps deployed within the central portion of the platform showed that material can move in both an on- and off-shore direction albeit with considerably less mass. During the experimental period it appeared that sand was being reworked from the pocket beaches across the upper portion of the platform, and that there was a smaller flux of material also being delivered to the platform as collected in the outermost sediment trap. Trends in sediment movement may also affected by the density of algal mats present on the platform, suggesting an important interplay between biologically induced flow turbulence and surface roughness relative to sediment sources.

Poster Number: 11

Title: Dynamic changes in mangroves of the largest delta in northern Beibu Gulf, China: Reasons and causes

Author/s: Chuqi Long, Zhujun Dai

Abstract: Many mangrove forests occur along estuaries and deltas are experiencing irreparable losses throughout the world due to changes in natural factors and intensive anthropogenic interferences. However, little information is available regarding variations in mangrove forests and associated reasons and causes. Here, the long-term dynamic patterns of mangrove forests in the Nanliu River Delta (NRD), the largest delta in the Beibu Gulf, China, were detected based on a series of hydrosediment data and remote sensing images between 1986 and 2020. The results indicated that the total mangrove forest area of the NRD increased in an incremental manner, even though a rapid decline occurred in the western terrestrial margin of the delta before 1998. Additionally, mangrove forests have expanded southeastward to the sea in the eastern NRD, and they have colonized to the southwest in the western NRD. Moreover, long-lasting horizontal seaward expansion with vertical accretion in the bare tidal flat of the NRD created new sites for potential mangrove regeneration. Furthermore, an average annual sea level rise of 0.2 mm per year and an 86% decline in fluvial sediment supply could not cause expansions and local losses of mangrove forests. The combination of local tidal currents and waves transports sufficient estuarine sediment to the northeast into the delta to provide important sediment material for the deposition of mangrove tidal flats. The mangrove forest destruction induced by local residents and the ecological restoration implemented by the government are the causes of the continuous serious losses and extensive gains of mangrove forests, respectively. The results highlighted that the dynamic changes in mangrove forests in the NRD caused by driving forces from natural and human interferences can serve as significant references for mangrove forest restoration and decisionmaking policy management in similar deltas around the world.

Poster Number: 12

Title: Biogeomorphology on Coastal Built Heritage: Practical conservation outcomes of wildlife-heritage interactions.

Author/s: Baxter, TI, Coombes, MA, Viles, HA

Abstract: Historic coastal structures constructed of stone (e.g. historic harbours, sea walls, coastal fortifications) provide unique habitats for marine wildlife. At the same time, colonising organisms (seaweeds, barnacles, etc.) can enhance and/or retard deteriorative weathering and erosional processes that occur on the surfaces of historic buildings. An improved understanding of the two-way interactions between marine wildlife and built heritage may provide mutually beneficial opportunities for joint wildlife-heritage conservation. As of yet, however, the potential benefits of biogeomorphological interactions on historic coastal structures have received limited research attention.

Here, we provide a comprehensive review of wildlife-heritage interactions in marine environments drawing on examples from around the world. Furthermore, we present new evidence of biogeomorphological interactions on maritime built heritage from across the UK based on 4 years of PhD research. Together this is used to identify management strategies with the greatest potential to benefit marine wildlife and cultural heritage, and potential avenues for future research including nature-based solutions for heritage conservation in marine and terrestrial environments.

Poster Number: 13

Title: Quantifying coastal change and exploring coastal processes via satellite-derived vegetation edges

Author/s: Muir, FME, Hurst, MD, Richardson-Foulger, L, Naylor, LA, Rennie, AF

Abstract: Our coastal landscapes and communities are increasingly under threat of climate change-related hazards such coastal erosion and coastal flooding. Climate-change induced acceleration and amplification of these risks is expected due to sea level rise and increased storminess. To identify and adequately support the communities at greatest risk of these impacts, regular and repeatable observations of coastal change from a range of change indicators are required. Shoreline positions offer a simplistic representation of spatiotemporal changes in coastal position; however, shoreline positions fluctuate significantly in macrotidal areas and are subject to tidal bias. A more stable measure of coastal change, and one arguably more relevant to coastal communities, infrastructure and the natural geomorphology that enhances their resilience to coastal change, is the vegetation edge (VE). Presented here is a Python toolkit which builds on and enhances the shoreline extraction tool CoastSat, by automatically identifying coastal vegetation edges from satellite imagery. A trained neural network classifies pixels and uses weighted peaks thresholding to extract sub-pixel contours between vegetation and non-vegetation classes. Sentinel-2 images offers the highest accuracy at the test site of St Andrews, Scotland (RMSE of 10.4m). Extracted VEs are then compared with other derived coastal characteristics such as the vegetation transition zone, beach width, and coastal topography, to infer relationships between them and therefore create proxies for predicting different geomorphic regimes. By building temporally dense vegetation timeseries (~12 day intervals) from freely available satellite imagery, the tool can be readily expanded to assess historic coastal trends globally in traditionally data-starved areas.

Poster Number: 14

Title: Erosion estimation in coastal historic landfills using terrestrial laser scanning

Author/s: Shudan Xue, Kate Spencer, Stuart Grieve

Abstract: There are approximately 1200 historic coastal landfills in England that predate modern environmental practices and are frequently poorly managed as rates of sea level rise increase and storms become more severe and frequent, increasing numbers of these landfills will experience coastal erosion. The Local Government Association Coastal Special Interest Group & Coastal Group Network has reported that landfills from at least 10 councils are actively eroding. This current and future erosion will lead to the release of landfill gas, particulate and soluble pollutants into the marine environment. However, we have little understanding of the magnitude of the environmental risks posed as there are no robust constraints on current landfill erosion. The overall aim of this project is to assess the impacts of eroding coastal landfills on the adjacent sediments and the coastal environment. In this study, erosion volume was estimated to evaluate the extent of waste release and its subsequent effects using repeat Terrestrial Laser Scanning (TLS) surveys of an eroding historic landfill in East Tilbury, Essex. Preliminary results demonstrate significant erosion between 2022 and 2023, and identified local hotspots of erosion. In one 8 meter section of landfill front 2.35 m3 of contaminated sediment has been released in under a year. These results provide a basis for future shoreline management plans and to identify immediate targets for remediation.

Poster Number: 15

Title: Examining an overlooked type of beach: grain size characterisation of an urban anthropogenic beach in Granton, Edinburgh

Author/s: Yuchen Wang, Y. W., Martin D. Hurst, M. D. H., Larissa A. Naylor, L. A. N.

Abstract: Beaches comprised primarily of man-made materials are under-studied when compared to 'natural' beaches. Artificial materials can be released onto beaches through coastal erosion of made ground, and these beaches and erosion will be impacted by climate change, manifest as changing storm activity and sea-level rise. Such anthropogenic beaches are not yet characterised nor documented in any existing sedimentary beach classification system. Therefore, it is important to study these artificial and often urban beaches in terms of their compositions, morphological features, distributions, and morphodynamics to better manage these coasts in the face of climate change. Here we present a characterisation of Granton Beach in Edinburgh, where surface sediments are composed of over 80% artificial materials such as bricks, concrete, and slag. We characterised beach sediments along 3 transects perpendicular to the shoreline using a mixed-method approach. UAV imagery and lidar were also obtained to generate a digital elevation model of the beach. The mean grain size (D50) of surface sediments is 2.05mm. For each transect, it is characterized by the largest D50 near the mid-tide line. While the transects composed of more artificial materials are of larger D50. It infers that, compared to natural beaches, artificial materials move under higher wave conditions. D50s distributions of the beach of a higher resolution will be obtained from the UAV imageries using digital grain size analysis, and the results will be compared with wave conditions of different areas to verify our speculation.

Poster Number: 16

Title: Mangrove Seaward Extent Changes in Mary River, Northern Territory, Australia

Author/s: Porni Mollick,PM, Colin Woodroffe,CW, Kerrylee Rogers, KR

Abstract: Coastlines are dynamic and mangrove distribution is temporally variable; however, the relationship between these factors remains unclear. In addition, the dynamic nature of coasts and mangrove distribution is likely to be further modified by accelerating sea-level rise, and the implications of this on mangrove extent and distribution are uncertain. This study aims to characterise and describe the relationship between the coastline and mangrove dynamics, initially at the seaward extent, along the coastline near Mary River, Northern Territory, Australia. Using existing datasets describing mangrove distribution changes and coastline changes derived from Landsat imagery since 1987 are compared. The Digital Shoreline Analysis System (DSAS) tool was undertaken to characterise changes in mangrove boundaries over time and this was compared to the linear rate of regression quantified from the DEA Coastlines dataset. The greatest mangrove seaward extent contraction occurred along seaward extent dominated by tidal creeks to the west of Mary River. Conversely, the greatest progradation and mangrove expansion occurred east of Mary River. This information was used to characterise four types of mangrove seaward extent dynamics: contraction, progradation, establishment, and stability. This study confirmed that mangroves are dynamic, even under the modest rates of sea-level rise that have occurred since 1987 and demonstrate the need for ongoing monitoring. It anticipated that expanding this approach to characterise mangrove changes across coastal floodplains and along estuaries would provide critical information for hypothesising processes' contribution to mangrove extent changes.

Poster Number: 17

Title: Channel Incision and Interaction with Erosion Resistant Delta Substrates

Author/s: Johnson, J.E., Parsons, D.R., Hackney, C.R., Coulthard, T.J., Best, J.L., Edmonds, D.

Abstract: Deltas are densely populated and ecologically critical landforms that exist in a state of balance between sediment deposition, costal erosion, and subsidence. All of these processes are increasingly disrupted by human activity, through sediment capture in reservoirs, global sea level rise and sub-delta fluid extraction. This 2020 field study of the Wax Lake Delta (WLD, Louisiana, USA) utilises high resolution bathymetric data to assess how the delta's channels are interacting with the underlying resistant cohesive substrate. Acoustic Doppler current profiler velocimetry and backscatter data were collected to measure the channel water and suspended sediment discharges at transects throughout the delta and analyse water and suspended sediment partitioning through four delta bifurcations.
In agreement with previous studies, the WLD was found to contain bedforms that indicate erosion or sediment deprivation across the majority of delta channels. Bifurcations on the delta correspond most closely to previous mathematical models for asymmetric bifurcations, but with considerable variability in time and across the delta. Despite the minimal degree of planform change in the analysed delta, many of the bifurcations did not match stability criteria proposed by existing models. Therefore, we propose that the resistant substrate underlying the delta affects the evolution of bifurcations, thereby slowing the erosion that deepens dominant distributaries and, hence increases their capacity for water and sediment transport at the expense of smaller distributaries. This leads bifurcations to either be stable even in flow conditions that would normally cause them to be unstable, or to evolve towards full avulsion more slowly.

