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Monitoring the spatial and temporal dynamic of annual floods in the Niger Inner Delta using MODIS satellite imagery

Andrew OGILVIE1,2, Gilles BELAUD2, Carole DELENNE2, Jean-Claude BADER1, Aurélie OLEKSIAK1 and Jean-Stéphane BAILLY3

1Institut de Recherche pour le Développement, UMR G-eau, Montpellier, France
2Montpellier SupAgro, UMR G-eau, Montpellier, France
3Université Montpellier 2, UMR Hydrosciences Montpellier, France
4AgroParisTech, UMR Tetis-Lisah, Montpellier, France
5Department of Geography, King’s College London, United Kingdom

Background
Flooding of large alluvial plains provides a vital resource for ecosystem services and rural livelihoods (crops, fisheries, livestock) combining the improvements in heterogeneous land use and flat topography

Objective is to develop a method to detect and follow annual floods in the Niger Inner Delta (4M ha wetland) combining the improvements in remote sensing with field data

Results
Spatio-temporal dynamic of the flood

Spatial variations in the timing and duration of the flood

Hydrological correlations for grid cells and the whole delta

Materials and methods
- MODIS 8-day composite satellite images, 500m resolution
- MNDWI-NDMI composite index, constant thresholds
- Three K-means classified Landsat 30m Images used for threshold calibration
- Hydrologically relevant grid overlaid
- MRTbatch to crop, project and extract geotiff files
- ENVI IDL programme to automate procedure on 526 images of 2000-2011, producing image of the flood and statistics on % of flooded pixels per grid cell for each image
- Cloud interference evaluated as % of cropped image area using LDOPE and IDL (14 images per year removed)
- Stage measurements at 15 hydrological stations to correlate and validate the results

Conclusions
- Automated method successful in monitoring the flood peak and its subsequent decline.
- Results per grid cell highlight the spatial differences in hydrological behaviour, with a significantly delayed and prolonged flood in the downstream areas.
- Maximum simultaneously flooded areas vary from 11,700 km² to 21,000 km² over 2000-2011.
- Good correlations (at the grid cell and whole delta level) between stage data and remotely sensed flooded areas validate the method.
- Relationships obtained notably allow the estimation of the total flooded area from a single stage measurement.
- A 300 m³/s reduction in peak flow due to the Fomi dam could reduce the peak flooded area in the Inner Delta by over 3,000 km²