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# A long-term, dynamical, high-spatial resolution inundation extent dataset at global scale, from the combination of multiple satellite datasets

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Several satellite observations can monitor surface water inundation over the globe: Visible/infrared observations (e.g. MODIS/Landsat), active (e.g. SAR) and passive microwave. Each one of these observations has its own advantages and drawbacks: for instance, passive microwave has a low spatial resolution while visible observations cannot detect water below clouds or vegetation. We will review several of the techniques currently used.

The Global Inundation Extent from Multi-Satellites (GIEMS) database is derived from multiple satellite observations (visible, active and passive microwave). It provides multi-year monthly variations of the global surface water extent at about 25kmx25km resolution, from 1993 to 2007. Work is currently being conducted to obtain measurements at 10-day intervals and extend the time-series to $\sim$30 years until present. GIEMS spatial resolution is usually compatible with climate and global land surface model outputs (for instance for methane emission) but is clearly not adequate for local applications that require the characterization of small individual water bodies. A downscaling approach for GIEMS was developed by Aires et al. (2017) relying on a floodability index generated from topographic data. The resulting downscaled GIEMS-D3 database possesses the same attributes as GIEMS, but with a high spatial resolution (90m) allowing to spatially delineate waterbodies and inundated areas globally.

GIEMS-D3 is assessed by analysing its spatial and temporal variability over the Niger, Amazon, Ganges-Brahmaputra and Mekong basins. GIEMS-D3 is also compared with other independent satellite databases such as GSWO (Landsat), G3WBM (Landsat) and GLWD (Lehner & Döll, 2004). In contrast to visible-based datasets, GIEMS-D3 is capable of representing inundations beneath dense cloud and vegetation cover, but it also suffers from topography limitations (Aires et al. 2018). As a result, large differences can be observed between GIEMS-D3 and the other datasets, particularly over the tropics and high latitudes.

An incipient international project aims to synthesise various global inundation datasets to provide the scientific community with a single harmonised and comprehensive surface water cover data product. The effort focuses on combining GIEMS-D3, the Landsat-derived GSWO (Pekel et al. 2017), the HydroLAKES (Messager et al. 2016), and the MERIT DEM topography (Yamazaki et al. 2017) datasets.