# S. Creation of MNDWI maps

Satellite images spanning more than 30 years (1985-2017) were considered for retrieving the morphological changes of an 80-km reach of the Vistula River downstream of the Polish capital Warsaw.

The images were downloaded and corrected for filling missing data and to account for radiometric and atmospheric effects, and then a yearly-averaged Modified Normalized Difference Water Index (MNDWI) was extracted (. Among the entire dataset, four images were selected for characterizing the long-term evolution of the reach, aiming to avoid uncertainties correlated with the hydrology (i.e., different areas covered by water, depending on the water stage). Indeed, the comparison was performed between images acquired with a similar discharge, giving an estimate of the morphological variations during the studied period.

## S.1 Satellite images & Data processing

The present analysis was performed using Landsat 5 TM, Landsat 7 ETM+ and Landsat 8 OLI data, all having a spatial resolution of 30 m and covering the period 1985-2017 (Table 2). The satellite images were downloaded as a Level‐1 Data Product in GeoTIFF format from the United States Geological Survey (USGS) Earth Explorer service (earthexplorer.usgs.gov) and handled with the freeware GIS software QGis. The data were pre-processed using common Landsat image preparation approaches, including radiometric processing, dark area subtraction and geometric correction. As cloud cover is a major limitation when using satellite data, a threshold was set to 10% to reject images having a higher cloud cover. A sensitivity analysis using a few cloud-free images shown the consistency of the results obtained following this procedure.

Given that the radiation from the Earth’s surface undergoes significant interaction with the atmosphere before it reaches the satellite sensor, potentially altering the monitored signal, the images were pre-processed to account for the atmospheric conditions by means of the Semi-Automatic Classification Plugin (plugins.qgis.org/plugins/SemiAutomaticClassificationPlugin) of QGis.

## S.2 Failure of the Scan Line Corrector

Given the failure of the Scan Line Corrector of the Landsat 7 ETM sensor happened in 2003, all the images between that year and 2017 were corrected to fill the gaps, which accounted for around 22% of all data.

This simple procedure was made with the freeware software QGis and its tool gdal\_fillnodata (gdal.org/programs/gdal\_fillnodata.html), which uses the masks downloadable with the relative images and an inverse distance weighting interpolation method. For the sake of comparison, an example of the same Landsat images before and after the processing is here reported (Figure S1).

## S.3 Modified Normalized Difference Water Index

For showing the reliability of the proposed methodology in extracting the MDNDWI, Figure S2 reports a comparison between a raw Landsat 8 image and the MNDWI map.