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## Why this project?

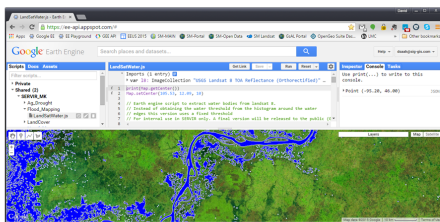
- The Lower Mekong Basin (LMB) is subject to extremes in streamflow conditions, including frequent flooding during the annual monsoon. Understanding and chronicling historic and current events are critical for land use planning and disaster response. This project will document the annual flooding extent of the Mekong River and tributaries for the years 2000-2015.

## Objectives

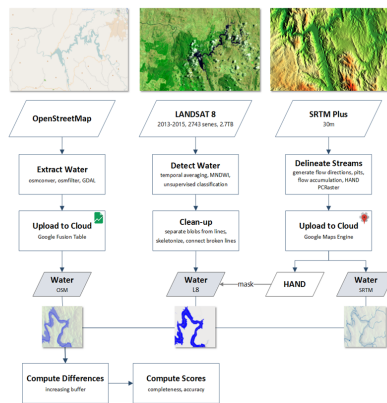
- Prototype a modular satellite-based water resources and water hazard mapping, early warning and post-disaster assessment visualization system.
- Produce a series of historic flood extent maps of the Lower Mekong Basin for the most extensive flooding during the monsoon for each of the years 2000 to 2015, showing the annual inundated areas and how they changed with time.

## Approach/Project Activities

- We are creating a tool to derive flood extent maps initially from Landsat imagery and later from Sentinel-1 radar data. A series of yearly maximum flood extent maps during the monsoon for each of the years 2000 to 2015 will be created for the LMB using the tool and will be verified with existing data sources.
- The tool consists of two components: (1) a Google Earth Engine (GEE) javascript or python application that performs image analysis and (2) a user-friendly site/app using Google's appspot.com that exposes the application to the users.



- We will develop an expert-calibrated automated image segmentation procedure that will accept Landsat-7 and Landsat-8 image collections as input maps.
- Outputs will be created showing flooded areas, permanent water, and areas not covered by water.
- A second version of the tool will be developed to work with Sentinel-1 radar data once available. Initial testing will be done using a 10-year archive of EnviSat ASAR data until Sentinel-1 data becomes available.



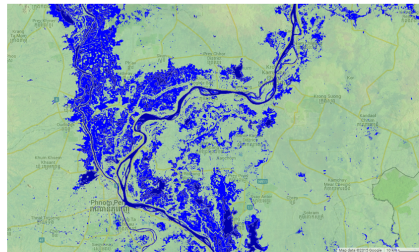
Adopted from: Donchyts, G., Schellekens, J., Winsemius, H., Van de Giesen, N.C., 2015. Quality assessment of OpenStreetMap water mask using LANDSAT 8 imagery and Google Earth Engine. Geophysical Research Abstracts, 17, EGU General Assembly, Vienna, Austria, 12-17 April 2015.

## Focus Area

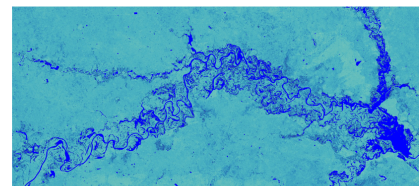
- Mekong river and tributaries from Vientiane, Lao PDR, to the South China Sea. (With adjustments the tool can easily be used elsewhere.)



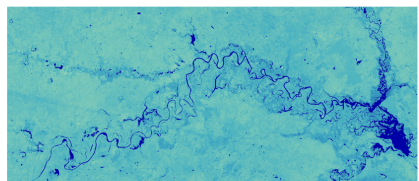
## Initial Results



Flooded area (light blue) around Phnom Penh between 2013 and 2015. Dark blue areas represent more permanent water.



Thailand Example: Modified Normalized Difference Index (8th percentile) over the Landsat 8 period. This normally represents flood water.



Thailand Example: Modified Normalized Difference Index (40th percentile) over the Landsat 8 period. This normally represents permanent water.

## Anticipated Impacts

- The project will produce annual maps of flood extent in order to inform end users on the historical range of monsoon flooding in the LMB.
- For example, the outputs of this product will be used by NHI (Natural Heritage Institute) to assess the role that channel topography, floodplains and ephemeral flood-derived ponds and wetlands play in fish spawning and how these patterns, structures, and functions can be sustained.
- A historical flood archive based on EnviSat and MODIS will be analyzed and compared to the results of the tool, from which we will validate:
  - Yearly maximum flood extent maps for the LMB using available LandSat-7/8 data;
  - Maximum flood extent maps for selected large floods using the tool with LandSat and EnviSat radar data;
  - Flood extent maps for floods that are available in the Sentinel-1 data to demonstrate operational use of the tool.
- The product will showcase SERVIR Mekong collaboration with the Climate Resilient Mekong project as an example of synergies within the Sustainable Mekong Program and numerous other partners.

## Project End Users

- Natural Heritage Institute
- Vietnam : Institute of Meteorology, Hydrology and Environment
- Cambodia : Ministry of Water Resources and Meteorology
- Lao PDR : Ministry of Natural Resources and Environment; Ministry of Energy and Mines
- Thailand : Department of Water Resources
- Mekong River Commission (MRC)
- WWF Greater Mekong Freshwater Program



Myanmar Flooding 2015

## Earth Observations & Other Inputs

- LandSat-7, LandSat-8
- SRTM Plus (30 m Digital Elevation Model)
- OpenStreetMap
- ASAR EnviSat
- MODIS

## Production Partners