Poster Number: 18

Title: An opportunity to improve channel hydromorphology and biodiversity net gains within a larger commercial infrastructure project

Author/s: Lavarini, C, Preston, J

Abstract: The Whittle Brook is a tributary of the River Mersey located in Warrington. A commercial infrastructure scheme is planned which requires realigning a section of the Whittle Brook due to existing physical constraints. We saw an opportunity to ensure that the channel realignment design improved the hydromorphology elements and biodiversity net gain status. Because the current channel has been heavily modified by human activities, some geomorphic features (e.g., berms, and point bars) that were absent had to be designed with no reference. These features were designed through empirical formulae, analogue examples and professional judgment. Our final design is made of a new 700m long pool-riffle reach, appropriate to the catchment setting of the Whittle Brook. The pool-riffle section includes berms, point bars, a two-stage channel, irregular meanders and a mobile substrate for effective flows. The proposed new channel design conserves channel length, enhances hydromorphological and ecological elements compared to the existing channel, and is a prime example of ensuring channel restoration as an opportunity within a project not necessarily concerned with such a venture.

Poster Number: 19

Title: Turbulent flow over dunes: The significance of curvature in the three-dimensional morphology in determining flow

Author/s: Hardy RJ, Best, JL, Marjoribank, TI

Abstract: Dunes are the most prevalent bedforms in sand bedded rivers and their morphology exert a control on the flow, sediment transport and hence morphological evolution of the riverbed. Current understanding of the turbulent flow over dunes has been derived from experiments considering simplistic morphologies of dunes in isolation. Here we present results of the time-dependent flow characteristics over four separate dune train morphologies predicted with a Large Eddy Simulation (LES) model. Each morphology used was generated through a set of flume experiments whose experimental conditions would predict the formation of three-dimensional dunes according to a bedform phase diagram. The morphology is characterised and then used as a boundary condition in the LES model. The results demonstrated the important effect curvature in the dune morphology has on the generation of the turbulent flow field. As profile curvature increases the amount of turbulence generated increases and this is reflected in the number of hairpin shaped vorticities detected. Octant analysis identifies vortex type and quantifies the contribution that different flow structures make to local shear stress acting on the bed. The results highlight how the size, morphology and stacking of coherent flow structures into larger flow superstructures is dependent on the local morphology and how these subsequently influences local bed shear stress and increase the three-dimensionality of bedform morphology.

Poster Number: 20

Title: How river embankments affect sediment transport, river morphology, and conveyance capacity in the Kathmandu Basin, Nepal

Author/s: Thapa S., Sinclair H. D., Creed M. J., Mudd S. M., Attal M., Borthwick A. G. L., Ghimire B. N.

Abstract: In recent years, flooding has become a frequent and catastrophic natural disaster worldwide, causing significant damage and affecting lives. In Nepal, rapid urbanization and anthropogenic activities like river confinement, floodplain encroachment, and sand and gravel extraction have led to the construction of river embankments to control flood damage and minimise flood risk. However, the increasing number of settlements in low-lying floodplain areas and infrastructure damage caused by overtopping, breaching, or seepage of embankments pose a growing threat and raise questions about the long-term sustainability of embankments as a solution to prevent future floods. Kathmandu has constructed many embankments along the rivers in the Kathmandu Valley.

This study uses computer models to investigate how embankments affect sediment transport, channel geometry, conveyance capacity and flooding along the Nakkhu River, which is a major southern tributary of the Kathmandu basin in Nepal. The study uses a coupled hydrodynamic and landscape evolution cellular automaton model, HAIL-CAESAR to simulate the flood-inundation and sediment transport using a high-resolution digital elevation model (2 m acquired in 2019-2020), field-derived sediment grain size and daily discharge obtained from the Department of Hydrology and Meteorology, Nepal.

The results suggest that the changes in channel geometry caused by sedimentation increase flood risk downstream, particularly where embankments follow sinuous channel courses, and that sediment transport should be incorporated into the design of future embankments and planned developments along the river floodplain to minimize flood risk. The study recommends that the construction of embankments alone may not be a sustainable long-term solution to prevent future floods in rivers with high sediment load.

Poster Number: 21

Title: Power and politics: urbanization and river channel change

Author/s: Ashmore, P

Abstract: Gradual urbanization of a watershed in Toronto, Canada, over 60+ years resulted in major channel changes. The temporal and spatial extent of channel widening are predictable from analysis tracking changes in total stream power along the river system as urban land cover extended across the watershed. The analysis is a geomorphically-satisfying, quasi-experimental test of regime theory of river channel change. But it misses important elements of the full trajectory of change that are not physically predictable. Treating urbanization as a neutral physical variable of changing watershed state that 'just happens' ignores the actual socio-political elements of power in urbanization and their impacts on the trajectory of geomorphological change. This includes the roles of various actors and events including, colonization, urban development policy, community attitudes to the river, forms of engineering intervention, and the role of epistemic communities engaged in mitigation, restoration and setting the future of the river system. I suggest that we need forms of political geomorphology to question processes of geomorphic change and management, and to extend the benefits of epistemological inclusion.

Poster Number: 22

Title: Is riparian vegetation affecting flood modelling?

Author/s: Yiwei Guo、YGuo, Michael Nones、MNones

Abstract: In rivers, bed roughness is one of the most important parameters for simulating hydrodynamic processes. Vegetation coverage has a significant impact on surface resistance, as it alters the roughness, contributing to determining the flow velocity and the flood wave celerity. By combining satellite-derived information and numerical modelling, this study aims to investigate fluvial bio-morphodynamics at a very high spatiotemporal resolution, eventually developing an innovative flood modelling approach that considers the evolution of riparian vegetation. A reach of the Italian Po River is selected as the study area and the MOD09GA version 6.1 product is used to derive the daily spatial bed roughness, a function of the local vegetation coverage. The calculated roughness is implemented in a Delft3D FM model, and water discharges measured at the upstream and downstream ends are used as boundary conditions. The model aims to reproduce the downstream daily cross-sectional discharge measured during the period 2021.01.01 to 2021.12.31. The results show that the model forced by the daily spatial roughness, function of the vegetation coverage, simulate performs better than the model run with a fixed roughness throughout the study area. However, differences between the two models are very limited, and in both cases, the per cent bias between simulated and observed discharges is around -13%, meaning an underestimation of the simulated discharges. This work represents the initial step of a larger study that aims to serve as a reference for developing flood risk maps and management plans when taking into account the local and catchment-specific hydro-morpho-biodynamics.

Poster Number: 23

Title: Connectivity changes in a large tropical river basin after damming and deforestation

Author/s: Chong Xin Yi, C.X.Y. Christopher Neil Gibbins, C.N.G. Damia Vericat, D.V. Ramon J. Batalla. R.J.B. Marco Cavalli, M.C. Stefano Crema, S.C. Teo Fang Yenn, T.F.Y. Karen Lee Suan Ping, K.L.S.P.

Abstract: This paper evaluates changes in structural connectivity across the Baleh catchment, Malaysian Borneo, in response to various anthropogenic pressures. Connectivity was assessed using the Sediment Connectivity Index (IC), a model that quantifies structural connectivity using spatially explicit data on gradient and roughness across the catchment. IC values were calculated at two scales. First, connectivity between the whole of the catchment area and its downstream confluence with the Rajang River was calculated for historical, current and some future scenarios; scenarios included forest clearance, damming and road construction. Second, the effects on connectivity of managing the reservoir to maintain different lake levels were assessed.

IC models suggested that historical changes in landcover (most recent 20-year period) have not altered connectivity between the Baleh and the Rajang markedly. Differences in IC between the current and 2001 landcover were minimal (i.e. mean change in IC was 0.01, maximum change was 0.6). Ongoing road construction and forest clearance were predicted to have detectable impacts on connectivity between the Baleh and the Rajang, with small decreases and increases in IC respectively. However, models suggested that once the dam is built the effects of the impoundment on connectivity will override those of roads and landcover change, with a major portion of the Baleh becoming disconnected from the Rajang. Sensitivity analysis using IC suggests that managing water levels in the lake may help control the dam's impacts on connectivity in the upper basin.

Poster Number: 24

Title: Discerning the hydrological controls on the behaviour of water surface area variations in oxbow lakes

Author/s: Ahmed, J

Abstract: Oxbow lakes serve as rich habitats for wildlife, natural contaminant filters, and an essential source of sustenance and prosperity for riverine communities around the world. Despite their significance, little is known about the controls on oxbow lake hydrology and the timescales over which they operate. Without an understanding of how these environments currently function, it will be challenging to protect them from the pressures of climate change and land use conversion, thus threatening their ability to deliver the wealth of ecosystem services they currently provide, in the future. Here I present an analysis of the temporal behaviour of 110 recently formed (1984-2022) oxbow lakes in the near-pristine catchments of three Amazonian tributaries and elucidate the hydrological controls on this behaviour using a combination of band-rationing procedures and tropical rainfall data. Water surface areas (WSA) fluctuate annually, with some increasing in size by >60% compared to the year immediately following formation. We found that proximity to the mainstem as well as seasonal and annual rainfall exerted a strong control on annual variations in WSA, with the former exerting the strongest control on the observed changes. Proximity of the lake to the mainstem was most important where flow could be directly conveyed through tie channels or breaches in the lake plug. Changes in hydro-climate, flow regulation, and land use will alter the dynamism of lake hydrology, thus potentially altering the functioning of lakes in the future.

Poster Number: 25

Title: Quantifying land use intensity and its effects on river water quality in New Zealand

Author/s: Julian, JP., deBeurs, K.M.

Abstract: Relationships between land use and water quality are complex with interdependencies, feedbacks, and legacy effects. Most river water quality studies have assessed catchment land use as areal coverage, but here we hypothesize and test whether land use intensity—the inputs (fertilizer, livestock) and activities (vegetation removal) of land use—is a better predictor of environmental impact. We use New Zealand (NZ) as a case study because it has one of the highest rates of agricultural land intensification globally over recent decades. To quantify weekly land disturbance for forests and grasslands, we used a novel remote sensing approach that fused MODIS and Landsat data. We interpreted water quality state and trends based on 26 years of monthly data from 77 sites in the National Rivers Water Quality Network. We found that median visual water clarity was best predicted inversely by areal coverage of intensively managed pastures. The primary predictor for all four nutrient variables, however, was cattle density, with plantation forest coverage as the secondary predictor variable. While land disturbance was not itself a strong predictor of water quality, it did help explain outliers of land use–water quality relationships. From 1990 to 2014, visual clarity significantly improved in 35 out of 77 catchments, which we attribute mainly to increased dairy cattle exclusion from rivers and the considerable decrease in sheep numbers across the NZ landscape. Despite recent improvements in river water quality, legacy nutrients and continued agricultural intensification are expected to pose broad-scale environmental problems for decades to come.

