

First UK-Vietnam Meeting on Mathematics for the Environment

Time:

- September 28-30, 2026: Autumn School
- October 1, 2026: Workshop

Venue: Vietnam Institute for Advanced Study in Mathematics, Hanoi

PROGRAM

Autumn School

Course A: Introduction to climate modelling

Course B: Optimisation for machine learning with insights from sustainable AI

Morning Session: Monday, September 28, 2026		
08:45 - 09:00	Welcome and opening remarks	
	Lecturer	Title
09:00 - 10:00	Francisco de Melo Virissimo (LSE, UK)	Lecture A1: Overview of the Earth system; Climate as a dynamical system.
10:00 - 10:20	Coffee break	
10:20 - 11:20	Francisco de Melo Virissimo (LSE, UK)	Lecture A2: Conservation laws and geophysical fluid dynamics Tutorial 1: Analysing a zero-dimensional energy balance model.
11:30 - 13:30	Lunch break	

Afternoon Session: Monday, September 28, 2026		
	Lecturer	Title
13:30 - 14:30	Tiffany Vlaar (University of Glasgow, UK)	Lecture B1: Introduction to deep neural networks.

14:30 - 14:50	Coffee-break	
14:50 - 15:50	Tiffany Vlaar (University of Glasgow, UK)	Lecture B2: Foundations of optimization. Tutorial 1: Build and train your own neural network from scratch in PyTorch.

Morning Session: Tuesday, September 29, 2026		
	Lecturer	Title
09:00 - 10:00	Francisco de Melo Virissimo (LSE, UK)	Lecture A+ Tutorial 3: Numerical methods for climate models.
10:00 - 10:20	Coffee-break	
10:20 - 11:20	Francisco de Melo Virissimo (LSE, UK)	Lecture A4: Spatial energy balance models and climate feedbacks. Tutorial 2: Implementing a 1D advection equation and comparing stable vs. unstable timesteps.
11:30 - 13:30	Lunch break	

Afternoon Session: Tuesday, September 29, 2026		
	Lecturer	Title
13:30 - 14:30	Tiffany Vlaar (University of Glasgow, UK)	Lecture B3: Generalization, regularization, and computational cost.
14:30 - 14:50	Coffee-break	
14:50 - 15:50	Tiffany Vlaar (University of Glasgow, UK)	Lecture B4: Advanced concepts in optimization.

Morning Session: Wednesday, September 30, 2026		
	Lecturer	Title
09:00 - 10:00	Francisco de Melo Virissimo (LSE, UK)	Lecture A5: Uncertainty, ensembles and earth system models
10:00 - 10:20	Coffee-break	
10:20 - 11:20	Francisco de Melo Virissimo (LSE, UK)	Coursework: Building and analysing a simple climate model Tutorial 3: Analysing a small ensemble of climate-model outputs and estimating the uncertainty in the projected variable (e.g. temperature).
11:30 - 13:30	Lunch break	

Afternoon Session: Wednesday, September 30, 2026		
	Lecturer	Title
13:30 - 14:30	Tiffany Vlaar (University of Glasgow, UK)	Lecture B5: Modern deep learning and reflections on sustainable AI.
14:30 - 14:50	Coffee-break	
14:50 - 15:50	Tiffany Vlaar (University of Glasgow, UK)	Course B + Tutorial 2: Dissecting deep neural networks.

TITLES AND ABSTRACT

Introduction to climate modelling

Francisco de Melo Virissimo (LSE, UK)

This course introduces the mathematical and computational foundations of climate and Earth system modelling. Participants will learn how climate models represent atmospheric, oceanic, and land processes, and how these models are used to simulate and predict climate dynamics. The lectures will combine theoretical concepts with practical insights into model design and interpretation.

Optimisation for machine learning with insights from sustainable AI

Tiffany Vlaar (University of Glasgow, UK)

This course covers the theoretical foundations of deep learning, focusing on optimization methods used to train deep neural networks and understand their generalization behavior. It will also explore the environmental impact of artificial intelligence, discussing how algorithmic and model design choices influence the carbon footprint of AI systems and how optimization can contribute to more sustainable AI.

