Hands On Applications of the Latin American and Caribbean Flood and Drought Monitor (LACFDM)

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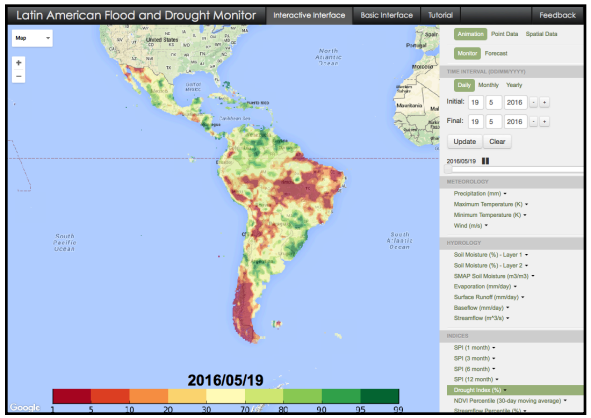
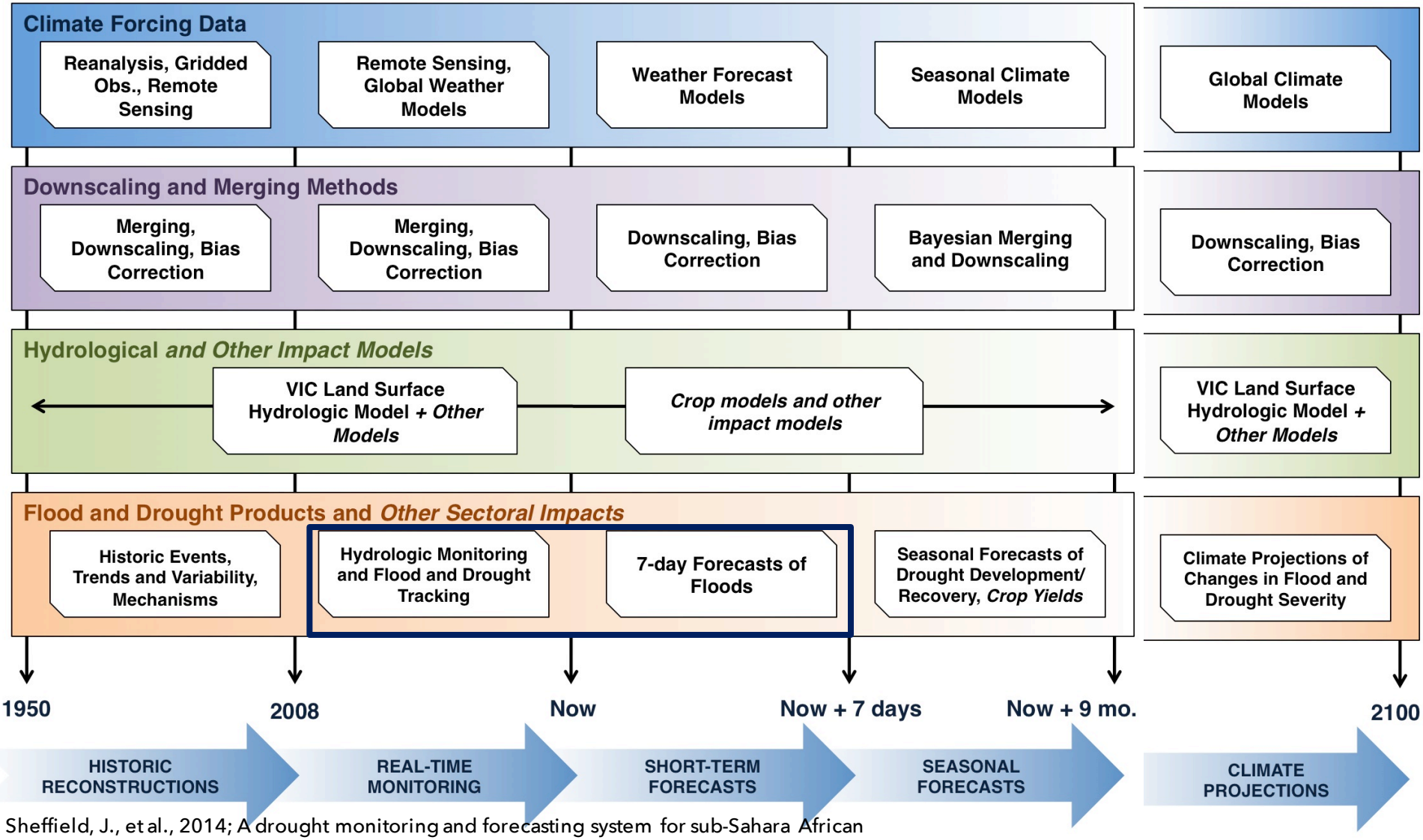
Princeton University

