EC-ESA Joint Earth System Science Initiative

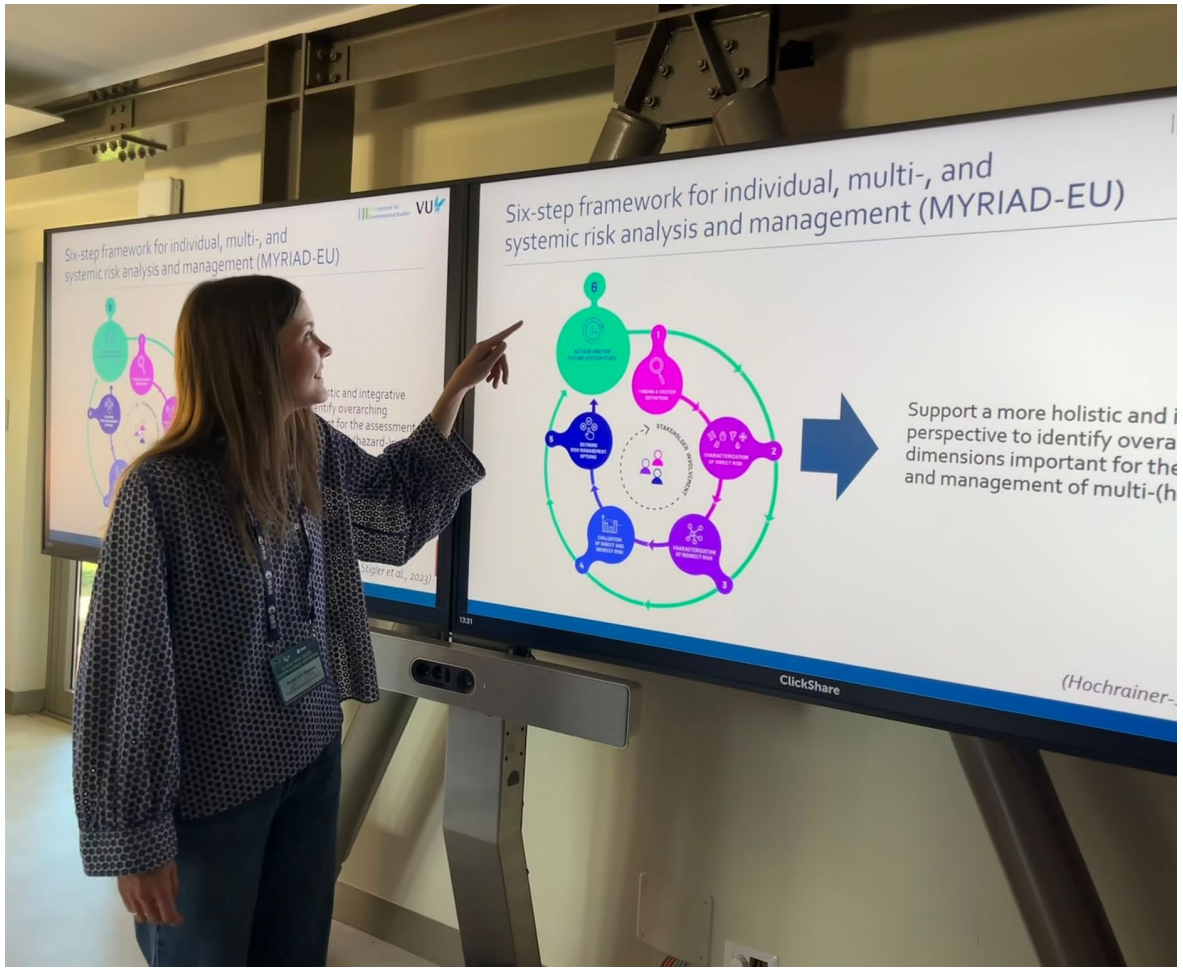
22-24 November 2023| ESA-ESRIN, Frascati, Italy

Wrap up for the Climate adaptation – Extremes, multi-hazards and compound events theme

