5th ECMWF-ESA Machine Learning Workshop

Programme

Monday
Agenda

Location: Botte B4 pavilion - DAMA Technopole

Agenda time displays according to the selected time zone.

The selected timezone is Europe/London

	Opening and keynote Session chairs: Massimo Bonavita (ECMWF) and Rochelle Schneider (ESA)	
12:00 to 13:00	**Registration and coffee**	
13:00 to 13:10	**Opening and welcome** Video recording	Massimo Bonavita (ECMWF) Rochelle Schneider (ESA)
13:10 to 13:40	**AI for Humanity: Foundational Machine Learning and Data Assimilation for a Resilient Earth** Keynote speaker Presentation slides Video recording	Rossella Arcucci (Imperial College London)
13:40 to 14:10	**Machine learning-driven advances in geophysical data assimilation** Keynote speaker Presentation slides Video recording	Marc Bocquet (École Nationale des Ponts et Chaussées and ECMWF Fellow)
14:10 to 17:10	**Poster session and ice breaker**	
14:10 to 15:10	**Coffee and posters**	
15:10 to 17:10	**Aperitivo cocktail reception and posters**	

Aperitivo sponsored by the University of Bologna, the Alma Climate Institute

ALMA MATER STUDIORUM
UNIVERSITÀ DI BOLOGNA

CENTRO INTERDIPARTIMENTALE
ALMA MATER RESEARCH INSTITUTE ON
GLOBAL CHALLENGENS AND CLIMATE CHANGE

Tuesday
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	Session 1.1: TA1 ML4DTE system Session chairs: Rochelle Schneider (ESA) and Mounia El Baz (ESA)	
08:00 to 08:30	**CLIM4health: from Citizen Science, Machine Learning and Earth Observation towards Urban Climate Services** Keynote speaker Presentation slides Video recording	Ana Oliveira (CoLAB +ATLANTIC)
08:30 to 08:50	**The WeatherGenerator Project: Building a multi-modal, multi-resolution Foundation Model for Weather and Climate science** Presentation slides Video recording	Ilaria Luise (ECMWF)
08:50 to 09:10	**Lessons from Weather: Adapting GraphCast for Global Ocean Forecasting** Presentation slides Video recording	Stefano Campanella (National Institute of Oceanography and Applied Geophysics - OGS, University of Trieste)
09:10 to 09:30	**High-Resolution Thermal Mapping for Land Cover Intervention Planning** Presentation slides Video recording	Hugo Poupard (Murmuration-SAS)
09:30 to 09:50	**Bris and Forecast-in-a-Box: Applications and results for Malawi.** Presentation slides Video recording	Lene Østvand (The Norwegian Meteorological Institute)
09:50 to 10:20	**Group photo and coffee break**	
	Session 1.2: TA1 ML4DTE system Session chairs: Rochelle Schneider (ESA) and Mounia El Baz (ESA)	

10:20 to 10:40	**Probing sensitivities in sea ice surrogate models toward probabilistic forecasting** Presentation slides Video recording	Flavia Porro (University of Bologna)
10:40 to 11:00	**Downscaling of vertical profiles of mean and turbulent atmospheric variables using deep learning** Presentation slides Video recording	Maximilian Pierzyna (Technische Universiteit Delft)
11:20 to 11:40	**Generative Adversarial Networks for Simulating Dynamic Interactions in Digital Twins of Coastal Ecosystems** **Online presentation** Presentation slides Video recording	Oscar Leung (HKU) Ye Ha Kim (UCL)
11:00 to 11:20	**AI Climate Emulators as Tools for Reducing Weather Risk Uncertainty: Insights from a Large-Ensemble Approach** Presentation slides Video recording	Amaury Lancelin (Laboratoire de Météorologie Dynamique (LMD), Ecole Normale Supérieure, RTE)
11:40 to 12:00	**Going with the flow: generalising physically consistent data-driven sea-ice models** Presentation slides Video recording	Tobias Finn (CEREA, ENPC, EDF R&D, Institut Polytechnique de Paris)
12:00 to 13:30	**Lunch break**	
	Session 1.3: TA1 ML4DTE system Session chairs: Rochelle Schneider (ESA) and Mounia El Baz (ESA)	
13:30 to 13:50	**A New Concept for Comparing Satellite Observations and km-scale Atmospheric Simulations using Self-Supervised Machine Learning** Presentation slides Video recording	Dwaipayan Chatterjee (Institute for Meteorology and Climate Research, Karlsruhe Institute for Technology)
13:50 to 14:10	**SHRUG-FM: Reliability-Aware Foundation Models for Earth Observation** Presentation slides Video recording	Joppe Massant (Ghent University)