International Training: 'Application of Satellite Remote Sensing to Support Water Resources Management in Latin America and the Caribbean' –
Foz de Iguazú, Brazil, 13 - 20 July 2016

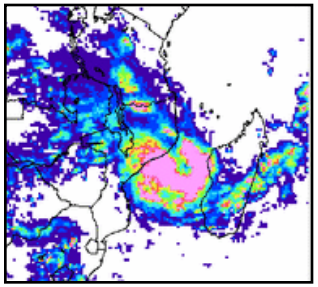


Applications for Flooding

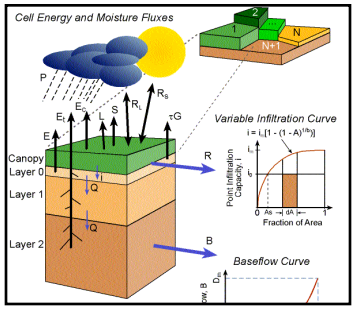


Sheffield, J., et al., 2014; A drought monitoring and forecasting system for sub-Sahara African water resources and food security. *Bull. Am. Met. Soc.*, June

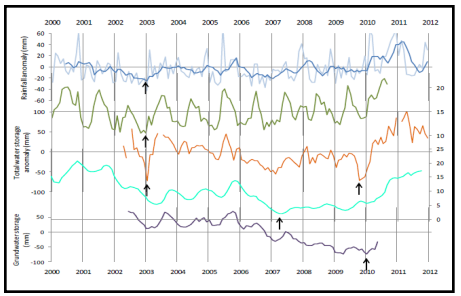
Putting it all together: Hydrological and Drought Monitoring System



Real-time Weather

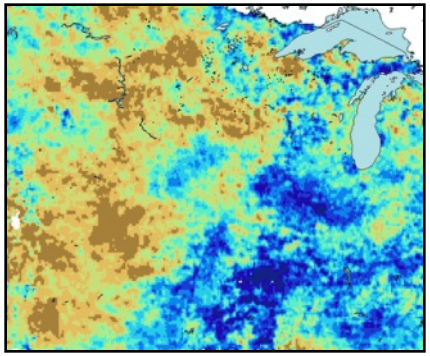


Land surface (hydrology) models



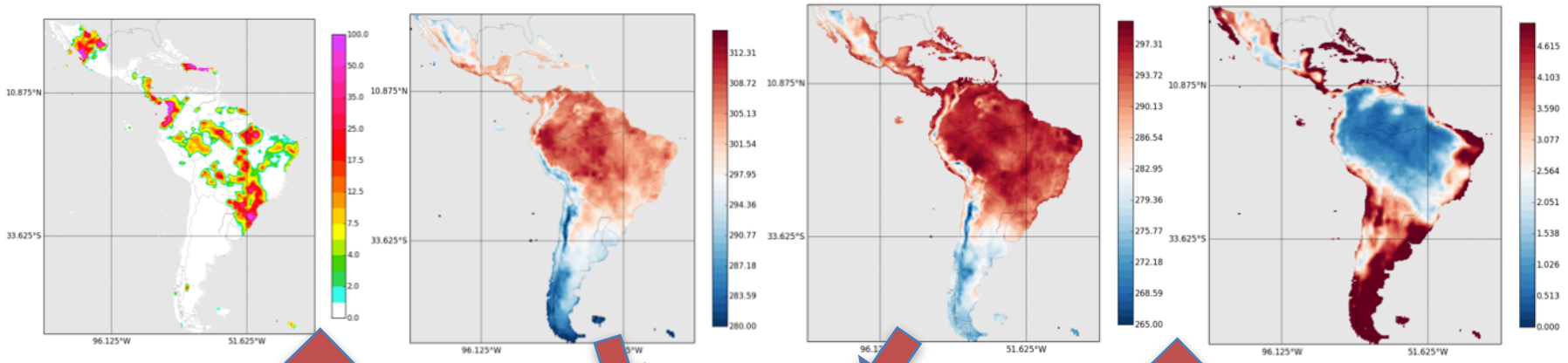
Hydrological Variables, Streamflow, Drought Indices