Dr. Carlos Domenech (GMV) on behalf of the participants from the disasters sessions

The disaster session in figures

- **44 attendees** representing the academia, space industry, civil protection agencies, the space agencies and the European Commission
- **11 posters** with lightning talks presenting on-going projects on disasters and the state-of-the-art research in the disaster community
- **21 keynotes speakers** from recognised European institutions researching in hydroclimate hazards, geohazards and multi-hazards
- **20+ ESA and EC's Horizon Europe projects presented**



Nicole van Maanen from VU presenting MYRIAD during the Disaster IV session

TREME & NATURAL DISASTER SCIENCE CLUST

extrAiM

XAIDA

MedCyclones
COST Action
CA19109

DTE Hydrology

4DMED
HYDROLOGY

ANYWHERE

4DHydr

Digital Twin of Alps

AI for Drought

GDA

OPEN EARTH
MONITOR

myriad_eu
Reducing risks together

CASSIE C-SQUEEZE

EOatSEE
Earth Observation advanced science tools for Sea level Extreme Events

ESA and EU science initiatives: *Agenda*

- EU Research on Impact Forecasting of High-Impact Climatic/Geological Disasters - Links with Earth Observation Space Technologies (Philippe Quevauviller, EC)
- Current and future ESA activities contributing to multi-hazards (Anca Anghelea, ESA)
- Roles of AI & EO for preparedness, early warning and anticipatory action with complex risks (Markus Reichstein, Max-Planck Institute)
- Overview of XAIDA (eXtreme events Artificial Intelligence for Detection and Attribution) especially the Multidisciplinary Approach to Compound and Cascade Events (Jakob Zscheischler, Helmholtz Centre for Environmental Research, DE)
- Early action: utilisation des données spatiales (Alix Roumagnac, Predict Services)

ESA and EU science initiatives: *Messages*

- EC and ESA-funded projects were presented aiming improving outcomes from climate extremes and multi-hazards
- Information needs to be communicated clearly and in time to be useful when used for early warning or emergency response
- Open question on how Earth Observation data can be integrated into harmonised protocols for forecasting and transnational emergency management
- In the preparedness for climate risks: current weather forecast -> OK, impact forecast -> quite OK, but communication to governance still needs improvement

Earth Observation for High-Impact Hydroclimatic Hazards: *Agenda*

- Understanding and monitoring hydrometeorological extremes using Earth Observation (Luca Brocca, CNR)
- Paving the way from understanding to predicting intense Mediterranean cyclones and the specific case of medicanes (Emmanouil Flaounas, HCMR, Greece)
- Monitoring extreme heatwaves for improving climate resilience (Anand Jasdeep Singh, University of Leicester)
- Challenges in using EO to characterise vegetation fires in the Global Fire Assimilation System of CAMS (Johannes Kaiser, NILU)
- Drought impact forecasting using Earth Observation (Bueechi Emanuel, TU Vienna)

Earth Observation for High-Impact Hydroclimatic Hazards: *Messages*

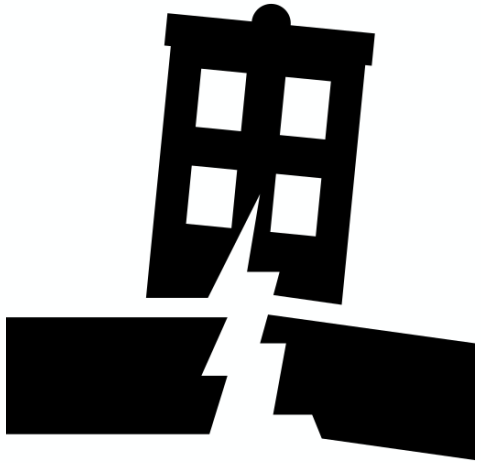
- In the hydro-meteorological domain working at 1 km scale with 3 hourly consistent data is important to advance science. Hopefully achieved through larger satellite constellations in the future, but complex to implement and has implications for the modelling community.
- For atmospheric and land surface processes spatial resolution is important and there are current efforts (e.g., Leicester Univ. for ESA CCI LST) to downscale spatial resolution of satellite products.
- Assimilating observations from several satellites is currently routinely done in wildfire emissions modelling, however uncertainties are still high.
- New satellite missions are required for early detection of (drought) stress on vegetation. Proposal put in place for Earth Explorer 12.

