Joint workshop organised by ESA and the DG-RTD of EC (22-24 November 2023, ESA-ESRIN).

Theme Climate attribution – Extremes and multi-hazards

DAY 1: Wednesday, 22nd November 2023

10:00 AM : Session 1.01 Plenary: Welcome session **Duration: 1 hour**

Chairperson: Diego Fernandez

Reporter: Karim Douch

-Welcome by ESA and introduction to the EC-ESA Joint Earth System Science Initiative (Diego Fernandez Prieto, ESA)
-EC-ESA initiative and the new GEO strategy: Earth Intelligence for all (Franz Immler, EC DG-RTD)
-Welcome keynote from EC DG-DEFIS (Michel Rixen, EC DG-DEFIS **Remote)**

11:00- 11:30AM: COFFEE BREAK

11:30AM: Session 1.02 Plenary: Frontiers of science and opportunities **Duration: 2 hours**

Chairperson: Diego Fernandez

Reporters: Elody Fluck and Anca Anghelea

- Bridging scales with satellite data to improve monitoring of ocean health (Marina Levy, LOCEAN-IPSL)
- Observing and predicting changes in the cryosphere and potential impacts (Jonathan Bamber, University of Bristol)
- Frontiers of science and opportunities in Biodiversity research (Vihervaara Petteri, SYKE)
- Opportunities and challenges in using EO data to characterise the terrestrial carbon cycle (Markus Reichstein, Max Planck, Institute for Biogeochemistry, DE)
- Compound weather and climate events: Current state of research and future opportunities (Jakob Zscheischler, Helmholtz Centre for Environmental Research, DE)
- Coupled Model Intercomparison Project evolution to support future climate assessments (Eleanor O'Rourke, Director, CMIP International Project Office)

1:20 – 2:20pm: LUNCH BREAK

2:20pm: Session 1.03d: ESA and EU science initiatives

(Duration: 1hr40. Each talk: 15 min + 4 min QA)

(Focus: This session will provide a comprehensive overview of the current initiatives being taken by the European Space Agency and the European Union to improve our understanding and monitoring of multi-hazards. From innovative technologies to collaborative efforts, the talks in this session will highlight how these initiatives are shaping the future of disaster management and mitigation)

Chairpersons: Elody Fluck and Claudia Vitolo

Reporter: Katy Burrows

- ✓ 2:20-2:25pm: Introduction (5 min): Agenda + Organization (Elody) and Objectives (Claudia)
- ✓ 2:25-2:40pm: (**Remote**) EU Research on Impact Forecasting of High-Impact Climatic/Geological Disasters - Links with Earth Observation Space Technologies (Philippe Quevauviller, EC)
- ✓ 2:45-3:00pm: Current and future ESA activities contributing to multi-hazards (Anca Anghelea, ESA)
- ✓ 3:05-3:20pm: Roles of AI & EO for preparedness, early warning and anticipatory action with complex risks (Markus Reichstein, Max-Planck Institute)
  3:25-3:40pm: *Missing title*: 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)
- ✓ 3:45-4:00pm: Early action: utilisation des données spatiales (Alix Roumagnac, Predict Services)

4:00-4:20PM: COFFEE BREAK

4:20:pm: Session 1.04d: Earth Observation for High-Impact Hydroclimatic Hazards

(Duration: ~1hr40. Each talk: 15 min + 5min QA)

(Focus: The objective of this session is to obtain a comprehensive understanding of the latest scientific advances and predominant gaps in data, methodologies, and EO technologies of high impact weather events)

Chairpersons: Elody Fluck and Katy Burrows

Reporter: Claudia Vitolo

- ✓ 4:20-4:35pm: Understanding and monitoring hydrometeorological extremes using Earth Observation (Luca Brocca, CNR)
- ✓ 4:40-4:55pm: Paving the way from understanding to predicting intense Mediterranean cyclones and the specific case of medicanes (Emmanouil Flaounas, HCMR, Greece)
- ✓ 5:00-5:15pm: Monitoring extreme heatwaves for improving climate resilience (Anand Jasdeep Singh, University of Leicester)
- ✓ 5:20-5:35pm: Challenges in using EO to characterise vegetation fires in the Global Fire Assimilation System of CAMS (Johannes Kaiser, NILU)
- ✓ 5:40-5:55pm: Drought impact forecasting using Earth Observation (Bueechi Emanuel, TU Vienna)

