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Deployment of scientific climate services for extreme events investigations

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Producing and providing useful information for climate services requires vast volumes of data to come together which requires technical standards. Especially in the case of extreme climate events, where scientific methods for appropriate assessments, detection or even attribution are facing high complexity for the data processing workflows, therefore the production of climate information services requires optimal technical systems to underpinn climate services with science. These climate resilience information systems like the Climate Data Store (CDS) of the Copernicus Climate Change Service (C3S) can be enhanced when scientific workflows for extreme event detection are optimized as information production service, accordingly deployed to be usable by extreme event experts to facilitate their work through a frontend. Deployment into federated data processing systems like CDS requires that scientific methods and their algorithms be wrapped up as technical services following standards of application programming interfaces (API) and, as good practice, even FAIR principles. FAIR principles means to be **Findable** within federated data distribution architectures, including public catalogues of well documented scientific analytical processes. Remote storage and computation resources should be operationally **Accessible** to all, including low bandwidth regions and closing digital gaps to 'Leave No One Behind'. including Data inputs, outputs, and processing API standards are the necessary conditions to ensure the system is **Interoperable**. And they should be built from **Reusable** building blocks that can be realized by modular architectures with swappable components, data provenance systems, and rich metadata.
Here we present challenges and preliminary prototypes for service which are based on OGC API standards for processing (https://ogcapi.ogc.org/processes/) open geospatial consortium (OGC). We are presenting blueprints on how AI-based scientific workflows can be ingested into climate resilience information systems to enhance climate services related to extreme weather and impact events. The importance of API standards will be pointed out to ensure reliable data processing in federated spatial data infrastructures. Examples will be taken from the EU H2020 Climate Intelligence (CLINT; https://climateintelligence.eu/) project, where extreme events components will be developed for C3S. Within this project, appropriate technical services will be developed as building blocks ready to deploy into digital data infrastructures like C3S but also European Science

Cloud, or the DIAS. This deployment flexibility results out of the standard compliance and FAIR principles. In particular, a service employing state-of-the-art deep learning based inpainting technology to reconstruct missing climate information of global temperature patterns will be developed. This OGC-standard based web processing service (WPS) will be used as a prototype and extended in the future to other climate variables. Developments focus on heatwaves and warm nights, extreme droughts, tropical cyclones and compound and concurrent events, including their impacts, whilst the concepts are targeting generalised opportunities to transfer any kind of scientific workflow to a technical service underpinning scientific climate service. The blueprints are taking into account how to chain the data processing from data search and fetch, event index definition and detection as well as identifying the drivers responsible for the intensity of the extreme event to construct storylines guiding to the event.