MS projects related to AWACA proposed at LTE for Spring 2026

The ERC Synergy funded project AWACA aims to understand the Atmospheric branch of the Water Cycle over Antarctica (https://awaca.ipsl.fr/). It relies on innovative observations of the tropospheric meteorological conditions and the isotopic composition of water vapor and hydrometeors along a 1100 km transect between Dumont d'Urville station (DDU) at the coast and Concordia station on the high inner Antarctic plateau. Various instruments have been deployed along this transect, and the projects below are related to the processing and/or analysis of the collected data.

Note that some of the proposed projects could be adapted into semester projects.

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1) Radar positioning using sunscans

StXPol is a new scanning precipitation radar which has been installed at Dumont d'Urville station (DDU) on the Antarctic coast as part of AWACA.

Knowledge of the absolute orientation of the radar is important for the accurate location of the measurement volumes within the atmosphere, especially for comparison to other instruments or to model data. One technique to assess the orientation of the radar is to use the position of the sun as viewed from the radar.

Open source software for sunscan analysis has been published by Paul Ockenfuss and Gregor Köcher (https://github.com/Ockenfuss/sunscanpy). The project would involve implementing the software on the data from StXPol to asses the accuracy and stability of the radar orientation.

2) AWACA: statistics from the first year at Dumont d'Urville

At DDU, three meteorological radars have been installed to investigate clouds and precipitation: StXPol (9.4 GHz), MRR (24 GHz) and WProf (94 Ghz).

Depending on the interests of the candidate, the project will include a subset of the following tasks:

- Identifying periods of data availability for the three instruments over the year.
- Detection and logging of cloud and precipitation events in the radar data.
- Statistical analysis of cloud and precipitation properties such as cloud base height, number of cloud layers or maximum reflectivity values and their seasonal variation.

3) Radar Calibration at Dumont d'Urville

At DDU, three meteorological radars have been installed to investigate clouds and precipitation: StXPol (9.4 GHz), MRR (24 GHz) and Wprof (94 Ghz).

Having multiple radars at different frequencies at each site allows for multi-frequency analysis of clouds and snow, allowing us to distinguish particle sizes and microphysical processes such as riming and aggregation (eg. Billault-Roux et al., 2023). However, such a multifrequency analysis relies on the radars being well-calibrated.

This project will apply the algorithm developed by Jorquera et al (2023) to the three radars at DDU, in order to track the inter-calibration of the three radars over time. Once the inter-calibration has been completed, microphysical case studies can be conducted using the multifreqency information.

4) Radar Calibration on the AWACA transect

At four locations along the transect, temporary container-stations were deployed. Each container includes three radars: a Metek MIRA 35 GHz cloud radar, an MRR-PRO (24 GHz) and a BASTA 95 GHz cloud radar.

Having multiple radars at different frequencies at each site allows for multi-frequency analysis of clouds and snow, allowing us to distinguish particle sizes and microphysical processes such as riming and aggregation (eg. Billault-Roux et al., 2023). However, such a multifrequency analysis relies on the radars being well-calibrated.

This project will apply the algorithm developed by Jorquera et al (2023) to the three radars at the four sites. Once the inter-calibration has been completed, microphysical case studies can be conducted using the multifreqency information.

5) StXPol Processing

StXPol (Solid State X-band Polarising radar) is a new scanning precipitation radar which has been installed at Dumont d'Urville station (DDU) on the Antarctic coast as part of the AWACA project. Since this is a new instrument, we are interested in evaluating the data processing routines provided by the manufacturer and possibly creating our own processing routines.

Depending on the interests of the candidate, the project will include a subset of the following tasks:

- Using a case study analysis to compare radar moments as calculated by the manufacture's proprietary algorithms and as 'recalculated' from the raw data.
- Developing python software to process the raw radar data, optimised for the processing of TB of data.
- Conducting meteorological case studies, using the processed radar data to investigate properties of precipitation on the Antarctic coast.