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

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Aim
- ITN ClOud-MicroPhysics-turbuLEnCE-TElemetry (COMPLETE) network [1]

Why study clouds?
- Uncertainty in weather prediction and climate modelling.
- Consequences of turbulence and its spatial distribution on cloud properties unknown [8].
- Graph shows scarcity of high frequency measurements and simulations.
- Current measurement techniques and limitations:
  - NOAA and NCAR smart balloons: heavy and large.
  - High-performance satellites: measure above 16-18 km [7].
  - Dropsondes: limited lifetime.

Design Principles
- Lightweight (20g)
- Hydrophobic
- Impermeable to gas and water
- Low cost
- Biodegradable

Starting with metallized balloons
- Based on Mylar balloons
- Properties
  - Metallized BO-PT
  - Inexpensive and light
  - Understanding the balloon making process
  - Testing for:
    - Helium permeability
    - Mechanical strength
    - Thermal stability
  - Good gas and water barrier properties
  - Resistant to tear and wear
  - Attenuation
  - Hydrophobicity

Improving on metallized balloons
- An attenuation of 6-10 dB can reduce communication by a few km depending on working frequency.
- Metals are hydrophilic.

- Replace components with biodegradable materials.
- Red beetroot (left) and red beetroot with starch (right) bio-elastomers [9].

Future developments
The first prototype will be calibrated at the National Institute of Meteorological Research (INRIM) Measurement campaign on UFS where probes are released by manned and unmanned aerial vehicles

After the first measurement campaign, optimization of the sensors as well as the materials will be undertaken.

References

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