6:05pm: POSTER PLENARY + COCKTAILS (Big Hall)

DAY 2: Thursday, 23rd November 2023

8:30AM: Plenary

9:00AM: Session 2.02d: Earth Observation in Geohazards: Latest Advances and Science Challenges

(Duration: ~2h. Each talk: 15 min + 5min QA)

(Focus: The objective of this session is to obtain a comprehensive understanding of the latest scientific advances and predominant gaps in data, methodologies, and EO technologies of geohazards)

Chairpersons: Elody Fluck and Anca Anghelea

Reporter: Karim Douch

- ✓ 9:00-9:15AM: (**Remote**) Earth Observation for the 2030 decade challenges in volcanology (Pablo Jose Gonzalez, CSIC de La Laguna, Tenerife).
- ✓ 9:20-9:35AM: Advances and challenges in landslide remote sensing (Katy Burrows, ESA)
- ✓ 9:40-9:55AM: Relation between surface dynamics and the 3D Earth structure (Joerg Ebbing, Kiel University)
- ✓ 10:00-10:15AM: Pushing the Frontiers of Earthquake Hazard Science with Earth Observation (Ekbal Hussain, BGS)
- ✓ 10:20-10:35AM: EO-based solutions and on-board data processing for disaster resilience (Pedro Ribeiro, Deimos)

11:00-11:30AM: COFFEE BREAK

11:30AM: Session 2.03d: Earth Observation for Multi-Hazards and Compound Events

(Duration: ~2h. Each talk: 15 min + 2min QA)

(Focus: The objective of this session is to obtain a comprehensive understanding of the predominant gaps or challenges in knowledge, data, methodologies, and technologies in studying connected weather and geohazards events leading to cascade events)

Chairpersons: Katy Burrows and Karim Douch

Reporters: Anca Anghelea and Claudia Vitolo

- ✓ 11:30-11:45AM: Multivariate extreme events in the terrestrial carbon cycle (Miguel Mahecha, Leipzig University)
- ✓ 11:47-12:02PM: 25-year assessment of Hot and Dry Weather Compound Events in Europe using EO (Elody, ESA)
- ✓ 12:05-12:20PM: Breaking the silos: towards multi-hazard risk assessment and management (Nicole van der Maanen, VU)
- ✓ 12:22-12:37PM: Multi-stressors in estuarine environments: compound flooding and ecosystem squeeze (EOatSEE) Almeida Luis
- ✓ 12:40-12:55PM: Cascading effects of NaTech events and Earth Observation techniques (Sabina Di Franco CNR)
- ✓ 1:00-1:15PM: Space Technologies for geo-hazards and hydro-meteorological risks to support the national users in Bangladesh - Cox's Bazar (Daniela Drimaco, Planetek)

1:20-2:20PM: LUNCH BREAK

2:30PM: Session 2.04d: Poster Lightning talks and Panel Discussion: Setting priorities for a better understanding and assessment of Extremes and Multi-Hazards (Duration: 1h40)

(Focus: Ask community members to Identify and prioritize scientific requirements related to multi-hazards: how to enhance our understanding to better investigate multi-hazard using current and future EO. -> Focus is on Science)

Chairpersons: Claudia Vitolo and Katy Burrows

Reporter: Karim Douch

2:30-3:00PM: Poster Lightning Talks:

1. UAS Hydrometry – Contactless airborne measurements of water level, depth, flow velocity and discharge in rivers and streams (Laia Romero)
2. Towards trustworthy satellite-based precipitation products: coupling explainable machine learning and uncertainty quantification methods (Panagiotis, Kossieris)
3. REWRITE project - Rewilding and restoration of intertidal sediment ecosystems for carbon sequestration, climate adaptation and biodiversity support (Vona Meleder)
4. Explainable Artificial Intelligence for Extreme Event Forecasting on Sentinel-2 (Pellicer-Valero, Oscar)
5. AI4DROUGHT: Seasonal Prediction of Droughts from large and local scale (Suso Pena)
6. EULIAA: European Lidar Array for Atmospheric Climate Monitoring (Gerd Baumgarten)

3:00-4:00 PM: Panel Discussion

1. Luca Brocca:
    a. What are the challenges to be addressed for using high-resolution satellite observations for flood, drought and landslide monitoring and prediction?
    b. How can ESA help advance science in this field? (Suggestions for future missions, procurements, community consultations and other events like this to be run more frequently?)