PROGRAM

UK – VIET NAM RESEARCH COLLABORATION WORKSHOP ON MATHEMATICS FOR THE ENVIRONMENT

Thursday, October 1, 2026

Venue: Thuyloi University (TLU), 175 Tay Son, Dong Da, Hanoi

Time	Activities	Speakers/ Lecturers
Morning Session		
Venue: Room P225-A1, Thuyloi University (TLU), 175 Tay Son, Kim Lien , Hanoi		
9:30-9:45	Welcome & Introduction <i>Brief introduction to the collaborative program, objectives and expected outcomes</i>	Nguyen Trung Viet (President of TLU) Le Minh Ha (Managing Director of VIASM)
9:45-11:30	Open Discussion on Research Collaboration	
	Short research intro 1: AI and Photonics for Advanced Biomaterial Characterisation and Smart Agricultural Monitoring	Pham Thi Hong, TLU
	Short research intro 2: From River–Sea Dynamics to AI-Enabled Early Warning	Dinh Nhat Quang, TLU
	Short research intro 3: UK research perspectives and opportunities for collaboration	UK colleagues
	Open discussion: cross-cutting research opportunities and potential joint activities	All participants
11:30-12:00	Lunch & informal networking	
12:00-13:00	Break/Preparation for the afternoon workshop	
Afternoon Session		
Venue: Room P500-A1, Thuyloi University (TLU), 175 Tay Son, Dong Da, Hanoi		
Zoom link: https://zoom.us/j/91313603708?pwd=li9aw3WfFvq02UpUyMkpWUsC8VsVs5.1		
Meeting ID: 913 1360 3708		
Passcode: 769563		
13:00-13:15	Welcome & Opening <i>Welcome remarks; opening remarks by the UK Embassy; brief introductions from UK colleagues (3-5 min each)</i>	Le Minh Ha, VIASM Pham Thi Thanh Nga, IMHEMS, Vietnam Representative of the UK Embassy in Hanoi

Time	Activities	Speakers/ Lecturers
13:15-13:35	Talk 1 (Online)	Eviatar Bach, Univ. of Reading, UK
13:35-13:55	Talk 2 (Online)	Jochen Broecker, Univ. of Reading, UK
13:55-14:15	Talk 3: Weather and climate modelling: some emerging issues	Truong Ba Kien, IMHEMS, Vietnam
14:15-14:35	Coffee break & Networking	
14:35-14:55	Talk 4: Atmosphere/climate dynamics, predictability, mathematical modelling, time-series analysis and ENSO	Stephane Vannitsem, NTU, Singapore
14:55-15:15	Talk 5: Hybrid Precipitation Downscaling in Ho Chi Minh City Using WRF Model and XGBoost Algorithm	Nguyen Duy Tung, VNU Univ. of Science, Vietnam
15:15-15:35	Coffee break & Networking	
15:35-15:55	Talk 6: From Lab to Field: A decade of multi-basin modelling and operational water forecasting in the greater Mekong region	Bui Du Duong, NAWAPI/Water Research Institute, Vietnam
15:55-16:15	Talk 7: Digital Twin Platform to Empower Communities towards an Eco-friendly and Healthy Future	Nguyen Ngoc Doanh & Stefan Gillott, VinUniversity, Vietnam
16:15-16:30	Coffee break – transition to group work	
Interactive Group Work – From Research Ideas to Collaborative Proposals (16:00-17:45)		
Thematic groups	Group 1: AI-Enhanced Climate Downscaling Venue: Room 500-A1 Zoom link: https://zoom.us/j/91313603708?pwd=li9aw3WfFvq02UpUyMkpWUsC8VsVs5.1 Meeting ID: 913 1360 3708 Passcode: 769563	Moderators: Tiffany & Pham T. T. Nga

