

Job Title: Internal Research Fellow (PostDoc) for Impact of smallsat constellations on weather prediction

Req ID 9125 - Posted 07/02/2020



EUROPEAN SPACE AGENCY

Research Fellowship Opportunity in the Directorate of Earth Observation Programmes.

ESA is an equal opportunity employer, committed to achieving diversity within the workforce and creating an inclusive working environment. Applications from women are encouraged.

Post

Internal Research Fellow (PostDoc) for Impact of smallsat constellations on weather prediction

This post is classified F2.

Location

ESTEC, Noordwijk, The Netherlands

Our team and mission

You will report to the Head of the Microwave Instruments Section, Future Missions & Instruments Division, Future Systems Department, Directorate of Earth Observation Programmes. You will work in close cooperation with science and engineering experts within the Directorate (Future Missions & Instruments and Earth & Mission Sciences Divisions), establishing links with meteorology experts at the European Centre for Medium Weather Forecasts (ECMWF) and Eumetsat. This represents an excellent opportunity to form a wide-ranging network of valuable experts.

These two Divisions deploy dynamic teams for conducting research and innovation activities, aimed at advancing EO capabilities and developing novel mission and instrument concepts in partnership with European and international industry and academia.

Earth observation satellites play a vital role in weather and climate forecasting. Currently, more than 90% of all observational data used in Numerical Weather Prediction comes from satellites. In support of NWP, ESA is now developing the MetOp Second Generation (MetOp-SG) programme which will cover the period 2021–2040. This consists of two different satellites. For each pair, identical recurrent models will be developed and launched roughly every seven years starting from 2021/22.

The development cycles of large-scale programmes contrast with the new generations of small satellites. These satellites, e.g. CubeSats, are cheap and fast to deploy using a riskier development and verification strategy. Their low cost allows not only early demonstration of new concepts but offers also the possibility of affordable satellite constellations with high temporal resolution.

The performance and functionality of satellites is improving with every generation, but their individual performance still falls short compared to that of larger traditional satellites, be it in terms of instrument capabilities, spatial resolution, stability, accuracy and/or other aspects. However, with constellations, the temporal resolution is greatly improved. To assess the potential for synergistic data exploitation from combining the different observing systems, it is becoming increasingly important to understand the interaction between instrument performance parameters, spatial and temporal measurement characteristics and the geophysical product with its associated uncertainty.

Field(s) of activities/research

The objective of this research placement is to assist the Agency in evaluating the impact small satellites with microwave sounding measurement capabilities can have on Earth observation and NWP. A tool will be developed to support the definition and design of realistic satellite observing systems and the corresponding test data sets that can be used to feed a NWP model. This entails linking mission, satellite platform and instrument characteristics of small satellite constellations with data product specifications such as radiometric accuracy, spatial and temporal coverage and resolution. The test data will be used as input to the NWP forecasting system at ECMWF with measurements from existing and planned operational

satellite systems. By analysing the forecast impact of several observing systems, the optimal configuration will be established. The focus will be on passive microwave imagers and sounders.

In parallel, a study financed by ESA will be carried out with ECMWF guaranteeing the necessary support and availability of required resources.

Main Tasks

1. Consolidation of user requirements

Based on various information sources (e.g. OSCAR database, NWP community including Eumetsat), user requirements at level 2 will be consolidated. From these, a translation to level 1 requirements will be made, defining sets of promising instrument and constellation architectures to be investigated in more detail. An "instrument data base" will be generated to link instrument performance with sizing parameters.

2. Tool development

You will collaborate with ECMWF and develop a tool that can generate the input to the NWP simulations. It will be used to generate 10-15 consistent observation system scenarios in a format that allows these systems to be processed by the ECMWF simulator.

3. Small satellite constellation trade-off

Together with ECMWF, an assessment of the 10-15 observation systems will be performed. The 3 to 5 promising scenarios will be down-selected for more extensive NWP impact assessments using the ECMWF forecasting system.

4. Impact assessment

With the support of ECMWF, you will evaluate the impact of the 3 to 5 observation scenarios. A final set of conclusions on the most suitable constellation(s) and recommendations on instrument design parameters will be made jointly.

You will, in this context, conduct research in the following domains:

- Remote sensing with passive microwave payloads
- Microwave technologies
- Small satellite technologies
- Orbit constellations
- Instrument modeling and end-to-end simulations
- Novel calibration methods (internal and cross-calibration with other systems)
- Retrieval methods and forward modeling
- Data reprocessing
- Data assimilation
- Numerical weather prediction, in particular ECMWFs Integrated Forecasting System
- Advanced data processing

Technical competencies

Knowledge relevant to the field of research

Research/publication record

Ability to conduct research autonomously

Breadth of exposure coming from past and/or current research/activities

General interest in space and space research

Ability to gather and share relevant information

Behavioural competencies

Innovation & Creativity

Continuous Learning

Communication

Relationship Management

Self Motivation

Problem Solving

Cross-Cultural Sensitivity

Education

Applicants should have recently completed, or be close to completion of a PhD in a related technical or scientific discipline. Preference will be given to applications submitted by candidates within five years of receiving their PhD. In particular for this position, the following is required:

PhD or equivalent qualification in physics, engineering or earth science.

Additional requirements

Knowledge and experience in microwave remote sensing and climate modeling would be an asset.

The working languages of the Agency are English and French. A good knowledge of one of these is required. Knowledge of another Member State language would be an asset.

Other information

For behavioural competencies expected from ESA staff in general, please refer to the [ESA Competency Framework](#).

The Agency may require applicants to undergo selection tests.

The closing date for applications is 28 February 2020.

In addition to your CV and your motivation letter, please add your proposal of no more than 5 pages outlining your proposed research in the "additional documents" field of the "application information" section.

If you require support with your application due to a disability, please email contact.human.resources@esa.int.

Please note that applications are only considered from nationals of one of the following States: Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Spain, Sweden, Switzerland, and the United Kingdom. Nationals from Slovenia, as an Associate Member, or Canada as a Cooperating State, can apply as well as those from Bulgaria, Cyprus, Latvia, Lithuania and Slovakia as European Cooperating States (ECS).

Priority will first be given to candidates from under-represented Member States.

In accordance with the European Space Agency's security procedures and as part of the selection process, successful candidates will be required to undergo basic screening before appointment