Earth Observation in Geohazards: Latest Advances and Science Challenges: *Agenda*

- Earth Observation for the 2030 decade challenges in volcanology (Pablo Jose Gonzalez, CSIC de La Laguna, Tenerife).
- Advances and challenges in landslide remote sensing (Katy Burrows, ESA)
- Relation between surface dynamics and the 3D Earth structure (Joerg Ebbing, Kiel University)
- Pushing the Frontiers of Earthquake Hazard Science with Earth Observation (Ekbal Hussain, BGS)
- EO-based solutions and on-board data processing for disaster resilience (Pedro Ribeiro, Deimos)

Earth Observation in Geohazards: Latest Advances and Science Challenges: *Messages*

- Presentations show EO techniques to study a wide range of processes from the Earth's surface down to deep Earth structure and relating these to volcanoes, earthquakes, landslides and sea level extremes
- There is a need to consider how vulnerability evolves in a multi-hazard event and whether EO can help us with this. Static estimates of risk or impacts do not give a complete picture
- Better resolution (in space and time) would unlock new capabilities for geohazards monitoring and early warning systems

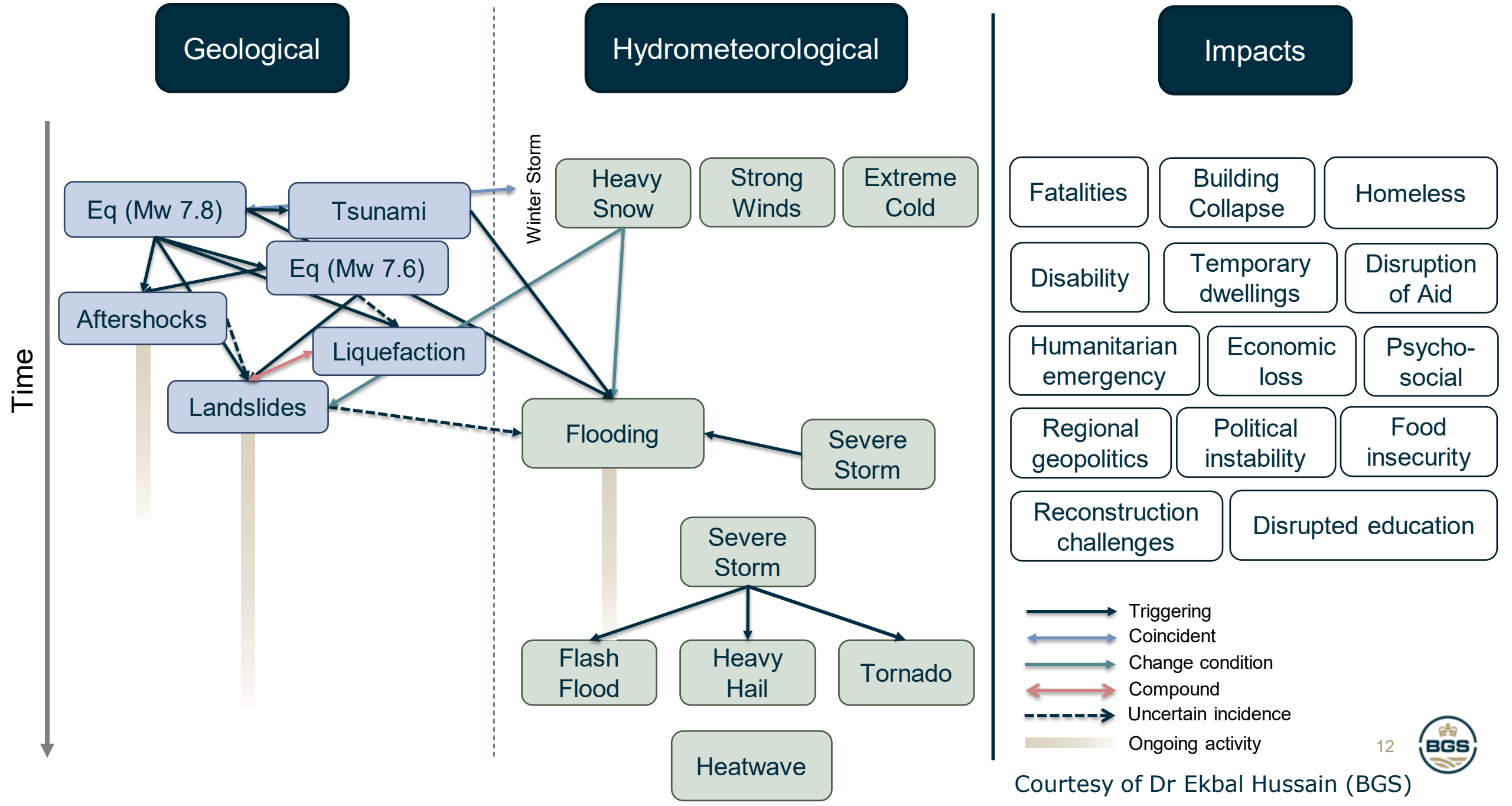


Disasters: Earth Observation for Multi-Hazards and Compound Events: *Agenda*

- Multivariate extreme events in the terrestrial carbon cycle (Miguel Mahecha, Leipzig University)
- 25-year assessment of Hot and Dry Weather Compound Events in Europe using EO (Elody, ESA)
- Breaking the silos: towards multi-hazard risk assessment and management (Nicole van der Maanen, VU)
- Multi-stressors in estuarine environments: compound flooding and ecosystem squeeze (EOatSEE) Almeida Luis
- Cascading effects of NaTech events and Earth Observation techniques (Sabina Di Franco CNR)
- Space Technologies for geo-hazards and hydro-meteorological risks to support the national users in Bangladesh - Cox's Bazar (Daniela Drimaco, Planetek)

Disasters: Earth Observation for Multi-Hazards and Compound Events: *Messages*

