

INTERNSHIP OFFER

Across scales comparison of rainfall measurements from an OTT Parsivel² disdrometer and a Micro Rain Radar (MRR-PRO)

Host Laboratory	CEREA — Centre d'Enseignement et de Recherche en Environnement
Location	Atmosphérique ENPC 6 et 8 avenue Blaise-Pascal - Cité Descartes - Champs-sur-Marne - 77455 Marne-la-Vallée cedex 2
Duration	5 to 6 months
Preferred period	Ideally 03/2027
Level / Educational background	M2 (MSc) or Engineering School
Supervisor(s)	Emna Chikhaoui (emna.chikhaoui@enpc.fr) Auguste Gires (auguste.gires@enpc.fr)
Application deadline	01/12/2026

Scientific context

Rainfall exhibits extreme variability across a wide range of scales in space and time. Characterizing this variability helps to understand rainfall microphysics and improve its estimations. Numerous instruments provide rainfall observations like disdrometers and micro rain radars (MRR). A disdrometer measures raindrop size (DSD) and velocity distributions near the ground, while the MRR retrieves vertical profiles of DSD and related parameters using Doppler effect. Differences in their measurement principles, sampling volumes and temporal resolutions can lead to discrepancies between their estimates.

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Objectives

The aim of the internship is to compare rainfall observations from an optical disdrometer OTT Parsivel² (temporal resolution: 30 s) and a MRR-PRO (temporal resolution: 10 s) across temporal scales, with a focus on the scaling behaviour of the measurements using the Universal Multifractals (UM) framework. Both instruments are installed on the ENPC campus. Comparison will be carried out on almost two years of available data. Temperature and wind measurements are also available on site.

Tasks

The analysis will begin by selecting rainfall events. Then, the instruments outputs such as rain rate and DSD features will be compared using standard scores (correlation, bias, RMSE...) at various observation scales. In a second step, an analysis of variability across scales using UM tools (see Schertzer and Lovejoy (1987) for theoretical background and Seppe Silva et al. (2025) for a recent application to measurement device comparison) will be carried to obtain robust results from second to event scale.

The results will help identify the temporal scales at which the two instruments provide consistent rainfall estimates and the meteorological conditions under which their measurements diverge, for example

depending on rainfall or wind intensity or stratiform or convective rainfall events. This study will contribute to a better understanding of instrumental uncertainties and to the development of more reliable strategies for combining disdrometer and MRR observations.

Wanted background

- Currently in M2 (or MSc) or last year of engineering school in environmental science or physics
- Some basic knowledge in Python

References

1. Adirosi, E.; Baldini, L. and Tokay, A. Rainfall and DSD Parameters Comparison between Micro Rain Radar, Two-Dimensional Video and Parsivel(2) Disdrometers, and S-Band Dual-Polarization Radar. *Journal of Atmospheric and Oceanic Technology*, American Meteorological Society, 2020, 37, 621-640.
2. Gires, A.; Tchiguirinskaia, I. and Schertzer, D. Multifractal comparison of the outputs of two optical disdrometers. *Hydrological Sciences Journal*, Taylor & Francis, 2016, 61(9), 1641-1651.
3. Seppe Silva, M.; Vieira Casanova Monteiro, R.; Jose, J.; Gires, A.; Paz, I.; Tchiguirinskaia, I. and Schertzer, D. Multifractal comparison of rainfall measurement with the help of a disdrometer and a mini vertically pointing Doppler radar. *Hydrological Sciences Journal*, Taylor & Francis, 2025, 70(7), 1072-1090.
4. Schertzer, D. and Lovejoy, S. Physical modeling and analysis of rain and clouds by anisotropic scaling multiplicative processes. *Journal of Geophysical Research: Atmospheres*, American Geophysical Union, 1987, 92(D8), 9693-9714.