Initial Conditions



Management/Mitigation

Land Surface Model Data



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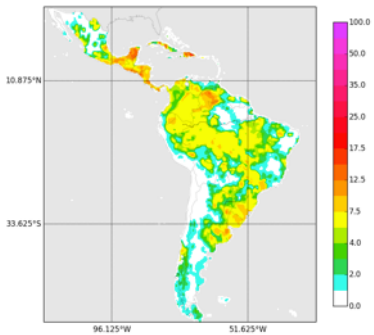
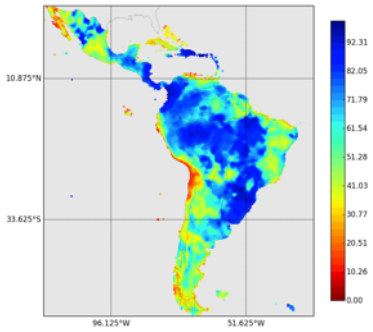
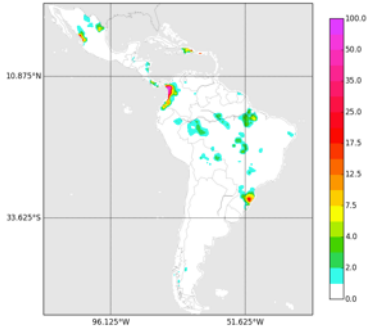


