Data Documentation: Satellite-derived flood maps and trend estimates for the Eastern Nile Basin
August 13, 2018

This document outlines the details of the datasets produced by Cloud to Street for the Eastern Nile Basin under contract with the World Bank and in collaboration with ENTRO and are available for download at http://eastern-nile-flood-database.appspot.com. Contact Colin Doyle at colin@cloudtostreet.info for any questions relating to the data described in this document.

Event Maps – MODIS
These flood maps are at 250-m resolution and the result of running the MODIS flood detection algorithm (Dartmouth Flood Observatory) on daily Aqua and Terra MODIS data acquired during each. The file-naming format is as follows:

"Nile_*ID*_MODIS_From_*YYYYMMDD*_to_*YYYYMMDD*"

where the "I*D*" is an arbitrary ID number to link to database, and the "From_*YYYYMMDD*" is the start of the event, and "to_*YYYYMMDD*" is the end of the event.

Each map has 6 bands:
0: "flooded" - the cumulative flood extent during the duration of the event. 0 = not flood; 1 = flood
1: "duration" - how many days during the event each pixel was detected as a flood
2: "clearViews" - how many times during the event each pixel had a clear observation (not flagged as cloud)
3: "clearPerc" - the percentage of observations during the event that each pixel had a clear view (not flagged as cloud)
4: "JRC_Perm_Water" - permanent water defined by the JRC global surface water data for a given year (https://global-surface-water.appspot.com/)
5: "JRC_Seasonal_Water" - seasonal water defined as a pixel that was detected as water at least 30% of historic observations during that time of month from the JRC water data (https://global-surface-water.appspot.com/)

Event Maps – Landsat
These maps are at 30-m resolution and the result of running the Landsat flood detection algorithm (Feyisa et al., 2014) on Landsat 4, 5, 7, and 8 data acquired during each event. The file-naming format is as follows:

"Nile_*ID*_Landsat_From_*YYYYMMDD*_to_*YYYYMMDD*"

where the "I*D*" is an arbitrary ID number to link to database, and the "From_*YYYYMMDD*" is the start of the event, and "to_*YYYYMMDD*" is the end of the event.

Each map has 6 bands:

0: "flooded" - the cumulative flood extent during the duration of the event. 0 = not flood; 1 = flood

1: "detections" - how many images during the event each pixel was detected as a flood. Because Landsat has a less frequent return time, duration cannot be calculated reliably.

2: "clearViews" - how many times during the event each pixel had a clear observation (not flagged as cloud)

3: "clearPerc" - the percentage of observations during the event that each pixel had a clear view (not flagged as cloud)

4: "JRC_Perm_Water" - permanent water defined by the JRC global surface water data for a given year (https://global-surface-water.appspot.com/)

5: "JRC_Seasonal_Water" - seasonal water defined as a pixel that was detected as water at least 30% of historic observations during that time of month from the JRC water data (https://global-surface-water.appspot.com/)

Event Composites – MODIS

These maps (250-m resolution) are the result of combining all of the MODIS-derived flood event maps. There are 5 resulting composites:

1. Population Affected Composite
   The total number of people affected by the flood events aggregated across all events.
2. Thresholded_Flood_Duration
   Number of events a pixel was flooded for 6 or more days during. This approach isolates areas that were flooded for longer periods of time, more likely to result in agricultural damage.
3. Total_Flood_Duration_Per_Pixel
   The sum of the "duration" layer of all MODIS-derived event maps. This composite represents the total number of days each pixel was flooded across all events in database.
4. Total_Flood_Events_Per_Pixel
   Number of events in database each pixel was flooded during.
5. Total_Flood_Extent_Across_All_Events
   All of the event flood extent layers combined. This map represents all pixels that were detected as flooding during any event in the database. 1 = flooded, 0 = not flooded.

Annual Maps – MODIS

These maps (250-m resolution) are the result of running the MODIS flood detection algorithm (Dartmouth Flood Observatory) on every daily Aqua and Terra MODIS image of a given year for the years 2001-2016. The file-naming format is as follows:

"Nile_*YEAR*_MODIS_From_*YYYYMMDD*_to_*YYYYMMDD*"

where the "*YEAR*" is the year the map represents, and the "From_*YYYYMMDD*" is the start of the year, and "to_*YYYYMMDD*" is the end of the year.