- To consider impact of humanitarian disaster you need to consider connecting climate extremes and societal pre-conditions and compound events
- For estimating vulnerabilities local data is needed, adaptation practitioners need to be involved
- For NaTech disasters – creating a forum with stakeholders is important. However it is challenging as it varies for the different countries



Courtesy of Dr Ekbal Hussain (BGS)

Panel Discussion: Setting priorities for a better understanding and assessment of Extremes

- The timeframe mismatch between EC and ESA projects makes them difficult to run jointly in parallel. Having longer bidding times for proposals and to be able to run projects consecutively rather than in parallel will help

- Teams from ESA-funded and EC-funded activities need to be able to discover each-other to collaborate. ESA-EC need to work together to enable this.

- Requirements to advance towards solution-driven science:
  - Continuity of activities in the long-term and larger scale projects
  - More flexibility in funding/contracts to allow for "fast science" activities **during** the actual events to collect and exchange scientific data across teams
  - Technology enabling access to data and computation is needed – Open Science & Digital Innovation
  - ESA and EC to create the bridge between scientists and users
  - More open data and a framework for data exchange and data sharing between institutions and from administrations to scientists
- There is a need for a multi-hazard database (that will be fulfilled by the EO4multihazard project)
- Multi-hazards require multi-disciplinary participation. We need to bring social and behavioural sciences into the conversation to help model the dynamics of vulnerability and risk
- Need to enabling research to take place outside of Europe, as multi-hazards occur globally. Involvement of local teams is essential for the scientific process. Data outside of Europe is very important but scarce and not easy to access. Open Science and technology play a big role.