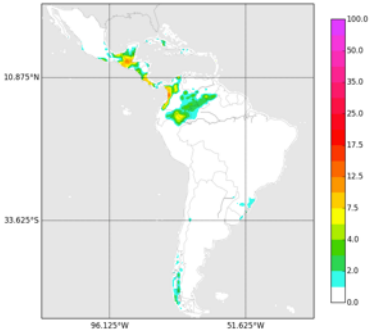
Sm 1



Runoff

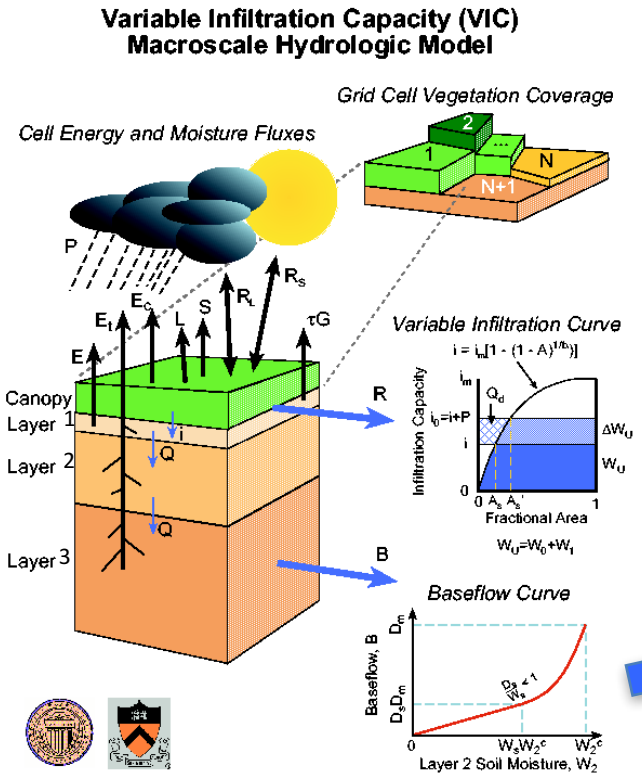


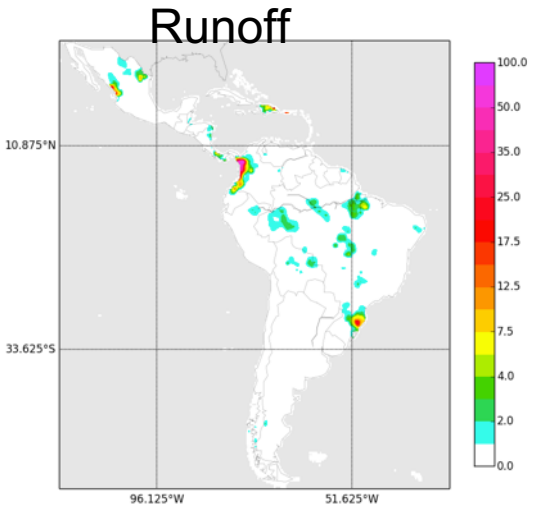
Baseflow

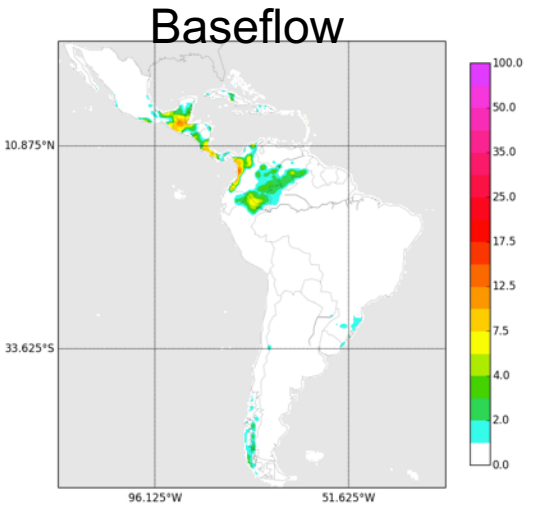


Land Surface Model: Simulate Discharge

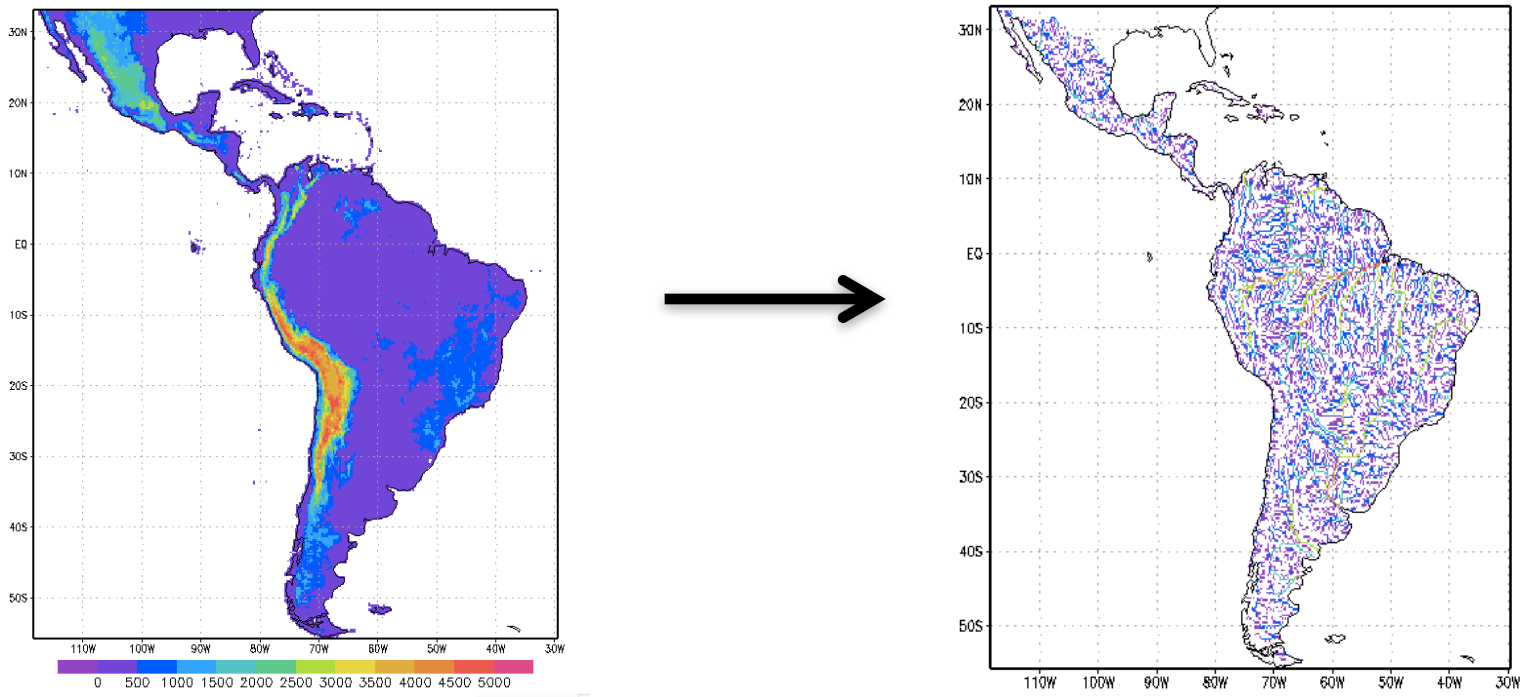
How do we simulate discharge at stream gauges using our land surface model output of baseflow and surface runoff?







