Supplementary Material

A first collective validation of global fluvial flood models for major floods in Nigeria and Mozambique
Environmental Research Letters

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1. Description of DFO JPEG to GeoTIFF conversion

The 2007 flood event vector data was not available from the Dartmouth Flood Observatory (DFO) website and instead the JPEG of the observed event (Figure 1) had to be georeferenced in QGIS (v2.18) for analysis. The QGIS 'Raster Georeferencer' tool was used to add latitudinal and longitudinal information to a raster image. As the DFO image in Figure 1 displays latitude and longitude on a simple grid, it was possible to input the exact coordinates of the four grid intersections in the Georeferencer tool. Coordinates were input as WGS84 as stated on the DFO event header (Figure 1).

The DFO inundation map in Figure 1 maps observed flooding in different shades of red depending on the recorded date of inundation. To allow for analysis, the range of colours representing flooded areas needed to be condensed into one common 'wet' type. To do this the 'RGB to PCT' tool in QGIS was used which creates a classified raster by grouping colours by similarity. Through trial and error, the optimal number of colour classes to use was found to be 150. This is compared with the original 25,000 colour classes present before. The various colour values of red were merged into one 'flooded' value using the GRASS GIS 'r.reclass' tool in QGIS. All remaining colours were redefined as zero.

Figure 1. Dartmouth Flood Observatory JPEG image of observed flooding in 2007 in Mozambique [1].

An issue that was encountered when georeferencing the DFO image was the town names and markers which overlap onto the river and the observed flood extents. A zoomed in image of this issue can be seen in Figure 2. Determining whether the pixels behind the text in the map were flooded or not was found to be a highly subjective exercise. To prevent any user bias these regions were reclassified as 'no data' regions, thereby excluding these areas from further analysis.

