

If you are interested in working with large volume of satellite soil moisture data to extract relevant information for the public and decision makers to raise awareness of imminent drought and flood events, then consider applying to the Visiting Scientist Activity “**Soil moisture anomaly workflows**” to be funded by the **EUMETSAT H SAF Visiting Scientist Programme**.

**Research Fields:** Soil Moisture, Validation, Scientific computing and data processing

**Visiting Scientist Proposal Abstract:**

Weather-related disasters, such as floods and droughts, have increased in frequency and severity in the past decades. Soil moisture remote sensing provides valuable information to identify anomalies from normal conditions both in space and time. There is a benefit in using soil moisture for drought and flood monitoring as it integrates information on precipitation, temperature and evapotranspiration and has a memory. The EUMETSAT Satellite Application Facility on Support to Operational Hydrology and Water Management (H SAF) provides soil moisture product with a long data record, making them particularly suitable for monitoring extremes and anomalies.

Many methods exist to quantify anomalous soil moisture conditions, where most are based on deviations from the long-term mean. With anomaly based methods there are several challenges. First, one can calculate climate normals differently, using different statistics over different aggregated periods, i.e. decadal or multiple months. Second, different indicators exist, such as Z-scores and percentile approaches. Each method will result in different anomaly conditions and this is a problem for decision makers. The same soil moisture condition can be classified differently, e.g. severe drought or mild drought, depending on the used method. When using soil moisture in applications such as early action for food security, the used method can make the difference between food aid or not. Therefore, it is imperative to assess the different methods and quantify differences between them. Furthermore, there is a need for recommendations on how to calculate anomalies and which approach suits the application best. Also, these workflows should be made available open source making analysis of anomalies reproducible.

To address these challenges, we propose a 12 month visiting scientist activity to investigate state-of-the-art methods to compute soil moisture anomalies. Using these methods, multiple soil moisture anomaly maps using H SAF ASCAT soil moisture products will be created for different regions in the world with different climate, vegetation types and soil types. The anomalies and indicators will be validated against historic drought and flood events and existing methods for monitoring anomalies such as the Standardized Precipitation Index. Based on these analyses, recommendations on which anomaly metrics are best suited for highlighting drought and flood events will be made. Lastly, a workflow that produces soil moisture anomaly maps from H SAF soil moisture products will be developed and provided open source.

**General contacts:**

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**Host Institute:**

TU Wien, Department for Geodesy and Geoinformation  
Wiedner Hauptstrasse 8-10  
A-1040 Vienna, Austria

**Benefits and salary**

The financial contribution to a VSA will consist of, cost reimbursement on a per diem basis and travel cost reimbursement (for the time spent at the host institute in Vienna), as well as contribution to salary costs to the Visiting Scientist's home institute.

The total cost of the activity will depend by the work plan proposed by the attendee (see the Annex) and it can't exceed 15.000 Euros.

It is foreseen a total of 12.000 Euros as fixed costs and 3.052 Euros for visiting the Host Institute.

**Eligibility criteria**

- Master degree in Earth sciences, environmental sciences, information sciences, geodesy, geoinformation sciences, physics, or similar
- Experience in (microwave) remote sensing and derivation of geophysical parameters from remote sensing observations (e.g. soil moisture, water bodies, vegetation, snow and ice, ...)
- Excellent programming skills in Python
- Strong analytical and technical skills and problem-solving capability
- Good written and spoken communication skills in English

**Conditions of international mobility of researchers:** Researchers are required to undertake transnational mobility (i.e. travel to Austria and other countries) when taking up the appointment.

**Selection procedure**

Description of the motivation and expected objective of the proposal are described below

**Applications must include:**

- Application Letter
- CV
- copy of valid identity documents

Applications must be sent by email to:

H SAF Science Manager  
Dr. Giulia Panegrossi  
[g.panegrossi@isac.cnr.it](mailto:g.panegrossi@isac.cnr.it)

Application deadline is **30 April 2023** (or until the positions is filled).

**Annex: tasks, methods and deliverables**

**Task 1:** Implementation and assessment of state-of-the-art methods to compute soil moisture anomalies and climate normals

Literature review and inventory of existing anomaly calculation methods. Quantifying the variability in different anomaly calculation methods applied to H SAF soil moisture products for different climates and land cover types. Climate normal computation will be tested. Focus will be on inter-comparing extent, duration and amplitude of different climate normal and anomaly methods.

**Task 2:** Evaluation and validation of anomaly maps using historic drought and flood events

The anomaly maps and time series will be evaluated using historic drought and flood event information. For droughts, the anomalies will be compared to benchmark drought indicators such as SPI and European Drought Observatory and United States Drought Monitor. For floods, different events will be selected based on the flood types, particularly between flash floods and other inland flooding. Also recent known flood events in Germany (2021), Nigeria (2022) and Pakistan (2022) will be assessed.

***Task 3:*** Recommendations and workflow

Based on the literature review and analysis a recommendation will be made on the use of climate normal and anomaly methods for flood and drought applications. This will be summarized in a white paper or journal publication. Furthermore, software and workflows in the form of a Python package will be made available through GitHub.

***Deliverables***

- Interim report on the literature review and intercomparison of climate normal and anomaly calculations (T0+4month).
- Interim report on validation and evaluation of soil moisture anomalies with historic flood and drought data (T0+8month).
- Final report with recommendations regarding climate normal and anomaly calculations (T0+12month).
- Software and workflows on GitHub (T0+12month).