Autrans thematic discussions

Three thematic discussions will be held during the Autrans workshop. They are aimed at summarizing the main outcomes of the Grenoble conference and at defining the most promising research lines for the radar hydrology community.

For each theme, three conveners are in charge of the preparation, animation and for making a summary of the discussions. The topics of the thematic discussions are described below.

A “Call for Contributions” is opened to all the workshop participants. In order to facilitate the conveners’ task, the following address:

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should be used to submit prior to the symposium any suggestion, expression of interest, result, (provocative) statement for one or several thematic discussions. Note that during the discussions, such contributions may take the form of very short oral presentations, typically with a single slide.

Theme 1: The most promising techniques for radar rainfall estimation

Conveners: Frederic Fabry (McGill University), Pierre Tabary (Météo-France), Remko Uijlenhoet (Wageningen University)

Operational weather radar networks are developing with increased density and spatial coverage, sophisticated maintenance and observation strategies. Besides reflectivity and Doppler velocity, polarimetric capability is becoming widely implemented in such networks. A growing interest is also noticeable for X-band polarimetric radars which may be a solid alternative to S-band and C-band radar systems for operation in mountainous and urban environments. With the explosion of mobile phone communication systems, rainfall measurement with microwave links becomes potentially feasible over large-scale continental regions. Research vertically pointing radars and ground-based raindrop spectrometers allow better understanding of the critical links between the radar measurables and the bulk variables of interest in hydrology (rainrate, erosive power…). Although this is not focused on in this symposium, rainfall satellite estimation has made impressive progress in recent years especially with TRMM and GPM. In spite of all such high-tech advents, raingauge networks are still the reference and favourite measurement system for many hydrologists.

Several technical and scientific questions can be formulated about the most promising techniques for rainfall estimation:
Is there one best rainfall measurement system: radar *versus* raingauge networks? X-band, C-band, S-band? Microwave links *versus* radar networks?
How to develop synergetic use of such devices accounting for their respective space-time sampling properties?
What is the added value of polarimetry in terms of quantitative precipitation estimation?
How to check radar signal stability, implement space-time adaptive processing algorithms and perform multi-sensor data merging for real-time applications?
Are there specific solutions for rainfall estimation in mountains, coastal regions, urban environnements?

Theme 2: Rainfall re-analyses for hydrological sciences

Conveners: Alexis Berne (EPFL), Guy Delrieu (LTHE), Eiichi Nakakita (DPRI)

Real-time rainfall detection and nowcasting was one of the main motivation for the deployment of weather radar networks. Maybe, radar hydrologists have underestimated the difficulty to make accurate real-time rainfall precipitation estimates owing to the complexity of weather radar systems and the associated processing algorithms. Research and operational efforts are however starting about the much simpler problem of using archived radar data to generate long-term rainfall space-time series. Three sets of practical and scientific questions may be listed about such rainfall re-analyses:

Like for meteorological re-analyses, a first problem is related to the data availability and to the strong evolution of the observation systems in time. Generally, raingauge networks date back to the 1950's, radar digital archives begin in the 1980's and satellite rainfall archives in 2000. There is a positive evolution of radar networks in terms of data availability and quality; such a statement may not hold for raingauge networks. Gathering such datasets and performing their critical analysis are very demanding tasks.

The next questions are related to the way such re-analyses may be established. The methodology should combine radar physics and statistical approaches to take the best benefit of the radar high space-time resolution on one hand and of raingauge data accuracy for large accumulation time steps on the other hand. Uncertainty assessment and establishment of error models (statistical distribution and space-time structure of the errors) deserve special consideration.

Many engineering and scientific topics could benefit from such re-analyses: establishment of multi-scale water budgets, assessment of meteorological models, distributed forcing of hydrological models, hydrological ensemble prediction, space-time "design rainfall", analysis of extremes, climatic trend detection…

Theme 3: Challenges in distributed hydrological modelling

Conveners: Isabelle Braud (Cemagref), Eric Gaume (LCPC), Daniel Sempere Torres (GRAHI/UPC)

Due to the growing environmental concerns and climate changes issues, the demand with respect to hydrological modelling has moved from localized flow prediction (e.g., flood prediction at gauged points, dam regulation) to a more integrated description of the water balance components at every point within a catchment. In addition, consideration of land-use and human-induced landscape modifications is now a major concern for quantitative and qualitative water management problems such as flood forecasting, pollutant and sediment transport. These are two strong motivations for developing distributed hydrological models. In addition, distributed geomorphological information (digital terrain elevation, pedology, geology, land-use maps) becomes widely available, allowing improved representation of the land-surface heterogeneities and water pathways.

However many questions are still open regarding the representation of hydrological processes, their characteristics scales and the way they are accounted for in models, over-parameterization problems, parameter estimation, data assimilation, validation limitations…
Within this symposium, special consideration will be given to the impact of an improved description of the space-time variability of rainfall on the prediction of the hydrologic response over a range of scales.
Another focus could be on the way distributed hydrological models should be used to help defining the observation strategies and experiments (e.g. AMMA, HyMeX…) designed to progress in hydrological process understanding and modelling.