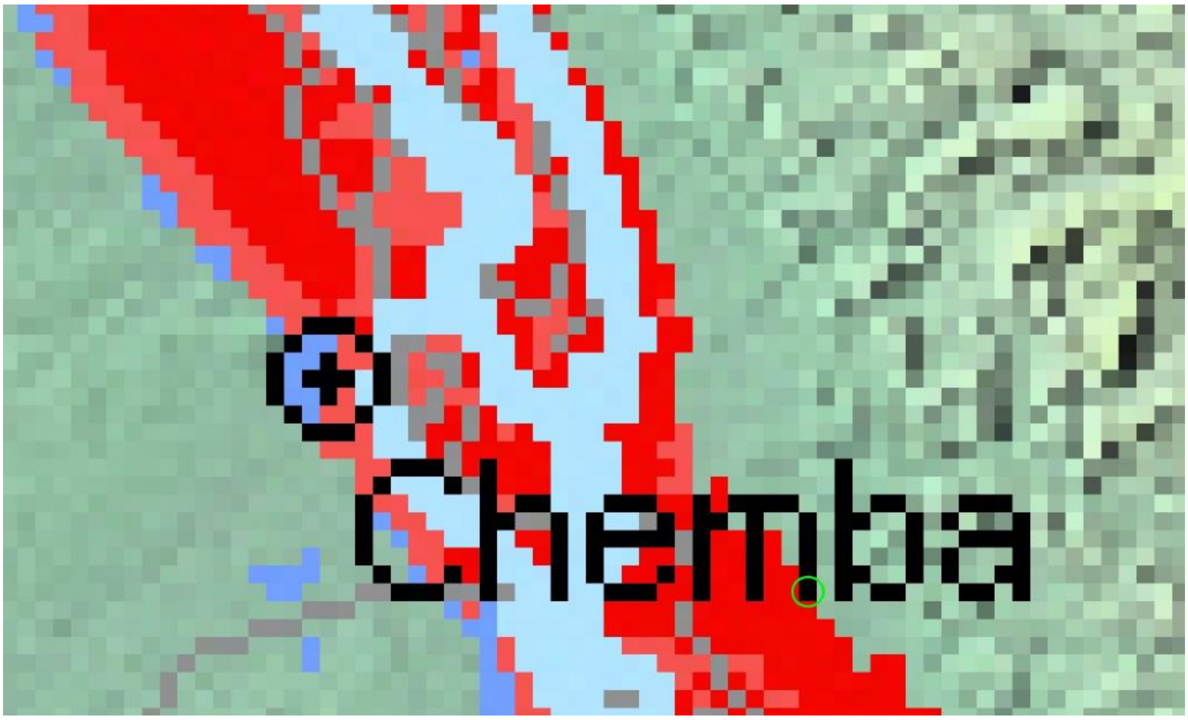

Figure 2. Zoomed in example of the issue caused with town names and markers. The green circle indicates a particularly difficult pixel to identify as either ‘flooded’ or ‘not flooded’.

2. Individual Global Flood Model Details

This table was taken from the supplementary material of the Trigg et al global flood model intercomparison paper as it provides key model structure information that is useful to the reader of the validation study [2].

Table 1. Model Details. Reproduced from [2]. © IOP Publishing Ltd. CC BY 3.0.

MODEL	Climate Forcing	Land Surface Model	River Routing	Floodplain	Flood Frequency	Down-scaling	Output Data Resolution	Smallest River size or upstream catchment area considered
GLOFRIS	EU-Watch reanalysis 1960-1999	Hydrological model PCR-GLOBWB 0.5 degree	Kinematic 0.5 deg	30 arc sec SRTM model	Flood volume Gumbel distribution for 1960 to 1999	Volume redistribution on 30 arcsec SRTM model	30 arc sec ~900m	Strahler order >=6 only
CaMa-Flood	JRA-25 Reanalysis 1979-2010 +GPCP rain gauge correction	MARSIRO=GW Energy and Water Balance (1 degree)	Inertia 0.25 deg	Sub-grid topo. Upscaled from 3 arc sec HydroSHEDS & SRTM	Water Level Gumbel distribution for 1979 to 2010	Flood depth downscaled onto 18 arc sec DEM	18 arc sec ~540m	Drainage area > 0.25 degree grid box (Approximately ~500km^2)
ECMWF	ERAInterim reanalysis 1979-2014	HTESSEL, T255 (~80km)	3 methods Kinematic, Inertia (x2) 0.25 deg	Sub-grid topo. Upscaled from 3 arc sec HydroSHEDS & SRTM	Flood depth GEV distribution for 1979 to 2014	Depth downscaled onto 19 arc sec DEM	18 arc sec ~540m	~500 km^2
JRC	GloFAS, ERA-Interim reanalysis 1980-2013	HTESSEL	LISFLOOD-Global (0.1 deg) + Inertia (30 arc sec)	Sub-grid topo. Upscaled from 3 arc sec HydroSHEDS & SRTM	Gumbel distribution for 1980 to 2013	N/A	30 arc sec ~900m	5000 km^2
SSBN	Regional Flood Frequency Analysis (FFA) from global gauge data	N/A	Inertia 30 arc sec	HydroSHEDS & SRTM 30 arc sec	From FFA	Depth downscaled onto 3 arc sec DEM	3 arc sec ~90m	~50 km^2
CIMA-UNEP	Regional FFA from global gauge data + ECEarth bias corrected	Continuum Model to improve FFA	Manning's at multiple points	Reconditioned HydroSHEDS & SRTM	From FFA, GEV fitting	Native at 3 arc sec	3 arc sec ~90m	~1000 km^2