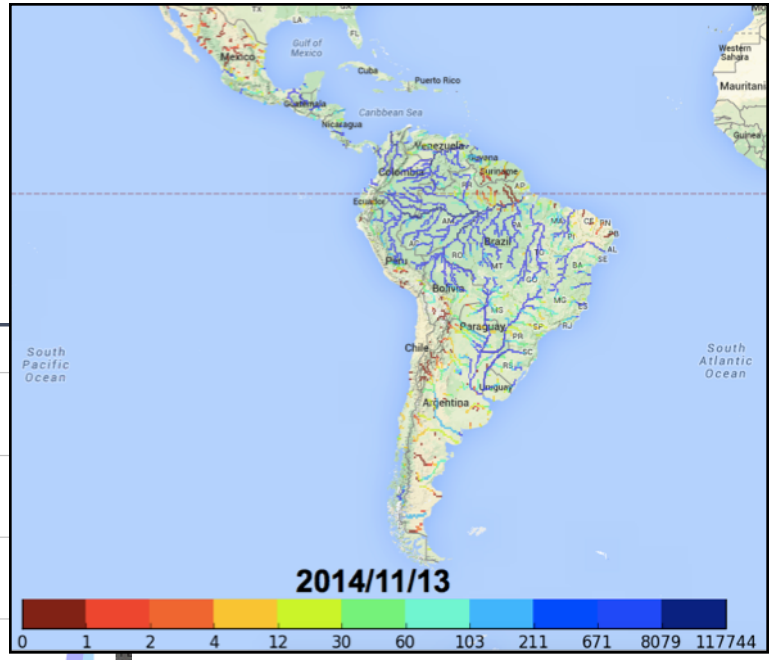
Simulate Discharge

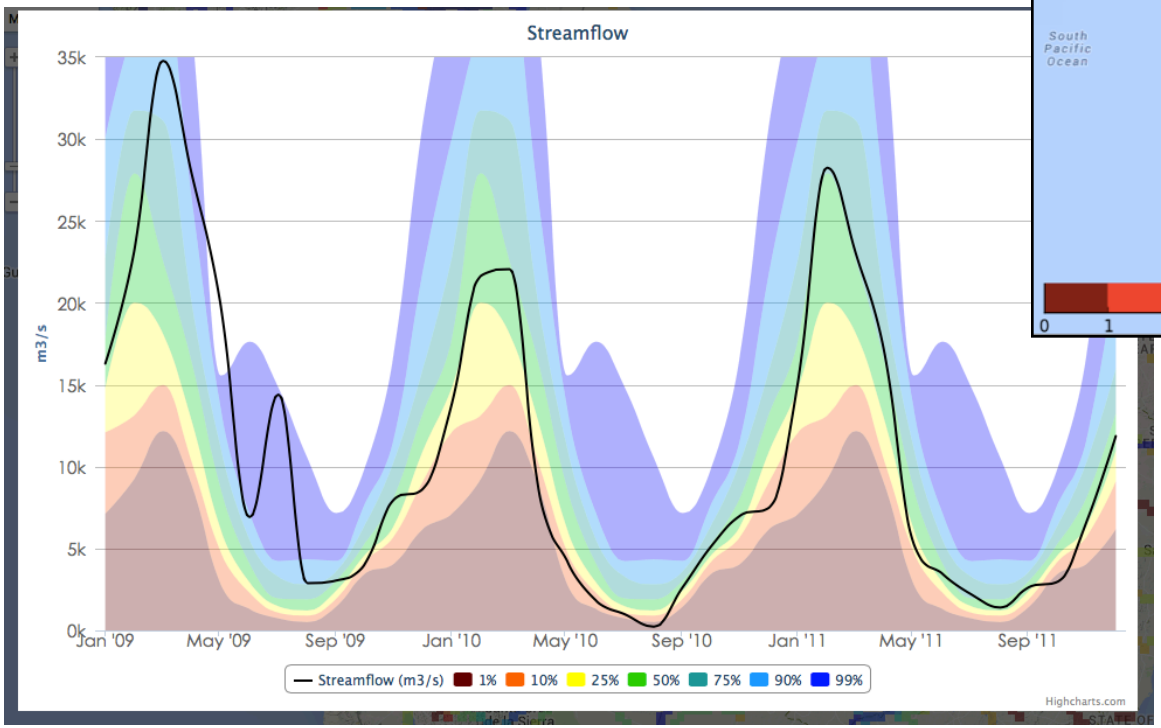


- Use the elevation data to delineate the basins (HydroSHEDS - WWF).
- Determine the path that surface runoff and baseflow from each grid cell follow until reaching the stream gauge.
- For each grid we essentially add up the contributions at that time step from all grid cells.

Simulate Discharge: Routing Model

Ultimately, we produce gridded estimates of discharge that can easily be viewed as time series for a single grid

