The application of radar-based rainfall observations and forecast in Early Warning Systems and Flood Forecasting. (Compulsory, 3 ECTS)

Coordinator

Prof. Daniel Sempere Torres

Aims

Flood risk management and decision making is highly dependent on rainfall forecast and the use of meteorological radar has become a useful tool in rainfall forecast. The research and methodologies regarding the application of radar measurements to hydrologic forecast has been improved in the last decades and operative early warning systems are taking advantage of high spatial and temporal resolution radar-based rainfields.

Description

The course introduces to the principles of quantitative precipitation estimates (QPE) using the radar data: procedures, chain correction of errors and Z-R application in order to assess the rainfall estimation. Hydrological application of radar QPE is included in the course, as well as the description and examples of Quantitative Precipitation Forecast (QPF) based on radar rainfields. Case studies in the catalonian region will be presented. The application of rainfall forecast in operational early warning systems will be introduced, both in the catalonian region (EHIMI) and the European domain (EFAS, European Flood Alert Systems). Finally, students can visit different hydrometeorological agencies as ACA (Catalan Water Agency) the SMC (Catalan Weather Service) and CECAT (Catalonian Emergency Center), as well as the Consell Comarcal del Maresme (Regional counsel of the Maresme region), which assess the different municipalities in rain forecast.

Teaching staff: UPC staff

Teaching and Learning Methods: Motivation talks with emphasis on the radar data processing in order to highlight the necessity of an accurate correction of intrinsic measurement errors (beam blocking, ground clutters, attenuation…). Also, the methods for the interpolation of rainfall at the ground from the radar data volume will be described. In general, limitations of radar QPE will be exposed, as well as the advantages in the hydrological application, particularly in Flash Floods at medium-small basins. Some examples and case studies to illustrate the application to hydrological forecast will be presented, as well as the description of the current software and tools for the flood risk management. Demos and didactic interactive software (student-oriented) will be used in the practical session.

Assessment: Conventional exam and/or a case study, to be chosen by the student or group of students with the agreement of the supervisor (maximum 3), to be resolved with an approximate extension of 15 pages corresponding to a workload of approximately 10 hours.

Course structure

- Conventional class activities
- Optional seminars
- Personal course work will consist in a selection, review and final report of a selected research paper regarding radar topic and application in hydrologic problems. The student may read, understand and redact a summary-report on the topic. Finally, the student will present the paper and the report in public. The amount of hours will depend on followed seminars.

The estimated number of self work hours for this course goes between 80 and 100, depending on the student conditions.

Course Content

The application of radar-based rainfall observations and forecast in Early Warning Systems and Flood Forecasting.

- Principles of quantitative precipitation estimates (QPE) using radar data. Associated errors and correction methods.
- Hydrological applications of radar QPE. Derived products for water management. Short term Quantitative Precipitation Forecast (QPF) based on radar data. Applications in real time and historical series reanalysis.
- Processes and elements of a hydrological forecasting system based on QPE and QPF.
- Simplified Early warning systems based on radar QPE and QPF. The European Flood Alert System (EFAS): A case study.
- Fieldtrips, visit to hydrometeorlogical and civil protection agencies (SMC, Consell Comarcal Maresme, ACA, CECAT)