Poster Number: 26

Title: Investigating bedrock exposure controls in mixed bedrock-alluvial river systems

Author/s: Mel Oliveira Guirro, MOG, Rebecca Hodge, RH, Fiona Clubb, FC, Laura Turnbull, LT

Abstract: In mixed bedrock-alluvial river systems, riverbed sediment cover depends on sediment supply, channel morphology, and flow properties. This study combines numerical modelling and field data to investigate how these factors influence the spatial distribution of bedrock exposure. Our study site is the River Carron in the Scottish Highlands, where we have data on channel geometry, sediment cover and grain size. We applied Network Sediment Transporter (NST) model from Landlab to simulate flow and sediment transport through this river network. The model represents the channel network as a graph of nodes and links. In our simulations, the links are 100 m reaches and nodes connect them. The NST was modified to enable sediment to be input every timestep and to calculate the extent of sediment cover in each reach. Our field data informed model input estimations. We tested scenarios by varying four main input parameters – initial sediment cover, flow depth, sediment supply and grain size – to analyse their effect on the spatial distribution of bedrock exposure at a steady state. We found that steady-state sediment cover is most sensitive to the sediment supply and water flow. Channel slope has a strong correlation with the spatial distribution of bedrock exposure. Despite discrepancies between model results and field data, particularly in representing reaches with partial sediment cover, the model provides a valuable tool for exploring controls on bedrock exposure in complex mixed bedrock-alluvial systems and improves our predictive capabilities in fluvial geomorphology.

Poster Number: 27

Title: How sequences of flood modify river morphology? Insights from the Evoflood experimental work.

Author/s: Delorme, P, McLelland, S, Parsons, D , Darby, S, Leylan, J, Liu, Y, Wortmann, M, Slater, L, Hawker, L, Neal, J, Boothroyd, R, Griffith, H, Cloke, H, Vahidi, E, Nicholas, A, Gebrechorkos, S, Bennett, G, Ashworth, P, Sambrook-Smith, G, Tatem, A.

Abstract: According to the last IPCC report the frequency and magnitude of high rainfall events will increase in the future due to climate change. This will therefore lead to more frequent flood event. To limit the impacts and cost of these potentially catastrophic events it is necessary to understand how rivers will evolve because of the changes in hydraulic conditions. Current flood models usually consider the river channel as a fixed conduit for water, however field evidence have demonstrated that the shape of the channel, and consequently its ability to accommodate high flows is strongly influenced by past flood history. To improve the prediction of flood water inundation, it is therefore necessary to understand how river morphology evolves to a succession of flood events.

In this study, we have used laboratory experiments to assess the morphological evolution of river channels in response to sequences of flood events. For the experiments we studied two channels, one with sediment input in equilibrium with the water discharge and the second one with a constant low sediment discharge. Both channels were then allowed to evolve in reponse to a sequence of medium and high flow events simulating a series of floods. We found that high discharge events leave a perennial imprint on the river morphology. For both channels; i) the first high discharge event generates the greatest change, ii) an increase in the channel conveyance capacity which is mainly driven by channel widening. Finally, by comparing the evolution of the two channels we found that every increase in water discharge (even the smallest one) for the sediment deficit channel generates significant changes in the conveyance capacity, whereas only the larger discharge events change the conveyance capacity of the channel with sediment supply in equilibrium with the flow

Poster Number: 28

Title: Morphology and surface roughness of rough-bed rivers

Author/s: Houseago, R.C., Hodge, R.A, Hackney, C.R., Ferguson, R.I., Hardy, R.J., Rice, S.P., Johnson, J.P.L., Yager, E.M.,

Abstract: River-bed surface roughness is a fundamental control on flow resistance and sediment transport. In fully alluvial rivers, sediment grain size provides an indication of bed roughness, yet these principles are unsuitable for rough-bed rivers (where flow is shallow relative to roughness height). In such rivers, exposed bedrock and large boulders introduce additional complexity, yet these effects on roughness are poorly constrained. This research utilises high-resolution digital elevation models to conduct geostatistical analysis of surface roughness and channel characteristics for 20 river-bed reaches encompassing varying channel properties (channel geometry, bedrock exposure, sediment grainsize, boulder density, and lithology). A host of elevation and gradient-based multi-scale surface roughness metrics are evaluated using correlation analysis to determine the most appropriate set of metrics for describing rough-bed rivers. Principle component analysis (PCA) showed that channel variation cannot be described using only reach-average metrics, but also requires directional-based metrics. Hierarchical clustering presents relationships between channel properties and surface roughness, revealing distinctions between reaches based on surface features (bedrock or boulders) and the dominant spatial scales. We compare our results to a parameter space developed for engineering applications that distinguishes surfaces based on the elevation skewness and frontal area. Our results identify the minimum range of parameters needed to distinguish between the morphology of rough-bed rivers with differing channel properties, and provide a framework for future research on quantifying flow resistance in these channels.

Poster Number: 29

Title: The formation of mountain fluvial anthropospheres from a socio-hydrological perspective

Author/s: Karol Witkowski

Abstract: The objective of the research was to determine the beginning of the formation of fluvial anthropospheres in the mountainous Skawa catchment (Poland) and the conditions of its functioning, taking into account the feedback between humans and the natural environment. Anthropopression in the Skawa catchment area, from the beginning of the development of organized settlement to the present day, has been divided into 4 periods. (I) In the 13th-15th centuries, the first breeding ponds using oxbow lakes were established. Watermills were built over natural channels. (II) In the 16th-19th centuries, about 70 km of millraces and 19 millponds were built. The development of milling in the main river interfered with the more and more popular timber rafting. The densification of the river network raised the groundwater level in the floodplains, which was a negative process from the agricultural point of view. (III) From the beginning of the 20th century, the Skawa River was channelized, which led to the liquidation of braiding and anabranching channels. The channelization of rivers coincides with the decline of watermilling, favouring intensive channel incisions. The last wetlands were drained and the floodplains were built up. The fluvial anthropospheres then replaced the natural environment. (IV) In the 21st century, a dam begins to work, the construction of which led to flooding of 12 km of the bottom of the Skawa Valley. The fluvial anthropospheres in many sections of the rivers are limited only to a narrow single-thread channel.

Poster Number: 30

Title: Monsoon-driven changes to river bifurcations in Nepal

Author/s: Cload, C., Dingle, E., Creed, M.

Abstract: Dynamic gravel-bed river systems in the Terai plains in Nepal have historically experienced frequent changes in course and flow distribution, which alter the location and extent of flooding. However, current flood risk mapping of these rivers does not consider channel bed movement, and there has been limited research into the drivers and controls of change. The aims of this research are to test whether variations in monsoon flood patterns could cause instability in these rivers, particularly around bifurcations, and to develop a method of mapping and quantifying the areas of instability within a river corridor.

Annual satellite images of the Karnali River over a 30-year period are compared with river discharge hydrographs to establish whether observed monsoon patterns coincide with geomorphic changes in the river. Initial review has shown that during several monsoon seasons, two large flood flows occurred. In almost all these instances, changes to the bifurcation were observed from the satellite images, with either a switching of the dominant channel, or a new channel appearing. Contrastingly, large single flows in other monsoon seasons caused no observable channel modifications. To create instability maps, Google Earth Engine was used to extract the wetted channel from the satellite images, using established multiple spectral indices. Temporal changes to the river planform were then quantified using GIS techniques.

The results of this study will help to establish a better understanding of the flood risk in the region, and will support development of a flood model which reflects the dynamism of the river system.

Poster Number: 31

Title: Assessment of river habitat monitoring for delivering multiple benefits of nature-based solutions

Author/s: Clarke, L, Harrison, A, Andrews, K, Robson, H

Abstract: A wide variety of methodologies have been proposed for characterising river habitats in order to meet different environmental objectives; these are important tools for monitoring river ecosystem health, understanding river functioning, determining the position and success of river restoration projects and as surrogates for biodiversity assessment. There are a number of methods and protocols for the survey, characterisation and classification of physical habitat elements but the strengths and limitations of these for monitoring the multiple benefits of nature-based solutions are unclear and therefore a variety of different methods are often used across different studies making comparison problematic. This research assesses the physical habitat at three different nature-based solution sites in south-west England (urban river restoration, in-channel leaky barriers and a wet woodland) using common measures of river habitat including the UK Habitat Classification, River Condition Assessment, Modular River Survey, River Naturalisation Survey and River Habitat Survey. The procedures, variables and outputs of each survey have been evaluated to determine the ecological and geomorphological data on the river habitat provided for each type of intervention, as well as the practical considerations associated with undertaking these. This presentation will outline the preliminary findings and will compare and assess the different methods to understand their application in the assessment of nature-based solutions.

Poster Number: 32

Title: Decadal-scale river bed incision in the Red River Delta, Vietnam driven by intense and widespread sediment extraction

Author/s: Hannah Runeckles, HR, Dr Christopher Hackney, CH, Dr Đỗ Thu Nga (DTH), Dr Lê Thị Vân Huệ (LEVH), Professor Andy Large (AL)

Abstract: Demand for sand has increased exponentially in the last decade, resulting in a boom in riverine sand extraction globally. The Red River Delta (RRD) is Vietnam's most densely populated catchment, with livelihoods intertwined with and entirely dependent upon the delta and its resources. Here, intensive and widespread riverine sand extraction is linked to substantial degradation of the delta, leading to riverbank instability and bed incision. Reports state riverbed subsidence of 2-3m in Hanoi, and 8-10m in other regions; however, like bank erosion, bed-level change is poorly understood in the RRD. Here, we quantify, for the first time, the role of anthropogenic activities upon morphological change in the RRD, and the implications this has for local communities.

High resolution (~0.2m) bathymetry data was acquired using a PicoCAT-130 multibeam echo sounder, paired with an EMLID Reach RTK dGPS system to allow accurate horizontal and vertical positioning. Surveys were conducted upstream within and downstream of the tidal zone, in areas of comparable pre-existing bathymetry survey, allowing quantification of bed elevation change between 2007, 2010 and 2023. This will provide the first assessment of mining-induced riverbed incision at sites across the RRD and allow for the independent corroboration of community impressions of sand mining impact, generated by rural riverine communities. We suggest the presence of relatively deep pits, hollows and scour, associated with sand mining vessels, have significantly altered natural riverbed morphology, having implications for riverbed and bank stability, as well as the livelihoods and cultural traditions of these resource-dependent communities.

Poster Number: 33

Title: The long-term dynamics of invasive signal crayfish forcing of fluvial sediment supply via river bank burrowing

Author/s: Sanders, C.H., Mathers, K.L., Rice, S.P. and Wood, P.J.

