15th Annual

Catchment Science Summer School

1–6th September 2024

University of Birmingham
Birmingham, UK,

Tentative Agenda

This 6-Day short course is intended for Post Graduate students and Post Docs interested in a hands-on Catchment Science curriculum, focusing on runoff processes and combined hydrometric, isotope/chemical tracer and modelling techniques in catchment hydrology.

The learning objectives for this short course are to understand:

- *Evolution of empirical and theoretical understanding of runoff processes*
- *Hydrochemical and isotopic measurement and analyses*
- *Model integration - linking field experiments with modelling approaches*

The course website can be found here:

https://water.usask.ca/hillslope/teaching/catchment-summer-school/home.php

Sunday, 1 September 2024	
Arrival in Birmingham	Throughout the day/weekend
5:30-5.45 pm	Registration and welcome in The Lapworth Museum of Geology. Students put up posters
5:45-6.30 pm	Reception and course intro lecture – (McDonnell)
6.30-8:00 pm	Class poster session *Drinks and food provided*

Monday, 2 September, 2024	
The Physical Process Basis for Catchment Science, Inst. for Global Innovation (IGI) Building	
9:00 am	Welcome and outline of short course objectives (McDonnell)
9:15 -12:45 am	Evolution of perceptual models in catchment hydrology -The early perceptual models: Horton (1933) through The First International Hydrological Decade (1965-1974) (McDonnell) -Isotope tracing changes perceptual models! (~1975-1990) -The era of connectivity, flow sources and transit times (1990-present) - 15 min (coffee) breaks at ~ 10:15 and ~11:30 am
12:45 pm	Lunch
2:00 – 3pm	-Perceptual models for plant water source, flowpaths and transit time (McDonnell)
3pm	Coffee break
3:15 -5pm	Paper Discussion: The Maimai Debate • **Group 1**: Mosley, M.P. (1979) Streamflow generation in a forested watershed, New Zealand, *Water Resources Research* 15: 795-806. • **Group 2:** Pearce, A.J., Stewart, M.K., Sklash, M.G. (1986) Storm runoff generation in humid headwater catchments: 1. Where does the water come from? *Water Resources Research* 22, 1263–1272. • **Group 3:** Sklash, M.G., Stewart, M.K., Pearce, A.J. 1986. Storm Runoff Generation in Humid Headwater Catchments: 2. A Case Study of Hillslope and Low-Order Stream Response. *Water Resources Research* 22(8), 1273–1282, DOI: 10.1029/WR022i008p01273.

	• **Group 4:** McDonnell, J.J., 1990. A rationale for old water discharge through macropores in a steep, humid catchment. *Water Resources Research* 26 (11), 2821–2832. 1 hr small group discussions; 1 hr reporting back to the large group
5 - 7:00 pm	Free time for reading, thinking, exercising
7:00 pm--	"Office hours" with McDonnell at The Edgbaston Park Hotel bar
Tuesday 3 September, 2024	
The Model Basis for Catchment Science, Inst. For Global Innovation (IGI) Building	
9:00 am	Overview of the day (McDonnell)
9:15 -12:45 am	- Introduction to hydrological connectivity (van Meerveld) - Historical development of ideas on streamflow modelling -Bucket-type models (incl. short overview of the HBV model) -Very short intro to spatially explicit, physically based models (SHE as an example) -Storage concepts in hydrology and hydrological modeling -Group discussion on hypothetical model applications in YOUR catchment - 15 min (coffee) breaks at ~ 10:15 and ~11:30 am
12:45 pm	Lunch
2:00 – 3pm	Model testing in catchment hydrology • Model calibration and validation • Uncertainty, equifinality, parameter identifiability • How good is my model? - the need for benchmarks (Seibert) • Value of data in hydrological modelling Short intro to the hands-on exercise (Seibert)
3pm	Coffee break
3:15 - 5 pm	Hands-on exercise Led by Seibert • Option 1: Calibration of HBV for HBVland and computation of design floods • Option 2: Tracking runoff components in HBV
5 - 7:00 pm	Free time for reading, thinking, exercising
7:00 pm-	Office hours with Seibert and van Meerveld at The Edgbaston Park Hotel bar

Wednesday, 4 September, 2024	
Field day to the Plynlimon catchment, Wales **The sites:** **https://www.ceh.ac.uk/our-science/monitoring-sites/plynlimon-research-catchments** **The History:** **http://www.history-of-hydrology.net/mediawiki/index.php?title=Plynlimon,_Wales_1969_-**	
8:30 am	Board bus (info will be provided separately). Meeting site board minibuses TBA.
~11:00 am	Arrive to Plynlimon (~95 miles, ~2 hr drive time)
In the field	Research Lecture and Introduction to the field site generally (Prof. Tony Jones, University of Aberystwyth) Research Lecture and Introduction to the field site specifics (Dr. Jack Crosby, CEH)
1:00 pm	Lunch in the field (bring your own)
1:30-4 pm	Concurrent Field Discussion Modules that students will cycle through in 4 small groups as we transit the upper headwaters: - Module 1: Hydrological processes at Plynlimon (led by Jones and Chappell) - Module 2: Transcending the uniqueness of place: putting your field site into a broader theoretical context (led by McDonnell) - Module 3: Hillslope hydrology and measuring dominant runoff processes (led by van Meerveld) -Module 4: Conceptual rainfall-runoff modelling and the dialog between experimentalist and modeller (led by Seibert)
4pm	Hike back to the mini-buses
5.30pm	Drinks and dinner at the Angel Inn in Llanidloes, Wales (closest town to Plynlimon), dinner included in your registration; one free drink incl.
~7.30-8pm	***Board buses for return to B'ham***

Thursday, 5 September, 2024	
Using water quality data to define catchment-scale processes, Inst. For Global Innovation (IGI) Building	
9:00 am	Overview of the day (McDonnell)
9:15 -12:45 am	- Top down approach: regionalising catchment hydrology with tracers (Soulsby) - Bottom up approach: tracers, hillslope and small catchment hydrology (Soulsby) - Opening the black box – isotopes in soil –vegetation systems: what happens, where (Soulsby) - 15 min (coffee) breaks at ~ 10:15 and ~11:30 am
12:45 pm	Lunch
2:00 – 3pm	Integrating isotopes in catchment scale models (Soulsby)
3pm	Coffee break
3:15-5 pm 5-7pm	Demonstration and Hands-on Exercise at the EcoLab outdoor flume sites -sub-stream zone mixing and thinking about stream-aquifer interactions, mixing and links to biogeochemical exchanges (led by Profs. David Hannah and Stefan Krause Free time for reading, thinking, exercising
7pm-	"Office hours" with Soulsby at The Edgbaston Park Hotel bar

Friday, 6 September, 2024	
Land use and climate change impacts on catchment science, Inst. For Global Innovation (IGI) Building	
9:00 am	Overview of the day (McDonnell)
9:15 -12:45 am	Land use (and climate) change effects on runoff patterns (van Meerveld) - 15 min (coffee) breaks at ~ 10:15 and ~11:30 am
12:45 pm	Lunch
2:00 – 3pm	Modelling hydrological change (van Meerveld and Seibert)
3pm	Coffee break
3:15-4.15 pm 4.15-4.30pm	Launching your academic career in catchment science (McDonnell) Course wrap up, evaluations