How reliably can we model inundated rural areas caused by surface water floods?

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Flood damages are caused by a wide range of different flood processes. Only rather recently, surface water floods have been identified as an important contributor to overall flood losses in different parts of the world. However, the expertise is still quite limited in terms of assessing and managing the risk of surface water floods. To a large degree, this is owed to a distinct lack of data concerning this particular flood process. Therefore, flood models often have to be applied in an uncalibrated and/or unvalidated mode in order to assess the hazard and, based thereon, the risk of surface water floods.

In order to quantify the performance of such a modeling approach in rural areas, we apply several hydro-dynamic flood inundation models to different case studies covering diverse geographical settings. The uncalibrated model results are then compared to mapped inundation areas that have been inferred from various sources such as field mappings, ground- and/or UAV-based photographs, etc. Thereby, using binary pattern performance measures, we can quantify the models' performances.

Across all models and case studies, the model performance is rather low. Mainly, the low performances can be attributed to biased predictions of effective rainfall and insufficient representation of the fine-scale topography by the considered digital elevation model. The influence of relevant factors on the model performances is quantified in more details by carrying out a sensitivity analysis. Overall, the model results, which are provided with an extremely high precision, have to be interpreted with care, especially when applying them in flood risk assessments or management.