Internship description for ALC hydrometeor project

The following sections must be filled according to the webpage for publishing internships and master thesis at EPFL.

Type:

Master project in company = PDME

Length:

25 weeks

Internship title:

Near-real time detection and flagging of hydrometeors measured by ceilometer.

Description and objectives:

Within the EUMETNET E-Profile cloud and aerosol profiling network (https://e-profile.eu), we process data from over 450 automatic lidars and ceilometers (ALCs) in Europe. The data are used to improve the representation of aerosols in numerical weather prediction (NWP) models, for instance at the European Centre for Medium-Range Weather Forecasts (Kahnert et al., in discussion in GMD). An important condition to exploit aerosol information from ALCs in NWP models is the identification and flagging of data affected by hydrometeors (clouds and precipitation) in real-time.

Machine Learning algorithms, both supervised and unsupervised, yield promising results when trained to identify hydrometeors from a time series of backscatter profiles, typically as long as 24 hours. This is, however, not suited for real-time applications, because such a long time series might not be available in an operational workflow, or it is computationally too costly.

In this PDME, we want to explore new ML architectures to develop an algorithm that can identify hydrometeors using a single profile instead of a time series of profiles.

Description of the tasks:

- Create a reference data set with ALC profiles and associated hydrometeor flags.
- Design and test various ML architectures working on a profile-by-profile basis to reproduce the reference data.
- Evaluate the results based on metrics common for the ML domain.

- Discuss the question of whether a single profile contains enough information for data affected by hydrometeors to be identified and give recommendations for future research.

Required skills:

The candidate should have an interest in meteorological data processing and a background in ML techniques. Good coding skills in Python are required, and experience working in a Linux environment is a plus.

Remark:

The PDME takes place at MeteoSwiss at the Aerogical Station of Payerne and includes international collaboration. If possible, the candidate can present the work at an international workshop or conference.

Related master:

Recommended master programs:

- Environmental Sciences & Engineering
- Computational science and engineering (Modeling, Algorithms, and HPC)
- Computer Science
- Data science

Contact:

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