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Innovative, green, floating radiosondes to track small-scale fluctuations along isopycnic surfaces in and around warm clouds.

Tessa Basso (1), Silvano Bertoldo (2), Giovanni Perona (3), Giovanni Perotto (4), Athanassia Athanassiou (4), and Daniela Tordella (1)

(1) Politecnico di Torino, Department of Applied Science and Technology, Italy (tessa.basso@polito.it), (2) Envisens Technologies s.r.l., Italy, (3) Dipartimento di Elettronica e Telecomunicazioni (DET), Politecnico di Torino, Italy, (4) Smart Materials, Istituto Italiano di Tecnologia (IIT), Genova, Italy

Warm clouds have a cloud top that doesn't contain any ice forms and are found to be responsible for 31% of the world's rainfall. Hence, innovative, green, ultralight radiosondes are being conceived within the context of the H2020 MSCA ITN ClOud-MicroPhysics-turbuLEnce-Telemetry (COMPLETE) network, which aims to characterise the cloud boundary, and develop the current understanding of cloud physics and related turbulent dynamics. The sondes are designed to float on an isopycnic level inside and outside the cloud boundary and track small-scale fluctuations in properties such as velocity, acceleration, vorticity, temperature, pressure and humidity for a duration of several hours. The probes will have various configurations and sensors depending on the task they must perform whilst floating at a chosen altitude between 1000 – 3000 m. They contain transmitters that send advanced statistical and spectral data to receivers on Earth which will be analysed and used to improve the prevailing numerical simulations and models. Preliminary testing of the response time on the determination of an oscillating trajectory of non-uniform amplitude and direction are performed in the laboratory.
The biodegradable materials, of which the probes will be made, are currently being developed in collaboration with the Italian Institute of Technology (IIT). The simplest versions of the environmentally friendly, expendable and hydrophobic balloons have a target weight of 20 g in total, allowing them to provide insight into the life-cycle of a cloud and its environment on a smaller scale than the existing smart weather balloons and drop sondes. These in-situ observations, together with laboratory experiments and simulations aim to characterise the direct interactions between cloud dynamics, thermodynamics and microphysics to contribute to the fragmented knowledge of climate modelling and weather prediction.