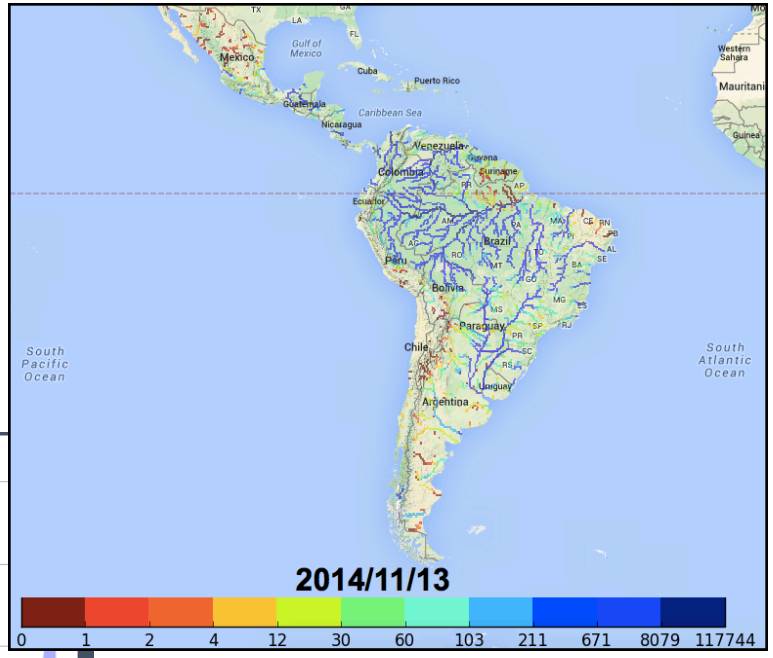


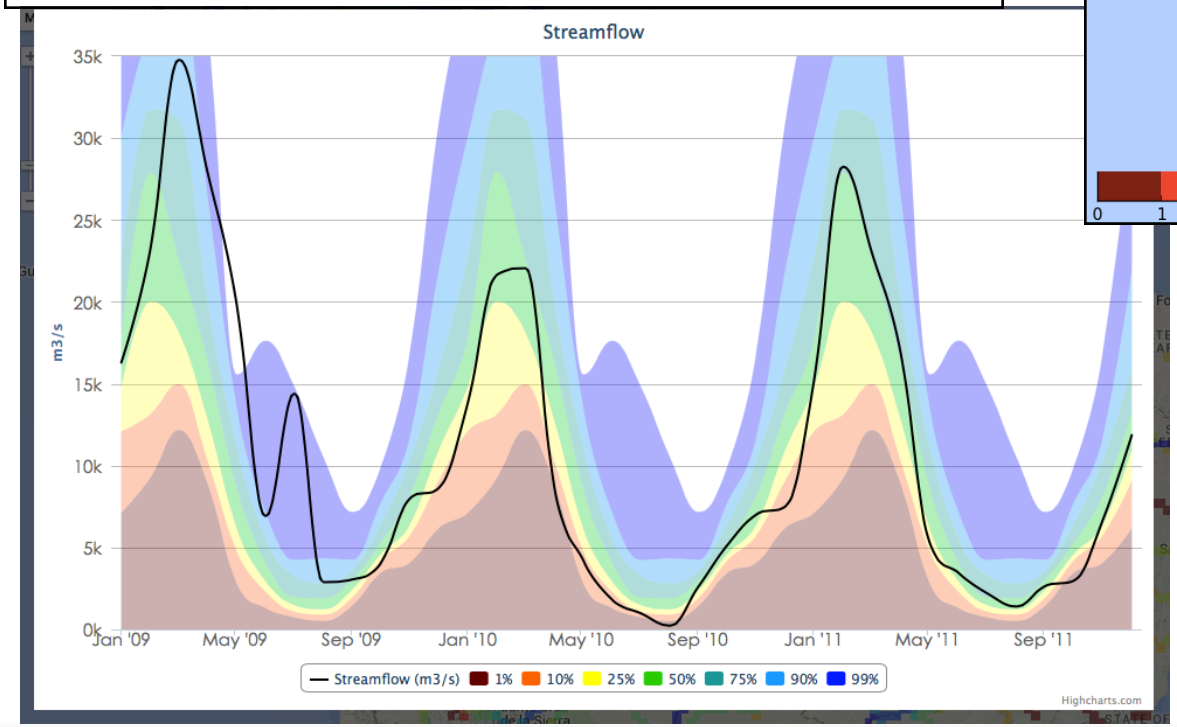


Simulate Discharge: Percentiles

Streamflow Percentiles- *Measure of the severity of hydrologic drought; low values indicate drought conditions.*

- Gridded estimates of discharge that can easily be viewed as time series
- Percentiles derived from historical VIC model runs

