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Automatic flood extent mapping using long time series of SAR imagery and water levels or discharge data

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Long time series of flood extent mapping are valuable for flooding frequency analysis, wetlands monitoring and hydrological model validation. In this study an automatic algorithm for flood extent mapping using long time series of synthetic aperture radar (SAR) imagery and observed water levels or discharge is presented. The key assumption of this algorithm is that the flooding extent is correlated to these two observed variables and the highest correlation is obtained when the flood/no flood threshold value of SAR backscatter coefficient is optimal. This study is conducted in the Biebrza River floodplain (approximately 220km^2) located in NE Poland. The floodplain is a natural wetland, relatively untouched by human, with complex inundation that involves not only river flooding, but also groundwater discharge and rain or snowmelt local inundation. In order to map 2014-2018 flooding series the automatic thresholding algorithm is run on Sentinel 1 data from one relative orbit, yielding 161 SAR scenes. The estimated 2014-2018 water line match well water levels from independent water gauge and the inundation maps agree with the MODIS 500m reflectance image. This approach was unable to identify inundation in remote parts of the floodplain except very intensive groundwater discharge events. This behavior may have several reasons, of which the most probable are that the dense vegetation obscuring inundated ground and that groundwater, snowmelt or rainfall inundation is not correlated to the variables recorded at a water gauge located in the river.