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Evolutionary assimilation of SAR-derived flood extents into a hydraulic model

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The potential for assimilating remote sensing observations into hydraulic models for improved flood prediction has been demonstrated over the past few years. Water levels derived through the integration of Synthetic Aperture Radar (SAR)-based flood extents with digital elevation data have typically been the variable of choice for data assimilation into flood hydraulic models. However, SAR-derived water level estimation requires simplistic assumptions about the nature of flow. The assimilation of SAR-derived flood extents, which are the directly observable flood feature from space, can eliminate the need for additional assumptions. Evolutionary data assimilation is applied to a flood forecasting model (LISFLOOD-FP) for the first time, to test its feasibility for model-data integration. A key issue in data assimilation is the representation of observational uncertainties, being SAR images of the flooding in this case. This was achieved through a semi-automated optimized texture-based neurofuzzy flood mapping algorithm. Resulting maps contain a fuzzy value of their membership to the flood class, modelled using a Gaussian distribution. The classifier was parameterized by a neural network based on SAR backscatter and optimized texture values, in flood and non-flood class training sets. The impact on predicted flood extent and water level from assimilating fuzzy flood extents into the hydraulic model using an evolutionary algorithm will be shown.