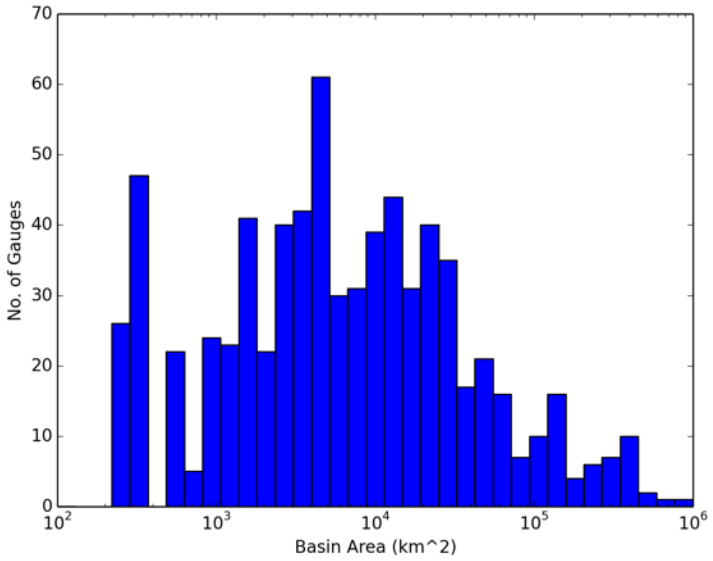




Validation: Grid Cell Runoff Observations

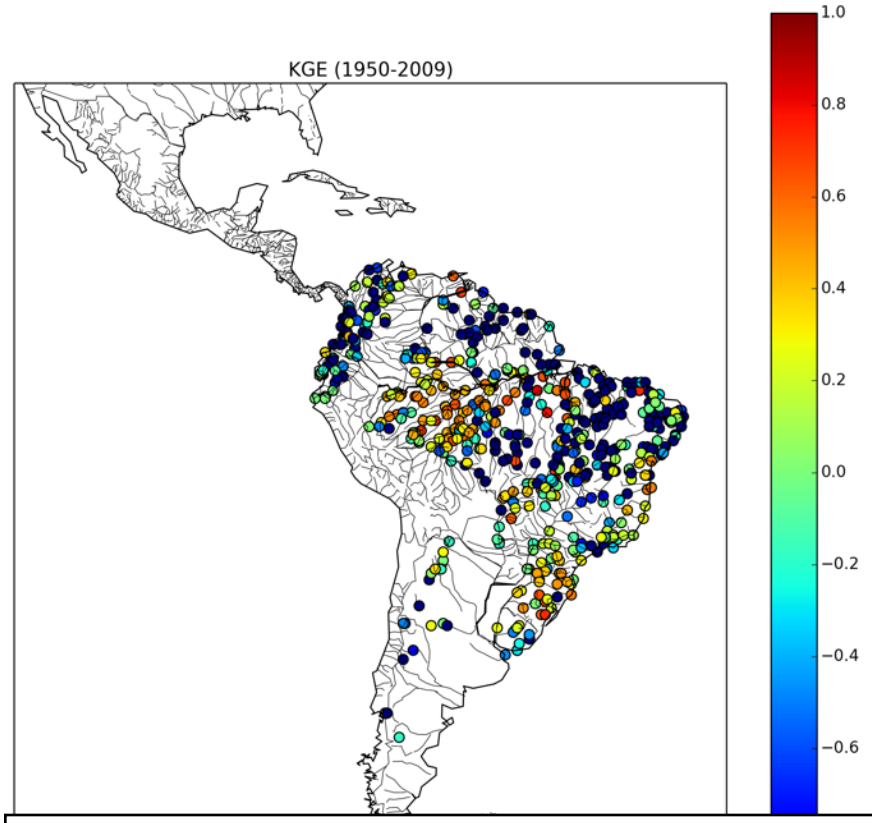
Validate the model against discharge observations

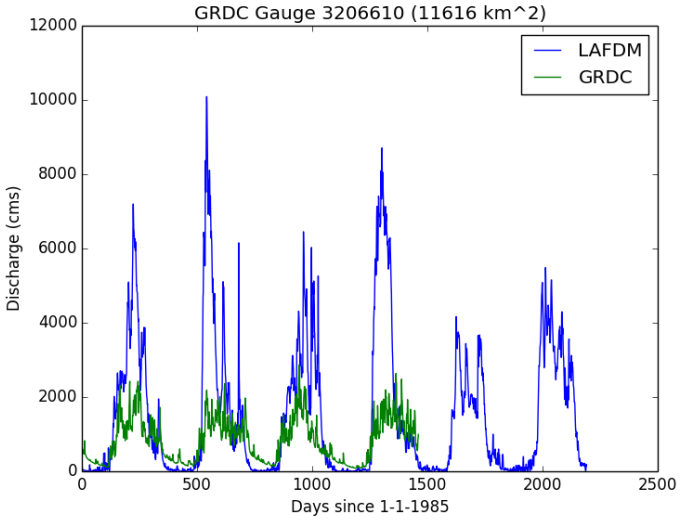
- GRDC (Global Runoff Data Center) database (1950 – 2010)
  - The points represent stream gauges.
  - Each stream gauge has a corresponding catchment.
  - Data is available in both monthly and daily forms

