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Flood Analysis using SAR imagery :uncertainties and enhancement of mapping using data fusion between images and high resolution Digital Elevation Model

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Spatial characterization is a recurrent question in flood risk management. However, spatial characteristics of a flood hazard are not easily gaugeable directly in the field with current tools. Techniques based on remote sensing imagery, especially on satellite imagery, could be very useful to complete gauging, calculate extend and volume of floods. Radar sensors, with their exclusive cloud penetration capacity, appear to be of great interest in flood events monitoring.

The general aim of our work is to use RADAR images for flood monitoring, and develop way to calculate spatial characteristics in order to help hydraulic modelling. Therefore, we have chosen a three stages approach. The first stage aims to extract flooded area from RADAR images, the second one to enhance quality of inundated area calculation and determine waterline elevation, and the last one to use spatial information calculated for flood modelling.

Here, we just present the result for the two first parts of the general study.

RADAR data, which are imperfect and sometimes incomplete, allow only uncertain flood mapping. As a result, to extract flood area using RADAR images we have to determine accuracy and uncertainty of result mapping. Therefore, we have to examine uncertainties linked to RADAR data and treatments used for mapping. These uncertainties are especially due to RADAR characteristics (e.g.: “speckle”, spatial and radiometric resolutions, etc.), some meteorological conditions (e.g.: wind, rain) and

some land cover (e.g.: forest and cities). This stage especially enables us to share calculated flood extent into certain and uncertain areas.

To enhance the calculated flood extent and determine water levels, we match it with very high resolution DEM. Only the certain areas of flood extent are usable for fusion. Moreover, we reduce water level uncertainties by introducing rules of hydraulic coherence on successive water levels along flood plain.

The perspective is to use spatial characteristics calculated with SAR images and DEM to help modelling, for example as initial condition, or for calibration or negation of a simplified hydraulic model. This kind of improvement of SAR imagery can be very useful to develop automatic methods, which could allow calculation of future evolution of a beginning flood.

Area of interest is the Moselle river between Thionville and Berg-sur-Moselle (France). The accuracy of water level calculations is about $\pm$ 50 cm using RADARSAT 1 image of flood (acquired 02-28-1997).