Abstract: Animals are important drivers of sediment dynamics. Invasive signal crayfish (Pacifastacus leniusculus) supply sediment to rivers by burrowing into riverbanks. Burrowing directly transfers excavated sediment into the river and also has an additional, indirect affect by promoting riverbank failure. While previous research has isolated burrow densities at a point in time, rates of burrow construction and of burrow loss due to erosion are unknown, which introduces uncertainty into estimates of how much sediment burrows contribute to rivers. We report results from a 5-year study that monitored 1,861 burrows at ten reaches across five lowland streams, to evaluate the temporal dynamics of crayfish populations, rates of burrow loss due to erosion, and the mass of sediment directly supplied to rivers by burrow excavation. Both crayfish and burrow densities were variable over time, suggesting that burrows contribute temporally variable amounts of fine sediment to riverine systems. Individual burrows lasted on average 461 days, and an average of 2.0 t km-1 a-1 of sediment was excavated to construct burrows, which is eight times greater than estimated in previous studies. Whilst total burrow densities in each year were not consistently correlated with contemporary crayfish densities, the mass of sediment excavated over the prior year was strongly correlated with contemporary crayfish densities. Current fine sediment management practices are largely aimed at controlling fine sediment delivery predominately via agricultural means, but biotic burrowing of riverbanks may represent an important and overlooked source of fine sediment supply.

Poster Number: 34

Title: Multi-model ensemble analysis of frost weathering risks across East Asia (1850-2100)

Author/s: Richards, J; Brimblecombe, P

Abstract: Frost events can cause frost weathering processes by causing internal stresses in a material when water becomes ice. Frost weathering is of particular concern for heritage materials, such as stone, brick and earth, as the loss of weathered material can negatively affect the value of a site or object. As climate change causes the average global temperature to increase, the frequency and location of frost events is likely to change. We use nine CMIP6 models to investigate three types of frost events in East Asia: freeze-thaw cycles; deep frost days and wet frosts, for the period 1850 to 2100. Future projections are run under the high emission SPS858 scenario. We undertook additional analysis for five 2° × 2° areas within the study region. Results showed that the three frost event parameters were spatially and temporally distinct. In Japan, South Korea and East China, a decrease in all three frost parameters was found, with some areas projected to reach zero frost events by the end of the 21st century. Therefore, the risk of damage from frost weathering in these regions is likely to be extremely minimal by the end of the century. However, in other areas, the risk of frost weathering damage remains with projected to increases over the 21st century of: wet frosts in Northwest China; and freeze-thaw cycles on the Tibetan plateau of Southwest China.

Poster Number: 35
Withdrawn

Poster Number: 36

Title: The Importance of Icefalls in Alpine Landscapes

Author/s: Wenban, W. J.; Swift, D. A.

Abstract: Icefalls are a common feature of many alpine glaciers, representing a sudden step change in the profile, they are visually striking landforms with a large impact on ice dynamics. But despite their obvious presence, they remain a little studied feature lacking in quantitative data. Other glacial landforms have received far more attention, such as cirques, whose altitudes have been found to co-vary with surrounding peak altitudes, forming the basis of the 'glacial buzzsaw' theory in which glacial erosion is said to limit the maximum altitude of mountains. An equivalent study for icefalls is absent. We present a manually collated inventory of icefalls across the Swiss Alps using a set of defining criteria. From this we quantify the impact of icefalls on current ice dynamics (e.g. velocity, ice thickness) and explore the influence of icefalls on the landscape in both a contemporary setting - consequences in a rapidly deglaciating environment - and in the view of longer-term landscape dynamics. We find a correlation between icefall altitude and the equilibrium line altitude that suggests a strongly climatic influence to the position of icefalls within the landscape and investigate what this could mean about the interplay of climate and tectonics in glaciated alpine environments.

Poster Number: 37

Title: The Last Glacial Termination in southernmost Patagonia

Author/s: Huynh, C., Hein, A., McCulloch, R., Garcia, J., Bingham, R., and Fabel, D.

Abstract: As the southernmost continental landmass outside Antarctica, southernmost Patagonia is an important region for studying past climate changes. Tierra del Fuego intersects the core of the Southern Westerly Winds (SWWs), which play an important role in global climate. Our study aims to date past ice margins in order to understand past climate changes in this region.

During the global Last Glacial Maximum (gLGM), major ice lobes in southernmost South America extended ~200 km from the ice divide in the Cordillera Darwin. A plethora of glacial landforms marking this gLGM extent have been extensively mapped and dated, suggesting that the onset of deglaciation occurred at 18 ka. Using cosmogenic exposure dating of erratic boulders and bedrock, we demonstrate that deglaciation was extremely rapid and ice had retreated ~150 km by 18-16.5 ka. We map and date terminal moraines that represent glacier re-advances during the Late Glacial and Holocene and use this data to constrain an ice sheet model. By modelling the temperature and precipitation condition required to drive these ice margin fluctuations, we aim to better understand past climate changes in southernmost Patagonia.

Poster Number: 38

Title: Ice buttressing controlled rock slope failure on a cirque headwall, English Lake District

Author/s: Carling, P.A., Jansen, J.D., Su, T., Andersen, J.L., Knudsen, M.F.

Abstract: Rock slope failures in the English Lake District have been associated with deglacial processes after the Last Glacial Maximum, but controls and timing of failures remain poorly known. A cirque headwall failure was investigated to determine failure mechanisms and timing. The translated wedge of rock is thin, lies on a steep failure plane, and yet the friable strata were not disrupted by downslope movement. Fault lines and a failure surface, defining the wedge, were used as input to a numerical model of rock wedge stability. Various failure scenarios indicated that the slope would have failed catastrophically, if not supported by glacial ice. The amount of ice required is insubstantial, indicating likely failure during thinning of the cirque glacier. As ice retreated, the wedge was lowered slowly down the cirque headwall slowly exposing the failure plane. A 10Be exposure age of 18.0 ± 1.2 ka from the outer surface of the wedge indicates late Devensian de-icing of the back wall of the cirque, with the upper portion of the failure plane exposed at 12.0 ± 0.8 ka. These dates suggests that a small buttressing ice mass lingered in the cirque for several millennia after general deglaciation of the area. The exposure age of 12.0 ± 0.8 ka represents a minimum age, as the highly-fractured failure plane likely experienced post-failure mass wasting. Considering the dates, it appears unlikely that the cirque was re-occupied by a substantial glacial ice mass during the Younger Dryas Stadial.

Poster Number: 39

Title: The Long-term Dynamics of the Glacially-fed River Systems in Patagonia

Author/s: Grace Skirrow, GKS, Rachel Smedley, RKS, Richard Chiverrell, RCC, Janet Hooke, JMH

Abstract: The eastern margin of the former Patagonian Ice Sheet was drained by large and dynamic river systems, which remain largely unstudied. New geomorphological mapping and luminescence chronology of the glacially-fed Río Chubut reveals the preservation of large gravel outwash terraces that previously acted as glacial spillways during previous glaciations. Here we present an age-constrained geomorphological record of fluvial change over at least the last 85.4 ± 7.8 ka. Considering the coincidence of a new luminescence age from the innermost ice lobe in the Epuyen area (18.1 ± 2.2 ka), palaeoenvironmental records (Moreno et al. 2018, Whitlock et al. 2007, Iglesias et al. 2016) and the PATICE ice sheet reconstruction (Davies et al, 2020); our findings include: (1) the depositional glaciofluvial outwash regime was punctuated by stages of incision during the last glaciation, (2) braiding, associated with glaciofluvial outwash, is sustained in a paraglacial landscape for ~5 ka after the ice had retreated into the Andean mountains, (3) the abandonment of the paraglacial braided planform for the successive meandering regime was time-transgressive and driven by a reduction in precipitation in the headwaters, caused by a weakening and southward shift in the southern westerlies. This work demonstrates: (1) the valuable archive of environmental change that is preserved as palaeofluvial geomorphology in Río Chubut corridor, (2) variability in river regime during the last glaciation, and (3) sensitivity to changes in precipitation in a paraglacial braided river. This has implications for understanding the resilience of contemporary paraglacial braided rivers that are sustained by precipitation, particularly from the southern westerlies.

Poster Number: 40

Title: From summits to cirques: Deciphering the nature and rate of ice loss from the last Welsh Ice Cap using high-resolution glacial geochronology.

Author/s: Oliver Thomas, OT, Philip Hughes, PH, Christopher Darvill, CD, Peter Ryan, PR

Abstract: Ice sheets are currently melting at unprecedented rates and through thinning and fragmentation will yield new, peripheral ice caps in the future. The Welsh Ice Cap decoupled from the main ice sheet during deglaciation at 20-17 ka, with thinning and receding ice exposing upland areas prior to complete deglaciation. Consequently, Wales presents a unique geological testbed for examining peripheral ice cap development and loss: from an ice cap abutting an ice sheet, to separation, thinning, cirque glacier development, and complete deglaciation. Despite substantial recent advances in our understanding of British-Irish Ice Sheet retreat, the nature and rate of Welsh Ice Cap deglaciation remains limited.

This study will highlight gaps in the geomorphological record for targeted high-resolution mapping of smaller-scale ice recessional landforms. Our new geomorphological maps will guide a campaign of detailed geochronological work to better understand the rate of ice cap loss through time. Cosmogenic exposure dating of glacial landforms and radiocarbon dating inter-morainal lake/bog sequences will establish chronological time-steps. Schmidt Hammer exposure dating will help to provide additional age control and fill any chronological gaps. Improved constraints on the timing and nature of deglaciation in Wales will offer important insights into the development and loss of peripheral ice caps in mountainous areas in the future. Moreover, the response of Welsh ice to Late-glacial climate oscillations (Oldest Dryas, Bølling–Allerød, Younger Dryas) will add to our understanding of Northwest Europe's wider environmental history during the last termination.

Poster Number: 41

Title: Reconstructing the glacial history of the Salto del Olivares (33°S), Central Chile

Author/s: Curry, C.S., Rowan, A.V., Livingstone, S.J., Diemont, C.R., Bravo, C., Antinao, J.L.