14:10 to 14:30	**Evaluation of GraphCast and PanguWeather over India and Downscaling using WRF for Simulating the 2023 North Indian Floods** **Online presentation** Presentation slides	Balu Shaharica (Indian Institute of Technology Roorkee)
14:30 to 15:10	**TA1 - Open discussion** Video recording	
15:10 to 15:40	**Coffee break**	
	Session 2.1: TA2 Hybrid ML-Physics based systems for DA and Weather and Climate prediction Session chairs: Rossella Arcucci (Imperial College) and Marc Bocquet (ENPC)	
15:40 to 16:00	**Advancing Global Weather Prediction at ECCC Using Spectral-Nudging-Based Hybrid NWP-MLWP Modelling** Presentation slides Video recording	Leo Separovic (Environment and Climate Change Canada)
16:00 to 16:20	**Hybrid NWP-AI at Météo-France : nudging AIFS large scales in the global NWP operational model ARPEGE** Presentation slides Video recording	Vincent Chabot (Météo France)
16:20 to 16:40	**Enhanced land surface data exploitation using machine learning** Presentation slides Video recording	Patricia de Rosnay (ECMWF)

Wednesday
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	Session 2.2: Session chairs: Rossella Arcucci (Imperial College) and Marcin Chrust (ECMWF)	
08:00 to 08:30	**Data Assimilation in the era of the AI revolution - where we stand today** Keynote speaker Presentation slides Video recording	Steve Penny (SOFAR Ocean)
08:30 to 08:50	**Development of an offline and online hybrid model for the Integrated Forecasting System** Presentation slides Video recording	Alban Farchi (ECMWF)
08:50 to 09:10	**Online bias-correction in sea-ice models using machine learning and data assimilation** Presentation slides Video recording	Giovanni De Cillis (Dept. of Physics and Astronomy “Augusto Righi”, University of Bologna, Bologna, Italy)
09:10 to 09:30	**RUSH: Rapid-Update High-Resolution precipitation nowcasting and Global AI/NWP downscaling in a single Latent-Diffusion model** Presentation slides Video recording	Simon De Kock (Electronics and Informatics (ETRO), Vrije Universiteit Brussel & Royal Meteorological Institute of Belgium)
09:30 to 10:00	**Coffee break**	
	Session 2.3: TA2 Session chairs: Rossella Arcucci (Imperial College) and Marcin Chrust (ECMWF)	

10:00 to 10:20	**Hybrid machine learning and ensemble data assimilation** Presentation slides Video recording	Wei Pan (ECMWF)
10:20 to 10:40	**Machine Learning-Driven Background Error Covariances for High-Resolution Data Assimilation** Presentation slides Video recording	Ravi Shankar Nemani (School of Mathematical, Physical & CompUniversity of Reading and National Centre for Earth Observation)
10:40 to 11:00	**Multi-hazard nowcasting system over Romania** **Online presentation** Presentation slides Video recording	Claudiu Adam (National Meteorological Administration)
11:00 to 11:20	**Unmasking Compensating Biases: A Process-Partitioned Neural Network Approach** Presentation slides Video recording	Yuiko Ichikawa (University of Cambridge)
11:20 to 12:00	**TA2 - Open discussion** Video recording	
12:00 to 13:30	**Lunch**	
	Session 3.1: TA3 ML applications for Earth system observations Session chairs: Maryam Pourshamsi (ESA) and Chiara Maria Cocchiara (ESA)	
13:30 to 14:00	**Harnessing Satellite Data and AI to Address Climate Hazards for Children** Keynote speaker Presentation slides Video recording	Do-hung Kim (UNICEF)
14:00 to 14:20	**Collaborative Labelling of Earth System Features in Satellite Data for Nowcasting and Climate Applications** Presentation slides Video recording	Lauren Biermann (EUMETSAT)

