

CIVIL AND ENVIRONMENTAL ENGINEERING

MUR DM 118 - EarthCARE Doppler radar products: from validation to process studies

Funded By	DIATI - Progetti MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [Piva/CF:97429780584]
Supervisor	BATTAGLIA ALESSANDRO - alessandro.battaglia@polito.it
Contact	
Context of the research activity	<p>Cloud and precipitation play a crucial role in modulating the Earth's radiation budget and the Earth's water cycle. In 2024 the European Space agency will launch EarthCARE with the goal of better understanding the impact that cloud and aerosol have on climate change. The PhD student will contribute to the calibration of the sensor and the validation of the products derived from the measurements of one of the key mission instrument, the 94 GHz first of its kind Doppler radar.</p> <p>Progetto finanziato nell'ambito del PNRR – DM 118/2023 - CUP E14D23001700006</p>
Objectives	<p>The ESA-JAXA EarthCARE (Cloud, Aerosol and Radiation Explorer, https://earth.esa.int/eogateway/missions/earthcare) mission - expected to be launched in 2024 - is a cutting-edge Earth Explorer mission aimed at advancing our understanding of the role that clouds and aerosols play in the Earth's radiation budget and energy cycle. One of the core instruments of the mission is a ground-breaking 94 GHz Doppler radar with unprecedented sensitivity, which will enable new science cloud studies. Products and retrieval algorithms have been developed in the preparation for the mission (Kollias et al., 2023, Mroz et al., 2023). The goal of the PhD is twofold.</p> <ul style="list-style-type: none">• In the first phase, immediately after launch, to test and validate the mission radar-based products by using data from the CALVAL program;• In a second phase (year 2-3) to exploit the EarthCARE observations to specifically address two science topics:<ol style="list-style-type: none">1) characterize ice clouds (sedimentation velocity, MC, dimension of ice crystals), particularly in anvils associated to deep convective;2) profile microphysical properties of light precipitation and snow. <p>The project will contribute to validate Numerical Weather Prediction (NWP) and Global Circulation Models (GCM), thus strengthening predictive capability of climate change effects which represent one of the key objective of the National Recovery Plan of Italy (PNRR), Mission 2 – Component 4.</p>

The PhD student will be hosted at Politecnico di Torino in the Department of Environment, Land and Infrastructure Engineering with the Cloud and precipitation microwave remote sensing group led by Prof. Battaglia, who is part of the EarthCARE Mission Advisory Group and of the Level 2 Doppler radar algorithm developers. The project will be carried out in strict cooperating with ESA EarthCARE scientists and with international researchers (specifically from McGill and Stony Brook University and ECMWF).

Kollias et al.; Processing reflectivity and Doppler velocity from EarthCARE's cloud profiling radar: the C-FMR, C-CD and C-APC products, EGU sphere [preprint], <https://doi.org/10.5194/egusphere-2022-1284>, 2022

Mroz et al.: Cloud and Precipitation Microphysical Retrievals from the EarthCARE Cloud Profiling Radar: the C-CLD product, EGU sphere [preprint], <https://doi.org/10.5194/egusphere-2023-56>, 2023

Skills and competencies for the development of the activity

The student will be trained in a wide range of topics including radar meteorology and cloud and precipitation remote sensing. Applicants should have a science or engineering degree. Knowledge of radar meteorology, Doppler systems, signal processing, cloud physics and meteorology, inversion theory, would be beneficial.

Programming skills in matlab (Simulink)/Python/C/Java/C++ and knowledge of signal propagation and numerical modelling could also be advantageous. Excellent knowledge of English is required.