Abstract: Glacial behaviour since the Last Glacial Maximum (LGM) is poorly constrained in the Central Chilean Andes (30°S – 40°S), as there is not enough data to make confident statements regarding the timing and dynamics of glacial/deglacial episodes. Nevertheless, local studies have revealed that Andean glaciers behaved asynchronously in the past, with the timing of deglaciation varying between glacier basins. In addition, recent works illustrate non-linear de-icing processes during the Holocene, with active (re-advance) and inactive (standstill) phases indicated through preserved subglacial bedforms. Reconstructing past glacial behaviour is key to understand the response of the cryosphere during interglacial periods, and thus we have targeted a glacier basin where there have been no local reconstruction efforts to date. We present the results of high-resolution geomorphological mapping in the Salto del Olivares basin, to determine ice marginal extents and glacier behaviour during and since the last glaciation. Geomorphological mapping was conducted from a high-resolution DEM (4 cm) created from an uncrewed aerial vehicle (UAV) using structure from motion. These data were supplemented by geomorphological field sketches during a visit to the area in April 2023. In addition, we collected 16 moraine boulder samples for 36Cl cosmogenic nuclide dating which are currently in preparation. We present an initial reconstruction of the Salto del Olivares based on geomorphological evidence, to propose the deglaciation pattern of the Olivares Glaciers. Our mapping suggests that deglaciation in this area was complex and non-linear, in agreeance with studies elsewhere in the Central Chilean Andes.

Poster Number: 42

Title: What controls shallow landslide size and why does it matter?

Author/s: Milledge, D.G.

Abstract: Rainfall-triggered shallow landslides, are hazardous and effective geomorphic agents. Though their size typically varies over several orders of magnitude within a single catchment, their size distributions appear surprisingly consistent across diverse landscapes (e.g. Oregon Coast Range and English Lake District). Similarity in minimum sizes at these sites is partly explained by theory based on the interplay of soil strength controls resisting failure but this alone cannot explain maximum sizes. We used hillslope-scale numerical experiments, to better constrain the controls on shallow landslide size combining a multi-dimensional stability model with a flexible spatial-statistical description for variability in hillslope properties. We found that: 1) landslides can occur not only in individual low strength patches but also when multiple patches coalesce; 2) reproducing observed size distributions requires a 'spikey' spatial strength field (strongly localized and of large amplitude); 3) this typically requires multiple interacting factors. However, because multiple hillslope properties influence soil strength these requirements can be met, and can even result in similar size distributions, across a very wide range of landscapes. This explains our observations of size similarity, but also suggests that site specific landslide size prediction will be extremely difficult because it depends on fine scale spatial variability in multiple hard to measure properties. Does it matter? Landslide size strongly influences runout behaviour. Its influence on initiation probability is less clear. Comparing models that explicitly represent landslide edges (thus size) with those that don't suggests surprising similarity at the scale of observed landslides, offering hope for simple infinite-slope modelling.

Poster Number: 43

Title: Reconstructing the Late Holocene Flood History of the River Ribble Catchment, North West England

Author/s: Haigh, A, Jones, A.F, Moses, C

Abstract: The risk of flooding is increasing within the UK, with wetter winters and drier summers predicted. However, understanding flooding and links to change in climate and therefore resilience, is limited by the short, instrumented record, which can be extended by analysing palaeoflood chronologies. This project explores the geomorphological development of the Ribble Valley and uses sediment cores to identify, date and analyse the frequency/magnitude of flood events recorded in the floodplain sequence within the catchment. The Ribble Valley has been shaped by a complex interplay of geological processes and frequent flood events. Thirty floodplain cores have been analysed (composition, grain size, organic content) to understand past flood events and identify periods of increased fluvial activity. The sediment cores also provide insights into the long-term dynamics of the river system, including changes in sediment transport and deposition.

Preliminary analysis of the sediment cores reveals distinct flood layers, indicated by fining-up sequences, and grainsize reversals. These layers can be correlated with historical flood records and radiocarbon dated samples taken throughout the cores to assess the recurrence intervals and magnitude of floods in the Valley. Variations in sediment properties between sites offer insights into local differences in channel behaviour and floodplain dynamics. By integrating the sediment core data with historical flood records and geomorphological mapping a comprehensive understanding of the Valley's flooding history can be achieved. This knowledge is crucial for flood risk assessment, land-use planning, and the development of effective flood management strategies in the region.

Poster Number: 44

Title: Filed validation of the first recorded historical strong earthquake in China based on the age of rock avalanche-dammed lake

Author/s: Wenfang Shi, State Key Laboratory of Earthquake Dynamics, Institute of Geology, China Earthquake Administration,Beijing, 100029, China;
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Abstract: China has rich historical document and a widely used earthquake catalog has been compiled since 1961. However, the field evidence for the first recorded historical strong earthquake, 780 BC Qishan earthquake, is limited, which occurred in the northern margin of the Qinling Mountains. Previous field survey shows that a cluster of ancient seismic landslides exists around Qishan city which is the inferred epicenter of 780 BC Qishan earthquake, and the landslides group could be related with this ancient earthquake.

In this study, we attempted to document the age of an ancient dammed lake that produced by Ganqiu rock avalanche, which is the largest one among the paleoseismic landslide clusters. A series of charcoal accumulated on the bottom of the dammed lake after collapse were dated and depth-age wiggle-matching was used to calibrate the radiocarbon ages of the sequence samples. The 30 radiocarbon ages indicate that the Ganqiu dammed lake occurred at 750-420 Cal BC. It can be deduced that the causative earthquake for this rock avalanche was the 780 BC Qishan earthquake. Our new result is different from the previous report of 10Be surface exposure age 10.0±0.9ka for the deposits of Ganqiu rock avalanche. This suggest the Ganqiu rock avalanche may be not triggered by a single earthquake and the 780BC Qishan earthquake retriggered a rock avalanche after the 10.0±0.9ka ancient earthquake. It enhances our understanding of the activity patterns of 780 BC Qishan earthquake in north Qinling Mountains.

Poster Number: 45

Title: Catastrophic debris flows from the last two glacial cycles in the High Atlas of Morocco

Author/s: Hann M.G., Woodward J.C., Hughes P.D., Rhodes E.J.

Abstract: The Tamatert Valley near Imlil in the Moroccan High Atlas contains a prominent (>2.5 km) train of very large sub-rounded boulders – a feature not observed elsewhere in the region. We have mapped 235 megaboulders (b-axis >2 m) in the valley; they ranged in size from 2 to 9 m (mean = 3.2 m b-axis) with 130 ≥3 m and 15 >5 m. The megaboulders are found in a variety of geomorphological contexts: (1) Isolated in the active channel; (2) Part of a megaboulder cluster; or (3) Partially embedded in Quaternary alluvium/colluvium. The vast majority (94%, n=221) are composed of extrusive igneous rock derived from the Precambrian basaltic bedrock which dominates the high glaciated slopes of the Jebel Toubkal massif. The remainder (6%, n=14) are intrusive igneous rock (granodiorite). This paper discusses the origin of these boulders and how and when they were emplaced. We argue they were transported by debris flow processes with much of the transported material generated by glacial activity in the Upper Tamatert Valley. A single debris flow event is preserved in a fan stratigraphy in the Lower Tamatert Valley where luminescence dating shows that it took place in the Late Pleistocene sometime after 42 ka. The thick fan stratigraphy suggests there has been only one debris flow of catastrophic magnitude since the regional glacial maximum (~50.2 ± 19.5 ka). We argue that the Tamatert Valley megaboulders represent two distinct populations: one from the last glacial and one from an earlier glacial stage.

Poster Number: 46

Title: Evolution of landslide activity and persistence following the Gorkha earthquake

Author/s: Harvey, E. L., Shrestha, R, Kincey, M. E., Rosser, N. J., Van Wyk de Vries, M., Basyal, G. K., Jimee, G., Densmore A. L.

Abstract: Persistent landslide activity in the years following an earthquake poses a significant hazard to local communities. Following the Gorkha earthquake, landslides and debris flow activity has continued for several years, inundating buildings, blocking roads and inhibiting post-earthquake recovery. Many of these landslides and debris flows originate from co-seismic landslide deposits, where an abundance of sediment is readily available. However, our understanding of which landslide deposits reactivate within the landscape and what controls this is limited, predominantly due to the lack of systematically derived multi-temporal landslide inventories.

Here, we explore the evolution and persistence of individual landslides within the 14 earthquake-affected districts in Nepal over eight years to better understand how the hazard posed by landslides changes in the aftermath of an earthquake. To achieve this, we utilise a unique multi-temporal landslide inventory for the Gorkha earthquake between 2014 and 2021. We use this inventory to assess how clusters of landslides evolve through time, focusing on landslide location, the persistence of individual clusters, and the post-failure behaviour of landslides, such as rates of runout and retrogression. Following this, we will also introduce our work applying an automated approach to obtain a national landslide inventory for Nepal to better understand the multi-hazard cascade. This research forms part of the Sajag-Nepal project, which aims to improve preparedness for the mountain multi-hazard chain in Nepal.

Poster Number: 47

Title: Modelling catchment scale hydrological effects of rewilding

Author/s: Hartley, A.T.

Abstract: Rewilding is a radical approach to conservation, focused on landscape-scale restoration of natural processes. Definitions of rewilding vary, but it is generally accepted that rewilding approaches are process-led, focused on ecosystem function rather than target species, and emphasise self-sustaining ecosystems rather than restoration towards a historic ideal. To date, assessment of rewilding has largely focused on biodiversity whilst impacts on hydrology are largely assumed. Research suggests that natural flood management approaches that work with natural processes can mitigate lower magnitude floods but are less effective for higher magnitude events. Research into effects on low flow stresses is lacking but indicates that natural flood management and related nature-based solutions could also help to maintain baseflows. This study investigates whether rewilding, which is a more hands-off approach to conservation and land management, is effective at mitigating high flows and alleviating low flows. The research will combine systematic literature review and meta-analysis of effect sizes, analysis of soil moisture dynamics using remotely sensed data, field measurement of river discharge and hydrological and hydraulic modelling. Despite the momentum in rewilding nationally and internationally, financial, and resourcing constraints and the limits of existing infrastructure networks present challenges for acquisition of field data to analyse change and parameterise models. To address this data gap, this research is also field-testing low-cost build-it-yourself sensors through instrumentation at rewilding sites alongside commercial grade sensors. The poster presents an overview of the PhD research, including a focus on the low-cost sensor field-testing currently underway.

Poster Number: 48

Title: A 21st century geomorphological reassessment of the Dolgarrog flood disaster of 1925

Author/s: Warburton, J, Woodward, J, Tooth, S, Griffiths, H, Lewin, J

Abstract: On 2nd November 1925, the failure of the Eigiau and Coedty dams along the Afon Porth-llwyd in north Wales generated a catastrophic flood that killed 16 people and devastated the local community. The disaster provided a key impetus for the Reservoirs (Safety Provisions) Act of 1930. Although almost 100 years have now passed, the hydrogeomorphological context of the disaster has not been studied in detail. As the centenary, approaches, we have initiated a project to investigate the geomorphological legacy of the event and better understand the physical processes involved. Our approach focusses on: (i) failure of the Eigiau Dam; (ii) flooding and erosion along the upper, low gradient course of the Afon Porth-llwyd and Coedty Reservoir; (iii) flooding, erosion and boulder deposition along the very steep, incised bedrock reaches below the Coedty Reservoir; and (iv) boulder fan deposition in Dolgarrog, on the margin of the Afon Conwy floodplain. Using archive sources, remote sensing and high-resolution topographic data and new field measurements, we are reconstructing hydrological and geomorphic events associated with the flood. Here, we present an initial reappraisal of the event to inform ongoing field investigations and modelling. We intend to host a BSG field trip to Dolgarrog in late 2025 to reflect on how well contemporary geomorphological tools and theory can inform understanding of historical upland floods and pay our respects to those who died in the disaster. We are working to engage with and share our findings with the Dolgarrog community.