Each map has 5 bands:
0: "flooded" - the cumulative flood extent during the duration of the year. 0 = not flood; 1 = flood
1: "duration" - how many days during the year each pixel was detected as a flood
2: "clearViews" - how many times during the year each pixel had a clear observation (not flagged as cloud)
3: "clearPerc" - the percentage of observations during the year that each pixel had a clear view (not flagged as cloud)
4: "JRC_Perm_Water" - permanent water defined by the JRC global surface water data for a given year (https://global-surface-water.appspot.com/)

Return Interval Maps – MODIS
These maps (250-m resolution) estimate flood extent for floods of different return intervals calculated from probabilities that each pixel will flood based on the 16 years of MODIS data (2001-2016). The title of the file is

"MODIS_returnPeriods"

The map has 8 bands:
0: "years_flooded" – the total number of years each pixel was detected as water
1: "probability" – the probability a pixel will flood in any given year calculated as the number of years detected as flood divided by the total number of years. Value range is 0-1.
2: "two_year" – estimated flood extent of a 2-year flood event. 1 = flood, 2 = not flood
3: "five_year" – estimated flood extent of a 5-year flood event. 1 = flood, 2 = not flood
4: "ten_year" – estimated flood extent of a 10-year flood event. 1 = flood, 2 = not flood
5: "fifteen_year" – estimated flood extent of a 15-year flood event. 1 = flood, 2 = not flood
6: "thirty_year" – estimated flood extent of a 30-year flood event. 1 = flood, 2 = not flood. NOTE: This is only calculated reliably with Landsat data.
7: "clearViews" - how many times during the data range each pixel had a clear observation (not flagged as cloud)
8: "clearPerc" - the percentage of observations during the data range that each pixel had a clear view (not flagged as cloud)

Return Interval Maps – Landsat
These maps (30-m resolution) estimate flood extent for floods of different return intervals calculated from probabilities that each pixel will flood based on the 33 years of Landsat data (1985-2017). The title of the file is

"Landsat_returnPeriods"

The map has 8 bands:

0: "years_flooded" – the total number of years each pixel was detected as water

1: "probability" – the probability a pixel will flood in any given year calculated as the number of years detected as flood divided by the total number of years. Value range is 0-1.

2: "two_year" – estimated flood extent of a 2-year flood event. 1 = flood, 2 = not flood

3: "five_year" – estimated flood extent of a 5-year flood event. 1 = flood, 2 = not flood

4: "ten_year" – estimated flood extent of a 10-year flood event. 1 = flood, 2 = not flood

5: "fifteen_year" – estimated flood extent of a 15-year flood event. 1 = flood, 2 = not flood

6: "thirty_year" – estimated flood extent of a 30-year flood event. 1 = flood, 2 = not flood. NOTE: This is only calculated reliably with Landsat data.

7: "clearViews" - how many times during the data range each pixel had a clear observation (not flagged as cloud)

8: "clearPerc" - the percentage of observations during the data range that each pixel had a clear view (not flagged as cloud)

Flooded Area and People Exposed

These tables list the total area flooded and the number of people exposed to the flood based on WorldPop Project population data (http://www.worldpop.org.uk/). There is a csv file that contains these estimates for all events and return periods for MODIS, and a separate csv file for Landsat.

MODIS: https://storage.googleapis.com/eastern-nile-flood-history/flood_stats/MODIS_Events_Population_Area_Affected_Estimates.csv

Landsat: https://storage.googleapis.com/eastern-nile-flood-history/flood_stats/Landsat_Events_Population_Area_Affected_Estimates.csv

Event Daily Precipitation

Each CSV file contains the daily precipitation (mm/day) during each flood event in the historic event database. The PERSIANN Precipitation Dataset was used to obtain daily precipitation measurements. In addition to the tabular data stored as a CSV, hyetographs from this data are also stored as PNG files.