3. Comparison of DFO extents and new database's extents

3.1 Lokoja

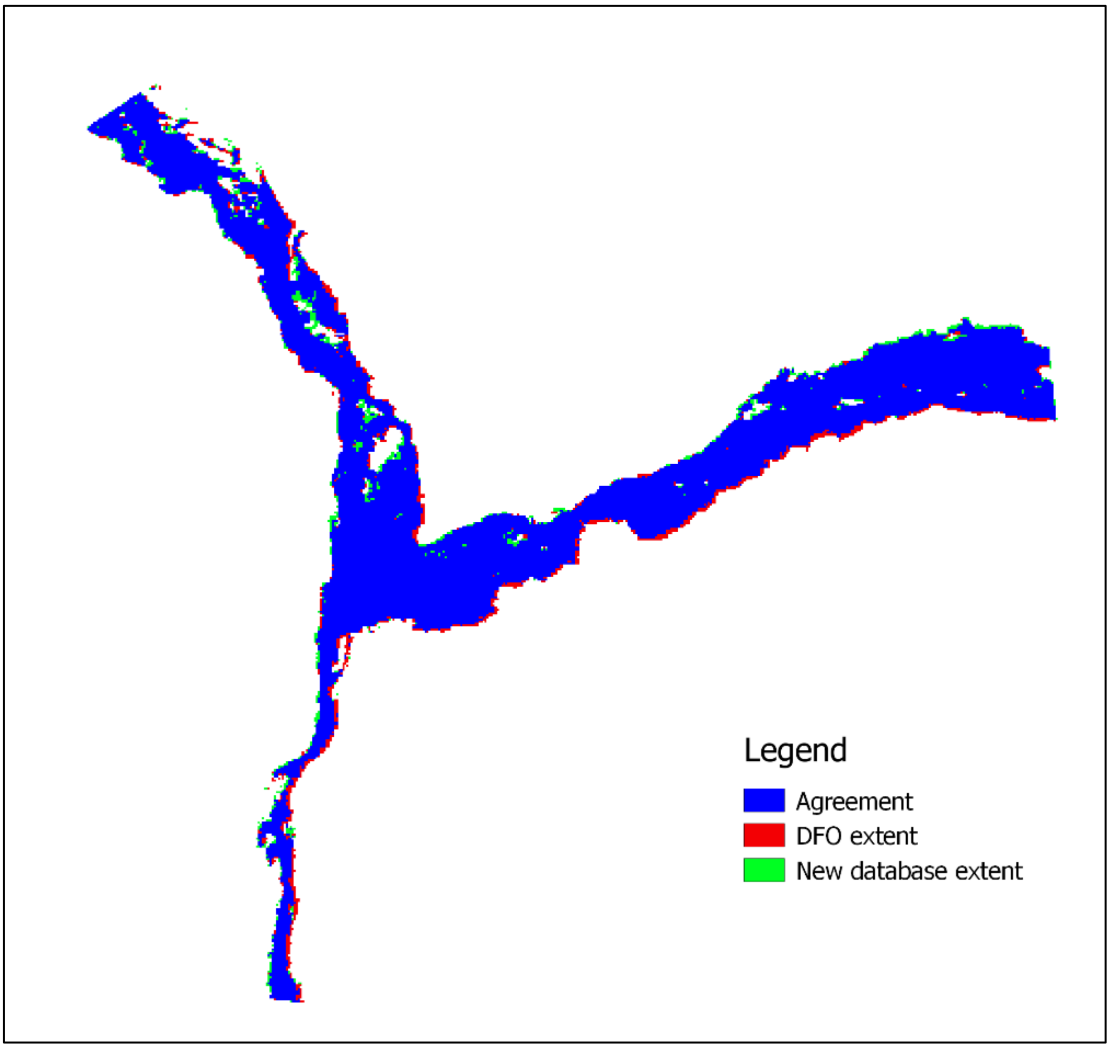

Figure 3. Overlap of DFO observed extent and new database observed extent for Lokoja.