Poster Number: 49

Title: Monitoring of landslide hazards with wireless sensor networks and machine learning

Author/s: Newby, K., Bennett, G., Roskilly, K., Luo, C.

Abstract: Landslide hazards are prevalent in coastal and mountainous regions across the UK and wider world. They pose a danger to lives and property and cause enormous economic loss and disruption. These hazards are likely to worsen due to increasing extreme rainfall events resulting from climate change, highlighting the need for landslide hazard monitoring and early warning systems.

Through SENSUM (smart SENSing of landscapes Undergoing hazardous hydrogeomorphic Movement), a wireless sensor network (WSN) has been developed using Internet of Things (IoT) technologies. Inertial measurement unit (IMU) sensors containing accelerometers, magnetometers and gyroscopes have been embedded in manmade boulders (SlideCubes) and deployed across two landslide sites in the UK (Lyme Regis and Isle of Wight) and preliminarily on the Harmalière landslide in France. Motion-based power management allows these battery-powered sensors to transmit movement data in near real-time while remaining operational for extended periods. The SlideCubes communicate via Long-Range Wide Area Network (LoRaWAN) gateways, and other sensors, such as rain gauges, are also incorporated into the WSN.
I will present data from sensors at both UK sites, including a preliminary evaluation of sensor performance. GPS data and UAV imagery validate sensor data and facilitate visualisation of significant movement events, providing a holistic picture of landslide kinematics. A longer-term aim is to use these data, alongside laboratory validation data, to train machine learning models to classify hazardous movement with a view to creating an early warning system.

Poster Number: 50

Title: Hydro-Geomorphology of Río Simpson, Patagonia-Aysén, Chile

Author/s: Dussaillant, A.R.; Reid, B.L.; Aguilar, F.; Jullian, A; Quezada, P.; Ancan, J.; González, C.; Fortini, F.; Chávez, P.; Sepúlveda, N.; Quezada, G.; Uribe, L.; Russell, A.; Perks, M.; Buytaert, W.;, Meier, C

Abstract: There have been few studies on Chilean Patagonia rivers altogether, including hydrogeomorphic processes. Yet pressures are mounting from human activities such as gravel mining, water abstractions, flood structures, cattle trampling, invasive species, and land use change including accelerated floodplain urbanisation. Additionally, accelerating climate change might impact the magnitude and frequency of high and low flows and therefore flow regimes and associated ecosystem processes. High intensity atmospheric rivers and deglaciating catchment hydrology have particularly impacted this region. Here we report on hydrological, geomorphological and ecological studies performed at the Río Simpson (2019-2023), a highly valued gravel-bed river for flyfishing, whitewater and other recreation activities, as well as water and gravel extraction. In particular, recently finished FIC/FSEQ projects focused on methods to estimate sediment transport and develop tools for more sustainable management of river gravel mining, as well as water resource & river-aquifer interactions. We adapted techniques to estimate streamflow (using image velocimetry techniques and lidar altimetry with R-Pi in-situ processing and near-real-time data telemetering) and sediment discharge (using bedload samplers, traps and morphological methods), low-cost turbidity sensor development, and photo-sieving for bed sediment characterisation. We will report results on Río Simpson hydrology, geomorphology, gravel extraction, sediment transport, aquatic biota and proposal of alternatives to reduce negative impacts of gravel mining and water resource abstraction.

Poster Number: 51

Title: The sedimentological control on knickpoint form and retreat rate

Author/s: Norriss, W.J., Baynes, E.R.C., Hillier, J.K., Lague, D., Steer, P.

Abstract: Understanding how rivers adjust their morphology in response to external forcing is critical for understanding landscape evolution over a variety of spatial and temporal time scales, with the presence and action of knickpoints playing a key role in separating transient from relict topography. Despite their importance, the understanding of knickpoint erosion processes remains poorly understood and unquantified, limiting the mechanistic understanding of how waterfalls form, retreat and interact with the wider landscape.

This study aims to utilise experimental data to provide an understanding of how varying sediment supply impacts knickpoint form and retreat rate. Six analogue experiments were performed in the Bedrock River Experimental Incision Tank at the Universite de Rennes, comprising of 2 groups: Group A consists of three experiments with sediment load varying from 0 g l-1 to 50 g l-1 of flow, with a constant base level fall rate of 3 cm hr-1, Group B consists of three experiments with sediment load constant at 25 g l-1 and a base level fall ranging from 1 cm hr-1 to 5 cm hr-1. The experiments provide a comprehensive dataset assessing the relative impact of sediment supply and base level fall rate on knickpoint retreat and therefore wider transient landscape processes. The dataset provides a useful insight into a key control on landscape evolution and provide a starting point to accurately model the impact of knickpoints on landscape evolution using a process based understanding.

Poster Number: 52

Title: The morphometry, age and origin of the South Hams landscape, Devon

Author/s: Verplancke, O., Murton, J.B., Hales, T.C.

Abstract: The South Hams region of Devon, England, comprises multiple planation surfaces and morphological units recording its long-term erosion and uplift. Many of the surface are dissected by valleys, some occupied by streams and/or periglacial head deposits. Past interpretations have proposed a series of marine surfaces, although this remains unproven due to a lack of identified marine deposits above the higher surfaces. We propose three further working hypotheses for the origin of elements of this landscape: (1) the low-relief surfaces formed transiently because of the dynamic reorganisation of river networks; (2) it is a frost-susceptible bedrock landscape of inherited relict or inactive periglacial landforms; and (3) it is inherited from pre-periglacial landsurfaces of the Palaeogene and Neogene or older. Here we present initial results from the testing of hypothesis 1.

As river basins evolve due to migrating drainage divides and channel capture events local topography is altered, and the results of these changes can be comparable to changes driven by uplift, climate, or lithology. We mapped six low-relief drainage basins within the South Hams region using the Chi (χ) methodology. Many of these drainage basins originate on Dartmoor, and most exhibit a long, narrow planform morphology. Our initial results show a discontinuity of χ values both within drainage basins and across drainage divides. Features such as wind gaps and knickpoints also occur within the drainage basins, and coupled with the Chi analysis results this suggests drainage reorganisation has previously occurred across the planation surfaces.

Poster Number: 53

Title: Linkage between sediment transport and heavy metals dispersal in catchments affected by legacy mines.

Author/s: Zidong Yao

Abstract: Although most of the coal or metal mines in the UK are now closed, the release of heavy metal pollutants from legacy mines of historical mining often represents a severe environmental hazard for nearby river and catchment. Sediments are the main carrier for metal pollutants in rivers and catchments: heavy metals generated from anthropogenic activities enter rivers and migrate in rivers and through catchments with sediment. Sediment transport occurs through soil and riverbank erosion, and fluvial transport of gravel. These processes are influenced by various environmental factors such as rainfall intensity and the seasonality of hydro-climatic conditions of the catchment. However, the linkage between sediment transport and metal pollutants mobility in historical mining affected rivers and catchments remains poorly understood. Therefore, my PhD project intends to conduct field sampling and laboratory analysis to study sediment and heavy metals dispersal in catchments affected by historical mining. The study area will be the Leadhills and Wanlockhead mining districts in Scotland. Specifically, I aim to: (1) Identify the sources of both heavy metal pollutants and sediments polluted by heavy metals in the river environment. (2) Characterize the spatio-temporal distribution of heavy metal pollutants in the catchment. (3) Understand the seasonal changes of heavy metals distribution associated with sediment transport driven by rainstorm event in the catchment. I will present preliminary results of the geochemical analysis of modern and floodplain sediment along rivers in the study area, as well as samples collected from tailing ponds and waste heaps that may constitute potential sources.

Poster Number: 54

Title: Intermontane basins formed by tectonics and river capture; the Kathmandu Basin of central Nepal

Author/s: Prakash Pokhrel, Hugh Sinclair, Simon Mudd, Mikael Attal

Abstract: The origin of the Kathmandu Basin is hypothesized to be the result of tectonic blockage of a trans-Himalayan or Lesser Himalayan river and the formation of a perched intermontane basin. Sedimentological and paleo-hydrological analyses of a ~2.5 Ma fluvial deposit at the base of the basin fill suggests a much larger catchment than is currently present. Overlying these deposits are lacustrine sediments recording the damming of the basin fill up to approximately 12 Ka when the present Bagmati River network initiated incision of the basin. In addition, topographic analysis, including catchment relief, long river profiles, and channel steepness, suggest that neighbouring trans-Himalayan rivers are capturing parts of the Kathmandu Valley through divide migration. To further evaluate the potential drainage capture of the Kathmandu Basin, we examine catchment-averaged erosion rates between the alluviated channels that drain into the basin, and the tributaries of the neighbouring trans-Himalayan Rivers, using Beryllium-10 cosmogenic nuclides. Our findings demonstrate the rapid erosion of the uplifting block to the south is associated with incision of the Bagmati River, and that erosion rates in and around the basin are orders of magnitude lower. We present initial interpretations that integrate the basin-fill sedimentology, geomorphology and cosmogenic nuclide measurements.

Poster Number: 55

Title: Soil erosion: Direct and indirect effects of hydrophobicity

Author/s: Mahboobeh Fallah, Ran Holtzman, Marco Van De Wiel

Abstract: Soil water repellency (SWR) refers to the reduced ability of water to infiltrate into the soil. By reducing infiltration, it increases surface runoff, which in turn was shown in some cases to enhance soil erosion. While this hydrological mechanism has been intensively studied, little attention has been given to the direct (mechanical) effects of SWR on erosion, for instance through affecting cohesion and aggregation. A simple numerical 1D model is proposed to assess the relative impact of the direct effect of SWR relative to the indirect (hydrological) effect. This model shows that SWR can lead to both increase and decrease of erosion, which could be used to explain the contrasting data from field observations. Further investigation is required to quantify the strength of both direct and indirect mechanisms under various sources of hydrophobicity (e.g. fire- vs pollution-induced), types of soils and other hydrological conditions.

Poster Number: 56

Title: Reach-Scale Morphological Control on Extreme Flood Sediment Production and Export

Author/s: Baynes E.R.C., Kincey, M.E., Warburton, J.