Time	Activities	Speakers/ Lecturers
	Group 2: AI for Emissions and Air Quality Modelling Venue: Room 1-K1 Zoom link: https://zoom.us/j/99004293767?pwd=OA1WxdBia1Kml3YcWdFcfwvTUUZFlid.1 Meeting ID: 990 0429 3767 Passcode: 461717	Moderators: Doanh & Francisco
	Group 3: Climate Risk and Resilience Planning Venue: Room 8 - K1 Zoom link: https://zoom.us/j/99026682744?pwd=tLCJ57VRzXQHHi7nuZPNE8h6e6aW9Z.1 Meeting ID: 990 2668 2744 Passcode: 194612	Moderators: Stephane Vannitsem & Du Duong
16:30-16:45	Collaborative idea development: research challenges and knowledge gaps; expertise, datasets, models and resources; opportunities for UK–Viet Nam collaboration; research questions and approaches; scientific and societal impact <i>Expected output: preliminary collaborative research idea(s)</i>	Thematic groups
16:45-17:00	Idea pitches & cross-group feedback (~5 min/group)	Group representatives
17:00-17:30	Mini-proposal development: research problem, objectives, key questions, methodology, partners, data/resources, expected outcomes, funding opportunities and next steps <i>Expected output: one structured mini-proposal per group</i>	Thematic groups
17:30-17:45	Mini-proposal presentations (~5 min/group)	Group representatives
17:45-18:00	Next Steps & Closing	
18:00	End of Workshop	

TITLES AND ABSTRACT

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Evitar Bach (University of Reading, UK)

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Jochen Broecker (University of Reading, UK)

Weather and climate modelling: some emerging issues

Truong Ba Kien (IMHEMS, Vietnam)

Weather and climate modelling is entering a new phase in which traditional dynamical models are increasingly combined with artificial intelligence, machine learning and advanced mathematical methods. This presentation discusses several emerging issues, with particular emphasis on high-resolution climate information and AI-enhanced downscaling. Global climate models provide essential information on large-scale circulation and climate response, but their coarse resolution limits applications to local hazards and decision making, especially in countries such as Viet Nam with complex topography, long coastlines, densely populated deltas and rapidly growing cities. A key challenge is that reconstructing kilometre- or sub-kilometre information from coarse model outputs is fundamentally an ill-posed problem: fine-scale atmospheric processes cannot be uniquely determined from large-scale fields. AI may generate realistic-looking spatial detail without correctly representing physical processes or extreme-event statistics.

This raises important mathematical questions concerning physical constraints, stochastic modelling, uncertainty quantification, effective resolution, model generalisation and validation under a changing climate. Particular attention will be given to probabilistic approaches, multivariable physical consistency, extreme events, and hybrid physics–AI frameworks. These challenges offer significant opportunities for closer collaboration among mathematicians, climate scientists and AI researchers in developing reliable and interpretable next-generation weather and climate models.

Atmosphere/climate dynamics, predictability, mathematical modelling, time-series analysis and ENSO

Stephane Vannitsem (NTU, Singapore)

Hybrid Precipitation Downscaling in Ho Chi Minh City Using WRF Model and XGBoost Algorithm

Nguyen Duy Tung (VNU, Vietnam)

From Lab to Field: A decade of multi-basin modelling and operational water forecasting in the greater Mekong region

Bui Du Duong (NAWAPI/Water Research Institute, Vietnam)

The Greater Mekong Region (GM), including the entire Vietnam and the Mekong basin, faces severe water governance challenges, with 90% of its territory sitting in transboundary basins marked by rapid dam expansion and data-sharing barriers. This talk chronicles a long journey since 2013 to bridge academic research and operational field solutions for these multi-scale real-world challenges. The presentation showcases an Integrated Solution Framework driven by numerical models, data fusion, IoT, and remote sensing. Key innovations include GM-ForcePast for near-real-time rainfall, GM-ForceCast for 16-day machine learning ensemble forecasts, and satellite tracking of essential reservoir variables for the entire GM region. Crucially, a Hybrid Intelligence model that fuses physically-based and AI mechanisms, coupled with river hydraulic and groundwater models, provides integrated decision support tools and insights for early warnings at various scales. Ultimately, this work highlights transdisciplinary synergies and lessons learned in transforming multi-basin modeling into scalable, practical tools that enhance climate resilience, proactive water management, and disaster mitigation from regional to local scales.

Digital Twin Platform to Empower Communities towards an Eco-friendly and Healthy Future

Nguyen Ngoc Doanh and Stefan Gillott (VinUniversity, Vietnam)

Rapid urbanization in Viet Nam and across Southeast Asia has intensified traffic congestion, greenhouse gas emissions, and urban air pollution. In this talk, we present our research where we have developed an AI-enabled digital twin framework for transportation and urban air quality to support data-driven policies for sustainable mobility. This research will enable the potential for developing a suite of transportation policies and incentives to encourage shifts to sustainable transportation modes, such as electric vehicles, transit, and ridesharing, to reduce emissions of air pollutants and traffic congestion.