# Proposition de Sujet de thèse 2018

*(1 page recto maximum)*

Laboratoire (et n° de l'unité) dans lequel se déroulera la thèse :
CNRM - UMR 3589

**Titre** du sujet proposé : **Use of dual-polarization radar observations for very-short-term numerical weather prediction**

**Nom et statut** (PR, DR, MCf, CR, …) du *(des)* responsable*(s)* de thèse (préciser si HDR) :
Olivier Caumont, chercheur HDR (CNRM)
Clotilde Augros, ingénieur/chercheuse Météo-France (DSO/CMR)

Coordonnées (téléphone et e-mail) du (des) responsable(s) de thèse :
05 61 07 96 46 / olivier.caumont@meteo.fr
05 61 07 95 25 / clotilde.augros@meteo.fr

Résumé du sujet de la thèse

In the last years, significant efforts have been devoted world-wide to upgrade operational weather radar networks with a new technology called 'dual polarization'. Besides measuring the intensity and the displacement of precipitation, dual-polarization radars provide additional information about the characteristics of water and ice particles (hydrometeors) within the observed volume. In particular, it has been shown that specific signatures could be observed in distinctive parts of severe thunderstorms (e.g., KDP columns and ZDR arcs and columns).

Concurrently, a new generation of numerical weather prediction (NWP) models with kilometre-scale horizontal resolutions and advanced representations of microphysics is making it possible to represent atmospheric processes at the convective scale with improved realism.

The joint use of dual-polarization radars and high-resolution NWP models opens a new area of investigation with potential breakthroughs in terms of knowledge of the microphysics and dynamics of thunderstorms, as well as improvements in the nowcasting and short-term prediction of these hazardous weather systems. Indeed, the simulation of realistic radar observations might shed light on the unobserved processes that drive the evolution of thunderstorms. Besides, such simulations could be useful to create diagnostics of severe convection for nowcasting applications or to assimilate dual-polarization radar observations in NWP systems.

The goal of the proposed PhD thesis is to leverage the concurrent availability of operational dual-polarization data and of state-of-the-art numerical modelling tools to improve the knowledge and very-short-term prediction of thunderstorms. More specifically, the following scientific questions will be addressed: Are the latest numerical models and their microphysical schemes able to reproduce dual-polarization signatures observed in thunderstorms? Can these models help understand the underlying microphysical and dynamical processes responsible for these signatures? To which extent are these signatures related to the severity of thunderstorms? How can dual-polarization signatures help improve the nowcasting and short-term prediction of severe thunderstorms?

To answer these questions, dual-polarization radar observations from the French weather service will be analysed for severe convection cases. The dual-polarization signatures of thunderstorms will be characterized for each stage of their life cycles and related to their severity. For the same cases, convective-scale numerical simulations will be compared with dual-polarization observations. The ability of the numerical model and its radar simulator to represent dual-polarization signatures will be assessed. This should help identify deficiencies in the model (and more specifically its microphysical scheme) or in the radar simulator and suggest paths of improvements. The suggested changes in the microphysical scheme and the radar simulator will be implemented and evaluated via sensitivity studies.