Abstract: Rapid earth surface evolution is discrete in nature, with short-duration extreme events having a widespread impact on landscapes despite occurring relatively infrequently. Here, we exploit a unique opportunity to identify the broad, process-based, controls on sediment production and export during extreme rainfall-runoff events through a multi-catchment analysis in Upper Swaledale, northern England. A three hour extreme rainfall event in July 2019 generated significantly different impacts across three catchments, ranging from (i) sediment export exceeding two orders of magnitude more than the typical long term average to (ii) a minimal impact, with this variability primarily controlled by catchment steepness and the presence of reach-scale morphological transitions caused by postglacial landscape adjustment. In any catchment worldwide where populations are at risk, we highlight the importance of combining topographic analysis with detailed mapping of channel bed material (e.g., presence of transitions between process domains) and identification of sediment sources within morphological transition zones for accurately predicting the impact of extreme events. We also discuss the implications of the flood for the pattern of mobilisation and deposition of heavy-metal contaminated sediments within the catchments.

Poster Number: 57

Title: Landscape evolution along the Main Gulf Escarpment in the southern sector of the Baja California Peninsula

Author/s: Arturo, G. T. Esperanza, M. S. Miguel, Castillo

Abstract: The Main Gulf Escarpment (MGE) of the Baja California Peninsula, is a north to south continental feature that formed during the extensional phase that led the opening of the Gulf of California since the Middle Miocene. The western and eastern of flanks of the escarpment have a notorious asymmetry on its topographic gradient where the steepest landscape are on the east which drives a westward migration of geomorphic processes and controls the landscape evolution in this region. We analyzed the eastern and western long river profiles diverging from the MGE to assessment the landscape response to the escarpment formation. We identified a set of knickpoints bounding the MGE from which we estimate retreat rates of ~1 mm yr –1 and uplift rates of ~0.05 mm yr –1 for the early stage of the MGE. The north to south comparison of the eastern and western long river profiles as well as X (chi) plots confirm that the eastern rivers are the aggressors. The long river profiles comparison allowed the estimation of the divide migration rate of ~0.06 mm yr –1 which is consistent with an ongoing westward mobility. The values of divide migration rates, close to uplift rates, are explained by the response of rivers to both vertical uplift and westward migration of the main escarpment divide. Our study highlights the importance of rivers as the main control driving the landscape evolution of the southern sector of the Peninsula of Baja California.

Poster Number: 58

Title: Jurassic paleoclimate in north Guizhou from Paleosol characteristics

Author/s: Qihang Li_1, College of Resources and Environmental Engineering, Guizhou University, China_1,
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Abstract: To better understand the paleoclimate environments of the Jurassic period in Guizhou. We study the Jurassic paleoclimate environments in the north of Guizhou, aim to identify the characteristics of Jurassic paleosol in the North of Guizhou and quantitatively inverts the paleoclimate environments of the Jurassic period. Observations of the colour of the paleosol layers and the angle between the soil layer and bedrock indicate that after the paleosol was formed, tectonic movement occurred (leading to 75° angle). We also collected paleosol soil samples, and analyzed their elemental and mineralogical compositions using Inductively Coupled Plasma Mass Spectrometry (ICP-MS) and X-ray diffraction. The soil layers showed different colours (e.g., purple, white, and red-brown) indicated that the formation of Paleosol has gone through multiple periods of alternating wet and dry. We also observe abundant plant roots, spherical and ellipsoidal soil-forming calcium-bearing nodules in the paleosol profile. It reflects the changes in redox conditions caused by water changes during the formation of paleosols. Variations (from bottom to top of profile) of illite and kaolinite content, chemical index of alteration values (107~140), SiO_2/Al_2O_3 values (0.18~0.31), Sr/Ba values (29.78~123.46), the values of Sr/Cu (4.5~12.5) and Rb/Sr (0.48~1.79) indicated the paleosol profile was formed in unstable climate conditions in which very wet and dry periods alternated. From these data, we conclude that the climate in north of Guizhou was savannah-like (alternating between wet season and droughts) in the early Jurassic period, which then transitioned into a prolonged drought period.

Poster Number: 59

Title: Alligators and Kites – Wind erosion of Bare Peat Surfaces

Author/s: Warburton, J, Zang, Y, Gan, L, Hardy, R

Abstract: Bare peat surfaces are highly susceptible to erosion and degradation by surficial processes including rain, frost and wind. The impact of these forces, on the exposed low-density peat, is intricately linked to the moisture balance of the surficial layers and antecedent wetting and drying of the soil. In terms of aeolian sediment flux, under wet conditions transport is dominated by wind-driven rain but in dry conditions (drought) desiccated surface peat is entrained directly by wind. This paper documents a novel sequence of bare peat soil erosion following an extended dry period (6 weeks) during which sediment production by surface desiccation (alligatoring) precedes surface erosion by soil crust entrainment (kite transport of peat 'sheets'). Based on field measurements from an upland blanket peat site in the North Pennines (UK) we quantify the extent and significance of this process; the size and transport lengths of the eroded peat sheets; and the timescale and environmental conditions required to facilitate the erosion event. During the period of surface drying the presence of a biological soil crust is key to the formation of the pattern of surface defects (alligatoring) which partially detach and roughen the surface, making it susceptible to entrainment by wind. At higher wind speeds the surface crust is entrained and transported like 'kites-on-the-wind', facilitated by the fragmentation of the bare peat surface into a mosaic of paper-thin polygonal sheets. Although spatially important, the process has limited impact on carbon loss as the eroded peat is mostly trapped by surrounding vegetation.

Poster Number: 60

Title: Quantifying the Importance of Wind Characteristics on the Erosion of Bare Peat: Initial Insights from Field Measurements and Wind Tunnel Modelling

Author/s: Zang,Y,Warburton,J,Gan,L,Hardy,R

Abstract: Peat erosion and degradation releases 2-6% of total global emissions of carbon each year. Wind erosion of bare peat surfaces, is a significant component of this erosion. However, how the rapidly-changing bare peat surface affects the aerodynamic properties of the local boundary layer and resulting erosion processes has not been fully quantified. This study investigates how the spatial and temporal characteristics of peatland wind erosion are controlled by the aerodynamic properties of the bare peat surface. Ongoing field measurements of local meteorology, peat surface properties and peat flux from a 3-ha bare area of upland blanket peat (Moss Flats, North Pennines, UK), have been analysed during a sustained period of strong winds and rainfall (November to April 2023). Results demonstrate that the eroded peat flux is correlated with the prevailing wind direction and as velocity increases, the wind direction becomes more focussed from the southwest (225°). Windward-facing peat fluxes are 4-9 times higher than those in the leeward direction. The vertical wind velocity profile over the bare peat shows a logarithmic pattern with height which is mirrored in the peat flux profile. Average friction velocity measured in some of the sampling periods was linearly related to the peat flux. Initial results suggest that peat surface aerodynamic characteristics directly affect the pattern and magnitude of eroded peat flux. Further work using wind tunnel experiments and numerical modelling is planned to test the field observations and define in detail how surface roughness influences erosion of bare peat.

Poster Number: 61

Title: Fingerprinting geomorphic process through hillslope morphology in Coprates Chasma, Mars

Author/s: Baternay, SA, Wharton, G, Grieve SWD

Abstract: On Earth, the morphology of hillslopes has long been used as a proxy for rates of erosion and as a method for fingerprinting different process domains across hillslopes. By analysing high resolution topographic data, insights have been generated into tectonic, climatic, hydrological, biological, and lithological controls on sediment transport and landscape form. Like the Earth, the Martian surface has been sculpted by a diverse range of processes, ranging from the terrestrial (liquid water, climate) to the extraterrestrial (CO_2 sublimation, impact cratering). These contrasts in process yield an exiting opportunity to explore fundamental mechanisms of landscape evolution over both long and short timescales. Here, we use LSDTopoTools to map ridgelines in the Coprates Chasma region of Mars, a large canyon system with significant evidence of both modern and ancient sediment transport. Using these mapped ridgelines, differences in the morphology of adjacent hillslopes are quantified to explore local and regional patterns of hillslope morphology, potential drivers of ridgeline migration and hotspots of modern sediment transport.

Poster Number: 62

Title: Detecting a Signal of Drainage Capture in Catchment-Averaged Erosion Rates

Author/s: Hoskins A. M., Attal M., Mudd S. M., Castillo M.

Abstract: A drainage capture event transfers drainage area from the victim catchment to the aggressor catchment. We numerically simulate a drainage capture event and observe the effects of drainage capture on downstream erosion rates and channel topology. We find that drainage capture produces an erosion rate signal by altering erosion rates in both the aggressor and victim catchments, however the pattern of erosion rates observed depends on the time since capture. The Sierra la Laguna mountain range in Mexico displays evidence of recent and ongoing drainage captures across the main drainage divide of the range. This evidence includes geomorphic observation of beheaded catchments, windgaps and barbed drainages, alongside trends in longitudinal profiles normalised by drainage area, and across divide comparisons of elevation, slope, and relief. Using 10Be concentrations we calculate catchment-averaged erosion rates for two catchments in the Sierra la Laguna that display this evidence of drainage capture. We employ a novel sampling strategy that encompasses a cross section of the mountain range, where samples are taken along the trunk channel of the two catchments and in major tributaries that feed into the trunk channel. We find that this approach allows us to distinguish between a regional pattern of uplift associated with normal faulting, where uplift decreases with distance from the fault, and the erosion rate signal of drainage capture that we observe in our modelling. This approach has implications for detecting recent drainage capture events in landscapes with non-uniform uplift.

Poster Number: 63

Title: A catchment scale investigation into the climatic, tectonic and topographical drivers of fluvial terrace preservation in the Nepal Himalaya

Author/s: Weir, E.F., Clubb, F.J., Densmore, A.L., Hurst, M.D

Abstract: Fluvial terraces are important archives of past environmental conditions, recording variations in both climate and tectonics on thousand-to-million-year timescales. Current constraints and limitations exist in our knowledge of the geographical extent of Himalayan fluvial terraces. Data gaps may be related to the preservation potential of terraces within a rapidly uplifting mountain range, which exhibits strong precipitation gradients, and is subject to stochastic occurrences of high magnitude flooding events such as glacial lake outburst floods (GLOFS). Alternatively, terraces may be difficult to distinguish or access in the field, or difficult to manually identify from aerial photographs or satellite imagery. An automatic method for identifying river floodplains and terraces has recently been developed (Clubb et al, 2017). Using this method, we identify for the first time fluvial terraces at a catchment scale within the three largest basins of the Nepal Himalaya: the Karnali, the Gandaki and the Koshi catchments. We explore the spatial pattern of terraces along the long profiles of each major river within the catchment by calculating the total terrace area adjacent to the channel. We then attempt to link terrace preservation to tectonic drivers by analysing the relationship between terrace pixels and channel steepness, knickpoints and major structural boundaries along the river profile. Such an investigation allows for the interpretation of whether terrace preservation downstream is dominated by tectonic forces or whether patterns of preservation are influenced by long term climate variations, or high magnitude flooding events.