3.2 Idah

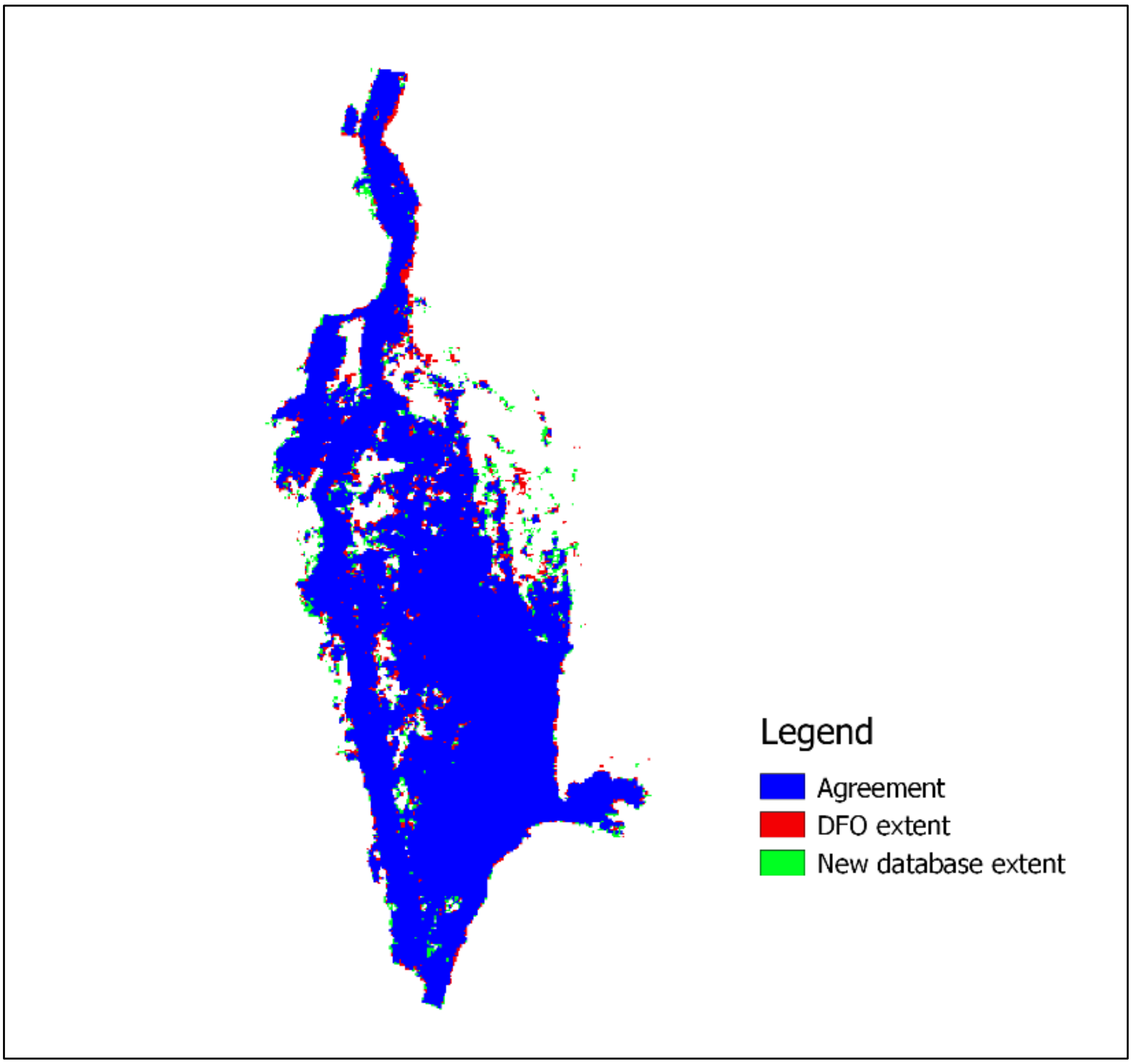

Figure 4. Overlap of DFO observed extent and new database observed extent for Idah.