14:20 to 14:40	**Machine-learning-based observation operators for land-surface data assimilation** Presentation slides Video recording	Peter Weston (ECMWF)
14:40 to 15:00	**A data-driven reanalysis of Amazon water levels with deep learning** Presentation slides Video recording	Ruben Cartuyvels (ESA)
15:00 to 15:30	**Coffee break**	
	Session 3.2: TA3 Session chairs: Maryam Pourshamsi (ESA) and Chiara Maria Cocchiara (ESA)	
15:30 to 15:50	**Benchmarking Earth Observation embeddings for large scale aboveground biomass mapping** Presentation slides Video recording	Yu-Feng Ho (OpenGeoHub)
15:50 to 16:10	**Contrail Instance Segmentation on Geostationary Imagery** Presentation slides Video recording	Ana Maria Pelin (EUROCONTROL & TU Delft)
16:10 to 16:30	**GridShield™: A Hybrid ML-Satellite Fusion Framework for Real-Time Power Grid Resilience and Climate-Verified Carbon Credit Generation Using ESA Copernicus Sentinel Data** Online presentation	Milagrosa Russelle Ballestar (iONTEK Power Solutions Corporation - Innovate with EU Space Data Mentoring Programme 2025)
16:30 to 16:50	**Data-Driven Eddy Detection from Wide-Swath Altimetry** Presentation slides Video recording	Matteo Broccoli (CMCC Foundation, Italy)
16:50 to 17:10	**Developing a Multimodal AI Framework for Wetlands Mapping with Multi-Sensor Earth Observation Data** **Online presentation** Presentation slides Video recording	Khunsa Fatima (University of Leicester)

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	Session 3.3: TA3 Session chairs: Maryam Pourshamsi (ESA) and Chiara Maria Cocchiara (ESA)	
08:00 to 08:20	**From Synthetic to Real: A Scalable Dataset and ML Framework for Global Methane Monitoring** Presentation slides Video recording	Enno Tiemann (OHB Digital Connect / Technical University of Munich (TUM))
08:20 to 08:40	**Filling the Multisensor Gap: Multimodal Generative Models for Volcano Monitoring** Presentation slides Video recording	Simona Cariello (INGV-OE Istituto Nazionale di Geofisica e Vulcanologia Osservatorio Etneo, Catania, Italia)
08:40 to 09:00	**Deep learning emulation of the far-infrared fast forward operator for ESA FORUM satellite** Presentation slides Video recording	Simone Raciti (University of Bologna)
09:00 to 09:20	**Intelligent All-sky Cameras for Dense Mesoscale Observations** **Online presentation** Presentation slides Video recording	Ben Pickering (Wx Labs Ltd and NCAS)
09:20 to 10:00	**TA3 - Open discussion** Video recording	
10:00 to 10:20	**Coffee break**	
	Session 4.1: TA4 End-to-end ML systems for DA and Weather and Climate Prediction Multidomain ML4ESOP Session chairs: Alberto Carrassi (UniBo) and Massimo Bonavita (ECMWF)	