Poster Number: 64

Title: Discerning the efficacy of intervention measures on contaminant sequestration in the Salmons Brook Catchment

Author/s: Alice Swallow, AS, Josh Ahmed, JA, Samantha Richardson, SR, Robert Thomas , RT

Abstract: Human activity has lead to an array of contaminants being released into our water courses. These contaminants then become legacy pollutants, where they become stored in sinks. Alongside this, intensified, high-magnitude precipitation events induced by climate change are leading to these legacy pollutants becoming remobilised. This causes detrimental impacts to aquatic life and water quality. This project will be investigating Salmons Brook, an Environment Agency stage 0 catchment restoration site in Enfield, London (UK). It will aim to identifying the presence and concentration of a suite of contaminants (e.g., nitrate, phosphate, heavy metals). We will explore the source of these contaminants and how they are being transported.

Both site visits and desk-based studies have been conducted to estimate where sources of suspended sediments and their associated contaminants are likely to be located. Using a sediment fingerprinting method, sediment characteristics from samples taken from these predetermined locations will be compared to the sediment characteristics of samples taken from bed and bank samples of Salmons Brook. This study also seeks to discern how effective the wetlands, which have been constructed along the upland reach, are at attenuating contaminants. The results from this project will offer evidence for decision-makers involved with catchment restoration schemes to assist in improving environmental monitoring schemes.

Poster Number: 65

Title: Alluvial fan morphometric relationships: a planetary perspective'

Author/s: Woor, S

Abstract: Alluvial fans are found in all climate settings on Earth as well as Mars and Titan. They are conically-shaped deposits which form at the outlets of confined upland catchments where sediment is transferred to zones of lower confinement and hence lower energy. Fan morphology (e.g. planform area and gradient) is intrinsically linked to the morphology of their catchments. Catchment area vs. fan area, for example, has been widely demonstrated to give a positive regression relationship because larger catchments produce larger volumes of sediment. Other factors, such as catchment geology and fan setting also play key roles in resulting fan morphology. Studying fan-catchment morphometric relationships is important for identifying the controls on landform evolution, as well as having direct societal benefit by identifying risks such as steeper fans and catchments being more likely to be formed by potentially devastating debris flows.

Despite this, studies of fan morphology on Earth remain regionally focused, typically within dryland settings. There has been no prior amalgamation of fan-catchment morphometric data to examine the controls on fans at the planetary scale, testing not only the influence of catchment morphology on fan morphology but also that of climate, geological and depositional setting. This study will present preliminary work using literature metadata to construct a global fan morphometric dataset for Earth across diverse climatic and geological contexts. It will use standard regression statistics and residual analyses to better quantify the controls on fans at the global scale, comparing where data allow with fans on Mars and Titan.

About Cuchlaine Audrey Muriel King

Cuchlaine Audrey Muriel King, (1922-2019) was a preeminent geomorphologist of the post WW2 era in the British Isles and the first woman to hold a chair of physical geography in the UK. Cuchlaine King was one of only two women in the original group of geomorphologists who founded the British Geomorphological Research Group, later the British Society for Geomorphology, in 1961. In 1981 she was awarded the BSG's David Linton Prize for her contributions to the subject. The following notes show something of her geomorphological work, from the days of landscape description, through quantitative analysis, dynamic systems fieldwork, process geomorphology and textbooks.

Cuchlaine's father, William Bernard Robinson King (1889-1963), had a distinguished record as a military geologist in both world wars. At the time of her birth, he was a demonstrator and assistant to John E. Marr, Woodwardian professor of geology at Cambridge, and from 1943 to 1955 he was himself Woodwardian professor at Cambridge. Cuchlaine was proud of the fact that she had a unique first name, invented by her mother – Margaret Amy, née Passingham (1885-1972), and grew up in an academic and geologically-focused environment in Cambridge. Family holidays were in Wensleydale, Yorkshire, where the King family had roots and to where she retired.

Cuchlaine King studied geography at Newnham College, Cambridge, specialising in physical geography, and graduated in 1943. Her meteorological knowledge was useful as a Women's Royal Naval Service 'wren'. She was posted to RNAS Dale in Pembrokeshire, Eglinton in Co Londonderry, then Sydenham in east Belfast. She always felt that her meteorological work could have been done by 'anyone' at Cambridge.

Returning to Cambridge as a graduate student, King learned topographic surveying from Frank Debenham (co-founder and first director of the Scott Polar Research Institute, who was on Robert Falcon Scott's 'Terra Nova' expedition). She used this skill later on her glaciological work in Norway and Iceland and on the beaches of Lincolnshire. She developed an interest in sand movement on beaches with William Williams, who had worked on beach surveys at St Annes (Lancashire) in preparation for the Allied landings in Normandy. She published a paper on the formation of sand bars with Williams in 1949 and completed her PhD on the topic the same year. Beaches and coastlines remained an interest throughout her academic life.

In 1951 King joined the geography department at the University of Nottingham, where she remained for the rest of her career, and where she was an inspirational teacher and especially encouraged student participation in fieldwork. Student field trips often involved surveying beaches and beach terraces. Her no-nonsense approach to investigations greatly inspired her students and fellow teachers and researchers. At Skegness in Lincolnshire, she set up a series of time-profiled investigations of beach profile changes at Gibraltar Point and investigated (with F.A. Barnes) the effects of the 1 February 1953 storm flood on the Lincolnshire coast. In the 1970s she uniquely obtained funding from the US Office of Naval Research to support her investigations on beach and near-shore tidal flow dynamics at Gibraltar Point.

At Cambridge she had also been influenced by William Vaughan Lewis and his innovative investigations of waves on beaches but particularly of aspects of glacial erosion. With encouragement from her father, Cuchlaine persuaded an undergraduate tutee, Jack Ives, to take her, and Helen Brash from Newnham College, as surveyors on an 'all-male' expedition to south Iceland. Her work on the mass balance and banding on glacier outlets of Vatnajökull took place on similar expeditions in the early 1950s. Although not part of Vaughan Lewis's Cambridge expeditions to the Norwegian glacier Vesl-Skatutbreen (in which her near-contemporary at Newnham, Jean Grove, participated), she did take part in the Cambridge Austerdalsbre expeditions (Norway, 1954-

8) where many students (including the Perse School, Cambridge and the Brathay Exploration Group) were involved in projects that laid the foundation for post-war UK glaciological research. The study of 'wave ogives' on an outlet glacier of Jøstedalsbre contributed to the theoretical work of John F. Nye, (1923-2019) then at the Clarendon Laboratory in Cambridge.

Such expeditions fostered student research capabilities in male-dominated fieldwork. Later, and at her instigation, she worked in Baffin Island (Nunavut, Canada) with Jack D. Ives (then working for the Canadian government – who had to be persuaded to accept a woman investigator in the field) and John T. Andrews (also one of her students at Nottingham). Both John Andrews and Jack Ives both became professors at INSTAAR (Institute of Arctic and Alpine Research) at the University of Colorado. Cuchlaine worked on the glacial geomorphology and chronology of the Henry Kater Peninsula near the Barnes Ice cap.

King's glacial and geomorphological work in Canada, Iceland, and Norway, as well as around Nottingham and in the Yorkshire Dales, led to publications in many scientific journals. She wrote the Northern England volume (1976) of the Geomorphology of the British Isles, and The Yorkshire Dales (1960) for the Geographical Association's British Landscape through Maps series. Indeed, she considered, 'a real appreciation of the value and beauty of the landscape' as essential for a successful career in geomorphology (Sack, 2004, and see Fig. 1 below).

King used her wide knowledge of physical geography, geology, and geomorphology and her own research to become a prolific writer of perceptive texts, paving the way for specialist geomorphology textbooks. She was an early proponent of 'quantitative geography' and the use of computers; 'Spitsym', written with Michael McCullagh in 1970, was a FORTRAN IV program for simulating coastal spit morphology. With John P. Cole she wrote Quantitative Geography (1968) and with John Doornkamp Numerical Analysis in Geomorphology (1971), both (as well as McCullagh) colleagues at Nottingham University's geography department where a laboratory was later named in her honour. She was also well known for Geomorphology, Glacial and Periglacial (1968) and Glacial Geomorphology (1975), both with Clifford Embleton. Her wide knowledge and writing abilities also produced Beaches and Coasts (1958 and 1972), Techniques in Geomorphology (1971), Introduction to Physical and Biological Oceanography (1975) and Physical Geography (1980), a text which passed muster at undergraduate level for many decades. She edited Landforms and Geomorphology: Concepts and History (1976), providing two substantial commentaries to a collection of forty-six facsimiles of significant papers.

At Nottingham, she progressed from assistant lecturer to lecturer in 1953, to reader in 1962, and professor in 1969. It says much for her character that she did not complain about any career slights ('perhaps they didn't want a lady professor'), arguing that it was only by her work that she should be assessed.

After her retirement from Nottingham in 1982, Cuchlaine King moved back to her family home in Worton, near Askrigg in Wensleydale, North Yorkshire. She was an enthusiastic campanologist and a commemorative plaque in St Oswald's Church, Askrigg, bears the inscription, 'In 2017 new bell ropes were provided through the generosity of Prof. Cuchlaine King, bell-ringer, 1988-2003'. Always unassuming, although with an individual grit and humour and scientific integrity, she was inspirational for many students over the years, both at Nottingham and world-wide. She died on 17 December 2019 in Wensleydale, requesting that the order of the memorial service at St Oswald's follow that for her father, fifty-six years previously.

W. Brian Whalley

Cuchlaine King Surveying at Morsárjökull, southeast Iceland, 1953.

Photo © Jack D. Ives

Left: Cuchlaine King surveying with a plane table below the Odinsbre (left) and Thorsbre outlets of Jostedalsbre, at approximately [61.590,6.988], probably 1956.

Photo: ©John Glenn

Below: A portion of a note to Dorothy Sack, 4th February 1980

In all these expeditions to isolated + difficult areas there was some initial hesitation about taking women, but this was soon overcome + women became a regular part of many similar expeditions. Even the Canadian Government overcame its initial reluctance + women became regular members of expeditions to the Arctic.

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The Fi Wi Road internships "supports Black students in building networks, voice and experience, encouraging them to stay within a discipline in which black geographers are consistently under-represented, and often brutally marginalised and squeezed out". To know more about the programme: https://fiwiroad.blackgeographers.com/about-us

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