2. Jakob Zscheischler:
    a. (supposedly) your presentation highlighted the importance of a multidisciplinary approach in improving our understanding and detection of compound and cascading extreme events. Could you elaborate on how different scientific disciplines can synergize within an AI framework to enhance predictive accuracy and reliability, and perhaps provide an example of how this has been successfully implemented in a real-world scenario?
    b. How can ESA help advance science in this field? …

3. Anca Anghelea:
    a. *What does ESA do to enable science initiatives? Future missions*

4:00-4:20PM: COFFEE BREAK

4:30PM: Session 2.05d: Poster Lightning talks and Open Discussion (optional): Setting priorities for a better understanding and assessment of Extremes and Multi-Hazards (Duration: 1h40)

(Focus: Ask community members to Identify and prioritize scientific requirements related to multi-hazards: how to enhance our understanding to better investigate multi-hazard using current and future EO. -> Focus is on Science)

Chairpersons: Karim Douch and Elody Fluck

Reporter: Katy Burrows

4:30PM-5:00PM: Poster Lightning Talks

1. SDGs-EYES: A Copernicus driven service for monitoring UN SDG indicators (Marco Mancini)
2. Earth Observation for high impact multi-hazards science (Carlos Domenech)
3. Towards a multi-hazard risk assessment of forest disturbances in Finland (Kristin Böttcher)
4. SAR4Wildfire: Sentinel-1 SAR Time Series for Near Real-Time Wildfire Monitoring with Deep Learning (Yifang Ban)
5. Evaluating climate trends of heat extremes using ESA-CCI Land Surface Temperature data: A Case-study of the 2010 Sahelian heatwave (Amina Maroini)

5:00PM-6:00PM: Open Discussion

1.Scientific Definitions: Should the scientific community with diverse backgrounds (geohazards, climate, hydrology ,etc..) agree on definitions of individual hazards (ex: heatwaves, droughts) depending on the context in which they are used? (ex: heatwave with impacts on agriculture ≠ meteorological heatwave)

2. Scientific knowledge gaps:

-From your perspective, could you list and prioritize the scientific knowledge gaps in Climate Adaptation, Extremes, and multi-hazards?

-Is an attribution of multi-hazards to climate change feasible? What could be the first steps?

-How can we facilitate the knowledge transfer from one discipline (ex: geohazards) to another (ex: meteorologists)?

3. Data/sets:

-Which existing data/sets should be preferably used by the science community to study multi-hazard and why?

-Which are the major limitations of these data/sets?

-Data accessibility/sharing: How can ESA facilitate the access to their data?

4. Methodologies & Tools:

- Which tools should be preferably used by the community in studying cross-disciplinary topics?

-What are the limitations of these tools?

-How can we make the community aware of these tools?

-How could we better predict the tipping point when a multi-hazard is about to become extreme?

-Which methods /tools could be used to quantify the total impacts resulting from compound and cascading events?

5. Scientific collaboration:

-How can we improve scientific collaboration and cross-disciplinary approaches in addressing the predominant gaps in EO for multi-hazards and compound events? Can you provide examples where such collaborations have led to breakthroughs in understanding and mitigating cascade events?

6. Science communication:

-How can cross-disciplinary communities better communicate with each other?

-Should ESA organize more workshops and conferences about multi-hazards?

7. Open Call Proposals:

-Which themes should be covered for future Call for Proposals about multi-hazards?

6:00pm: POSTER PLENARY + COCKTAILS (Big Hall)

DAY 3: Friday, 24th November 2023

9AM: Session 3.01d: Preparing Wrap up for the Climate adaptation – Extremes, multi-hazards and compound events theme.

Spokesperson: Carlos Domenech, GMV, Spain

Reporter: Elody Fluck

(Focus: Define the points for discussion during the wrap-up session, including among others the state-of-the-art science behind multi-hazards and a list of recommendations for future actions)

11AM: Wrap-up

11:00-11:30AM: COFFEE BREAK