

PhD Thesis

Estimation of dynamics from image assimilation

Application to: Rain nowcasting from ground radar images

Location: Inria, Center of Paris

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Context and Objectives

Rainy events are often not accurately forecasted by meteorological models. This is due to a weak description of rain and clouds and to the spatial resolution of the models, which does not allow accurately assessing the small scale processes. A strong collaboration for research and software development has been initiated between Inria and the SME Weather Measures¹ for the definition of local meteorology forecast tools. The end-users are farmers, which require a forecast at a temporal horizon of 4 hours and at the sub-parcel scale. These 4 hours allow to better plan and optimize the irrigation and use of fertilizers for instance.

A number of research subjects were jointly defined by Inria and Weather Measures, which are the core subject of the PhD, on the issue of rain nowcast from a local network of ground-radars. A sequence of three rain rates images is displayed on Figure 1, which was acquired by one radar operated by Weather Measures in the region of Clermont-Ferrand. These acquisitions are the input data, which are required for estimating the wind field and forecasting the future rain quantities.

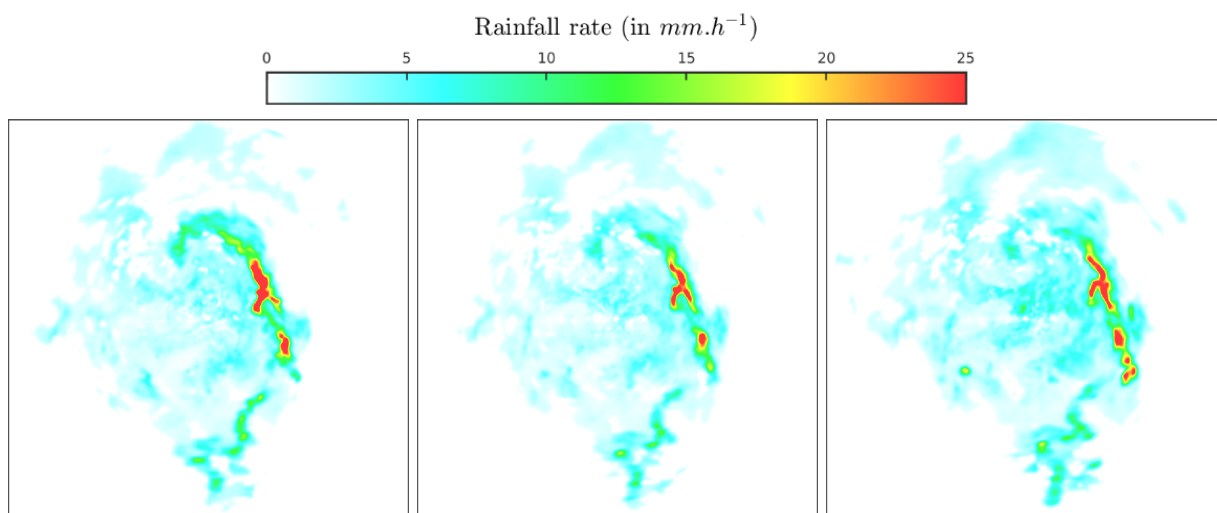


Figure 1: Three consecutive images, used as input for computing future rain quantities.

¹www.weather-measures.fr

Scientific Content

The research work on the nowcasting system includes two main parts.

First, the atmospheric dynamics is estimated from data acquired by the network of ground-radars monitoring the studied site. Experiments are currently conducted in the region of Clermont-Ferrand and one in the Beauce. The estimation method is based on data assimilation of the images with a numerical model describing the local advection, convection and diffusion processes. The work will concern the design of advanced data assimilation techniques, which permit the fusion with the low resolution images of the ARAMIS network, operated by Météo-France, and pointwise pluviometers measures.

Second, the short term forecast will be investigated. It needs accurate numerical schemes for synthetizing the future rain quantity frames and on HPC tools for producing near real time results.

As the research includes knowledge on the physical processes, on software development and on HPC technics, support will be available from radar specialists and computer scientists of Weather Measures and from researchers of Maison de la Simulation in Saclay².

Institutional Context

Inria is the French national institute for research in computer science and control, which is operating under the dual authority of the Ministry of Research and the Ministry of Industry. Inria is dedicated to fundamental and applied research in information and communication science and technology. The institute also plays a major role in technology transfer by fostering training through research, diffusion of scientific and technical information, development, as well as providing expert advice and participating in international programs.

The student will be hosted in the project-team Clime³, which is located in the Paris research center of Inria.

The working environment will provide scientific and technical support and also training for PhD students.

The doctoral school is DS386, Mathematical Sciences, Paris-Centre.

Further Information

Research field: applied mathematics in numerical modeling

Starting in: October 2016 (this can be adjusted)

Duration: 3 years (which is the normal duration in France)

Location: INRIA Paris, close to Gare de Lyon , in the project-team Clime. See (<http://www.inria.fr/centre/paris> for more information on the research center and its opportunities and <http://www.inria.fr/en/centre/paris/overview/how-to-reach-us> for visiting us.

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²<http://www.maisondelasimulation.fr/>

³<http://www-rocq.inria.fr/clime/index.en.html>