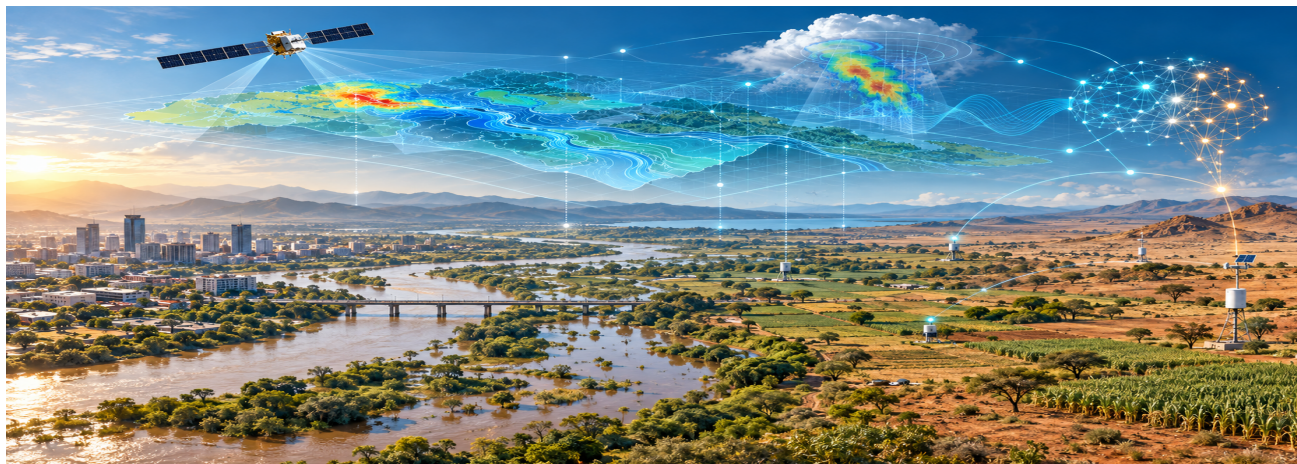


Hybrid Mathematical Modelling and Physics-Informed AI for Climate Resilience and Digital Twin Early Warning Systems

Two-page project and consortium partner offer for MSCA Doctoral Networks matchmaking



The opportunity

SEKU seeks partners to develop hybrid mathematical and physics-informed AI methods for climate-risk forecasting. Our proposed digital twin would combine observations and process models, update as new data arrive, simulate plausible scenarios, and communicate uncertainty and likely impacts. Initial use cases could address floods, droughts and climate-sensitive agriculture; the consortium will select pilot sites and priorities together.

Research contribution

- Mathematical and statistical models for time-varying climate and hydrological processes.
- Physics-informed learning, data assimilation and probabilistic forecasts in data-scarce settings.
- Digital twin workflows for scenario testing, risk mapping and interpretable early warning.
- Time-aware validation of forecast skill, calibration, extremes, lead time and decision value.

Proposed doctoral projects

1. **DC1: Physics-Informed AI and Data Assimilation for Flood Forecasting in Data-Scarce Catchments.** Develop hybrid models that combine hydrological processes, sparse observations and real-time data to improve flood forecasts.
2. **DC2: Probabilistic Digital Twins for Drought and Agricultural Climate Risk.** Integrate weather, satellite and agricultural data to simulate drought conditions and quantify uncertainty in risk forecasts.
3. **DC3: Explainable AI for Impact-Based Early Warning.** Translate hazard forecasts into interpretable estimates of likely impacts and evaluate warning thresholds, lead time and uncertainty communication.

SEKU PARTNER CAPABILITY AND COLLABORATION OFFER

Proposed SEKU role

South Eastern Kenya University (SEKU) seeks to join an MSCA Doctoral Network as a research and doctoral-training partner. SEKU will contribute expertise in statistics, mathematical modelling, time-series forecasting and artificial intelligence, with a focus on climate and agricultural applications in Kenya.

Subject to the call requirements, consortium agreement and institutional approvals, SEKU is ready to employ and host one doctoral candidate as a beneficiary. It also offers joint supervision and can host visiting PhD researchers in mathematics and AI for periods of 3–6 months.

What SEKU offers and seeks

SEKU offers	Hybrid modelling and AI expertise; doctoral supervision; development of Kenyan pilot use cases; and engagement with relevant stakeholders, subject to agreed access and partnerships.
Partners sought	Expertise in hydrology, climate science, remote sensing, digital twin engineering, agriculture, disaster risk management and the practical delivery of early warnings.
Joint activities	Co-designed doctoral projects; joint supervision; research visits and secondments; shared training; pilot evaluation; reproducible methods; and publications.

Work-package contributions

- **WP1 – Data integration:** Quality control, harmonisation and uncertainty assessment for ground, satellite and historical observations.
- **WP2 – Hybrid modelling:** Mathematical, statistical and physics-informed AI methods for forecasting and digital twin updates.
- **WP3 – Validation and early warning:** Pilot testing, impact thresholds, interpretability and evaluation with prospective users.
- **WP4 – Doctoral training:** Joint supervision, research visits, interdisciplinary training and dissemination.

Expected value for a consortium

A complementary research setting for testing transferable methods under uneven data availability; doctoral training across mathematics, AI and applied climate science; and an opportunity to co-design practical early-warning demonstrations. Specific data, facilities, pilot sites, employment terms and partner commitments will be confirmed during proposal development.

Invitation to collaborate

We welcome contact from prospective coordinators, academic groups, public agencies, technology organisations and practitioners interested in shaping an MSCA Doctoral Network around these themes. The next step is to agree the call fit, consortium roles, doctoral projects, pilot use cases and a realistic implementation plan.

Contact: Dr Robert Mathenge Mutwiri, Department of Mathematics and Actuarial Science, South Eastern Kenya University, Kenya. Please contact through the MSCA matchmaking platform.