3.3 Chemba

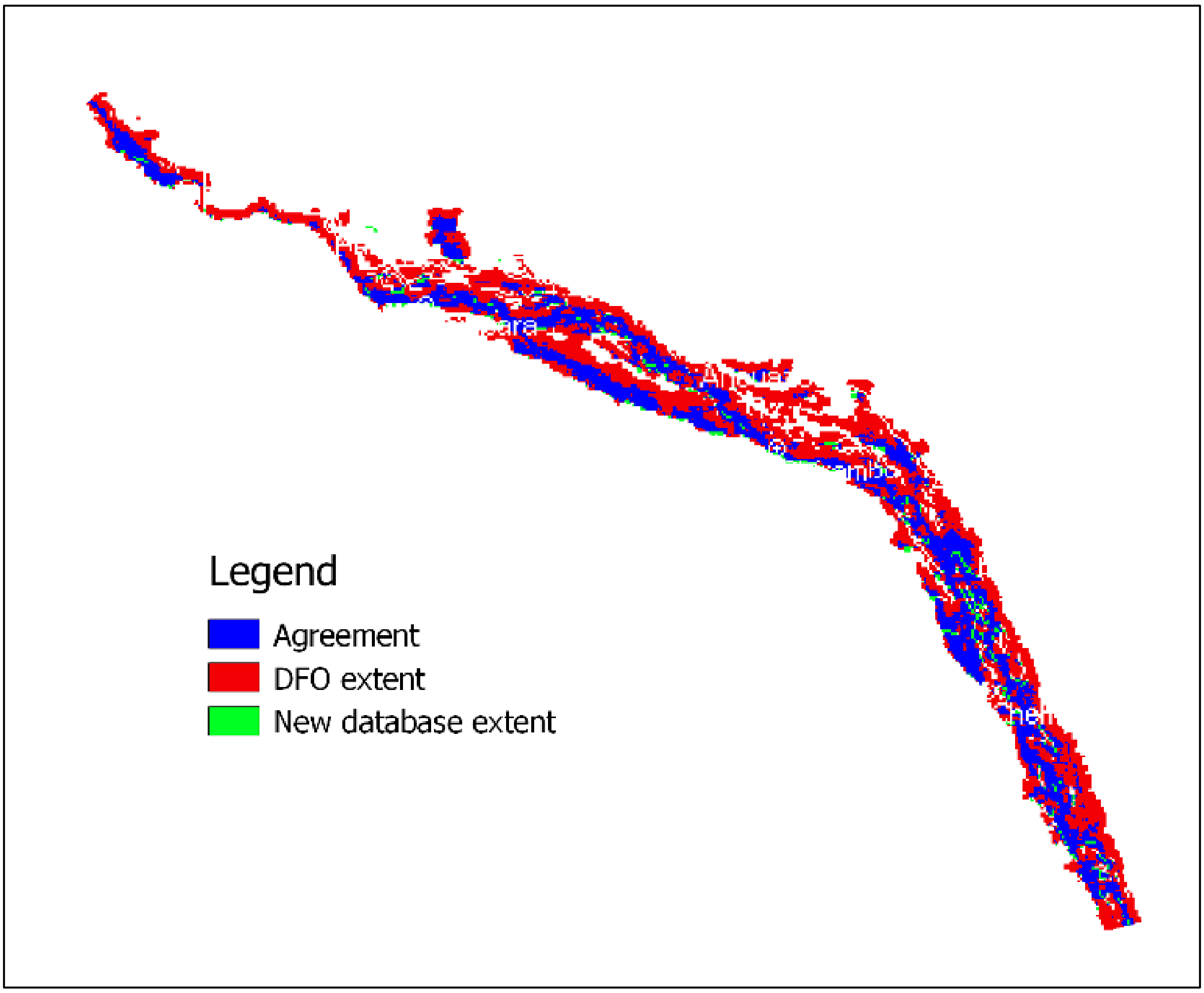

Figure 5. Overlap of DFO observed extent and new database observed extent for Chemba

Supplementary References

[1] Anderson E and Brakenridge G R 2007 DFO Event #2007-003 - Zambezi and Shire Rivers - Mozambique and Malawi - Rapid Response Inundation Map 1. (Dartmouth Flood Observatory

[2] Trigg M A, Birch C E, Neal J C, Bates P D, Smith A, Sampson C C, Yamazaki D, Hirabayashi Y, Pappenberger F, Dutra E, Ward P J, Winsemius H C, Salamon P, Dottori F, Rudari R, Kappes M S, Simpson A L, Hadzilacos G and Fewtrell T J 2016 The credibility challenge for global fluvial flood risk analysis *Environ. Res. Lett.* **11** 10