10:20 to 10:40	**GraphDOP: Are observations all you need?** Presentation slides Video recording	Eulalie Boucher
10:40 to 11:00	**An End-to-End Observation-Centric Graph Neural Network Framework for Global Earth System Prediction** Presentation slides Video recording	Azadeh Gholoubi (NOAA/NWS/NCEP/EMC)
11:00 to 11:20	**Duo-AttnOPNets: An End-to-End ML–4D-Var Framework for Atmospheric Composition Forecasting and Data Assimilation** Presentation slides Video recording	Judongyang Zhou (Imperial College London)
11:20 to 11:40	**Extending the Aila AI Weather Model: A Multi-Decoder Approach for Variable Expansion** Presentation slides Video recording	Mikko Partio (Finnish Meteorological Institute)
11:40 to 12:00	**AI-Based Weather Forecasting for Switzerland** Presentation slides Video recording	Claire Merker (MeteoSwiss)
12:00 to 13:30	**Lunch break**	
	Session 4.2: TA4 Session chairs: Alberto Carrassi (UniBo) and Massimo Bonavita (ECMWF)	
13:30 to 14:00	**From Real-Time Big Data Assimilation on Fugaku to Synergistic Development of DA and AI: Osaka Expo 2025 and Beyond** Keynote speaker Presentation slides Video recording	Takemasa Miyoshi (RIKEN)
14:00 to 14:20	**Beyond the atmosphere: Building a Data-Driven Earth System Model at ECMWF** Presentation slides Video recording	Nina Raoult (ECMWF)

14:20 to 14:40	**The physics of AI weather models** Presentation slides Video recording	George Craig (Meteorological Institute, LMU Munich)
14:40 to 15:00	**Interpretability of AI Weather Models via Intermediate Decoding** Presentation slides Video recording	Matthias Beylich (Meteorological Institute, LMU Munich)
15:00 to 15:30	**Coffee break**	
	Session 4.3: TA4 Session chair: Massimo Bonavita (ECMWF)	
15:30 to 15:50	**Leveraging the kilometre-scale AROME reanalysis to develop AI-based regional forecasting systems over Western Europe** Presentation slides Video recording	Thomas Rieutord (Météo-France)
15:50 to 16:10	**Probabilistic GAN for European Winter Storm Downscaling** Presentation slides Video recording	Athul Rasheeda Satheesh (Karlsruhe Institute of Technology)
16:10 to 16:30	**Towards few-sample extreme event likelihoods with guided diffusion models** Presentation slides Video recording	Peter Manshausen (NVIDIA)
16:30 to 17:00	**TA4 - Open discussion** Video recording	

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	Session 5.1: TA5 - HP and new computing technologies for ML applications in ESOP Session chair: Nina Raoult (ECMWF) and Diego Jatoba Dos Santos (ESA)	
08:00 to 08:30	**Combining HPC and AI to advance potential: Example from HLRS and HammerHAI** Keynote speaker Online presentation Presentation slides Video recording	Bastian Koller (High Performance Computing Center Stuttgart)
08:30 to 08:50	**Scalable GPU-Accelerated Training of Graph Neural Networks for High-Resolution ESOP Simulations** **Online presentation** Presentation slides Video recording	Oscar Leung (HKU) Ye Ha Kim (UCL)
08:50 to 09:10	**Improving the performance and scalability of Anemoi** Presentation slides Video recording	Jan Polster (ECMWF)
09:10 to 09:30	**Satellite Earth Observation and AI–QC-Physics methods for enhanced climate predictions and volcano–climate interaction modeling** Presentation slides Video recording	Eleonora Amato (Istituto Nazionale di Geofisica e Vulcanologia (INGV), Sezione Osservatorio Etneo, Catania, Italy)
09:30 to 10:00	**Coffee break**	
	Session 5.2: TA5 Session chair: Nina Raoult (ECMWF) and Diego Jatoba Dos Santos (ESA)	

10:00 to 10:20	**Optimising Anemoi for higher resolution data and next-generation systems** Presentation slides Video recording	Cathal O Brien (ECMWF)
10:20 to 10:40	**Global Volcano Monitoring from Space with hybrid Quantum Convolutional Neural Networks** Presentation slides Video recording	Federica Torrisi (INGV-OE Istituto Nazionale di Geofisica e Vulcanologia Osservatorio Etneo, Catania, Italia)
10:40 to 11:00	**Profiling Machine Learning Weather-Forecasting Models in Anemoi** Presentation slides Video recording	Marieke Plesske (HPC Applications Team)
11:00 to 11:30	**TA5 - Open discussion** Video recording	
11:30 to 11:40	**Closing remarks** Video recording	Massimo Bonavita (ECMWF) Rochelle Schneider (ESA)