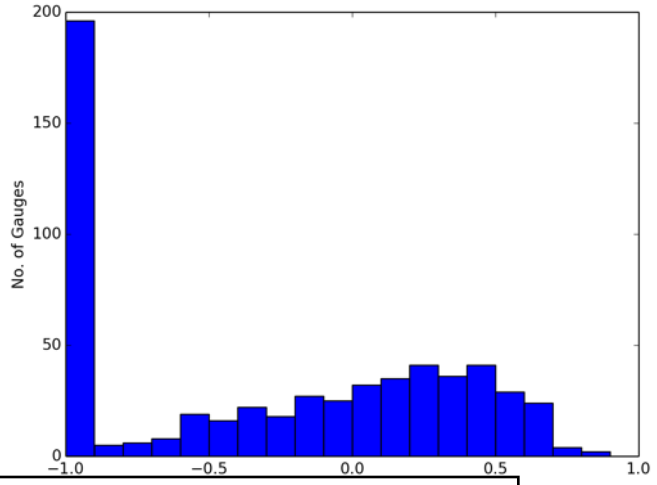


Validation of the Land Surface Model

Kling-Gupta Efficiency:
Measure of the correlation, bias and variability of model, 1 is perfect, <0 means the mean is better



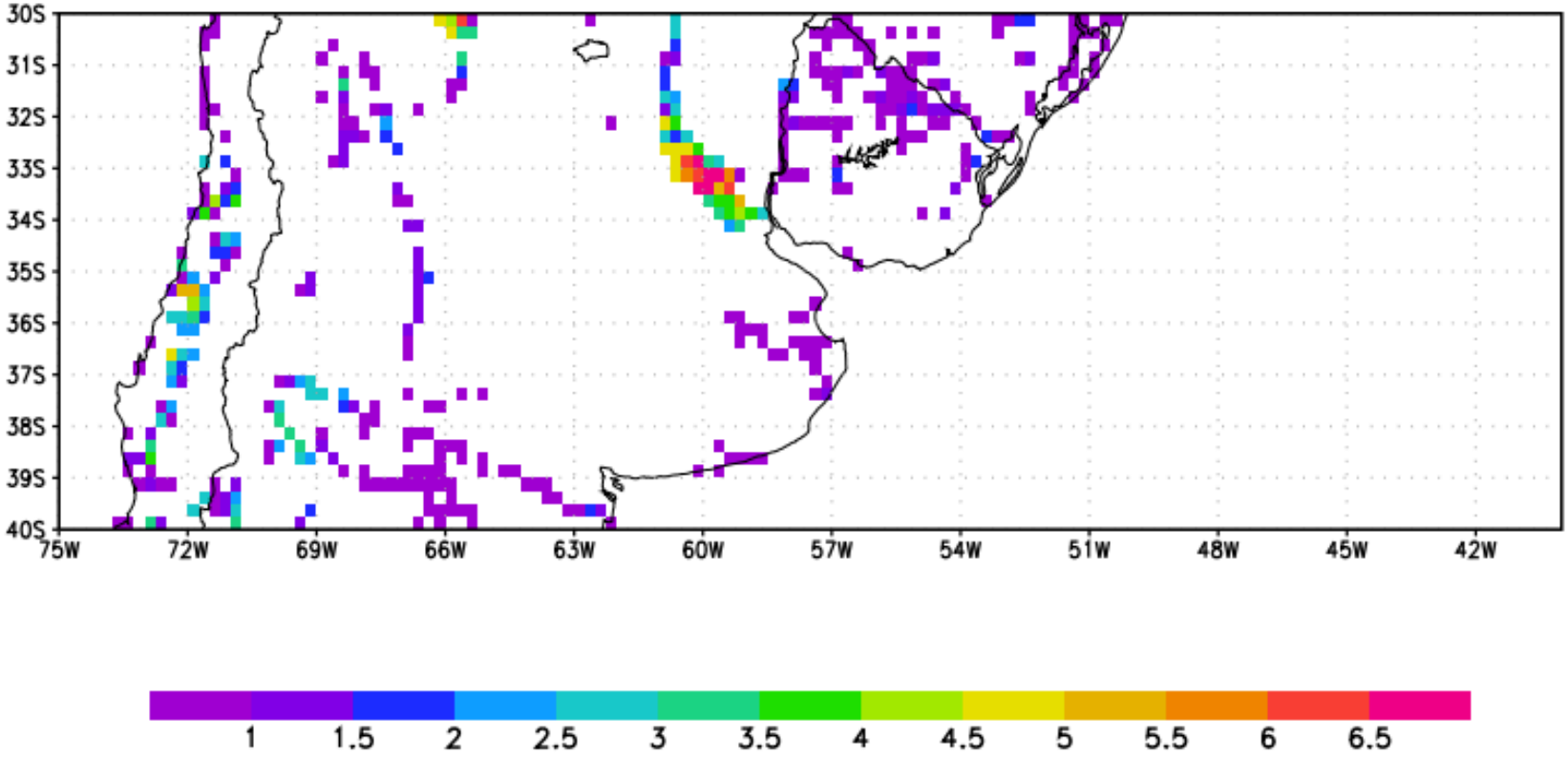




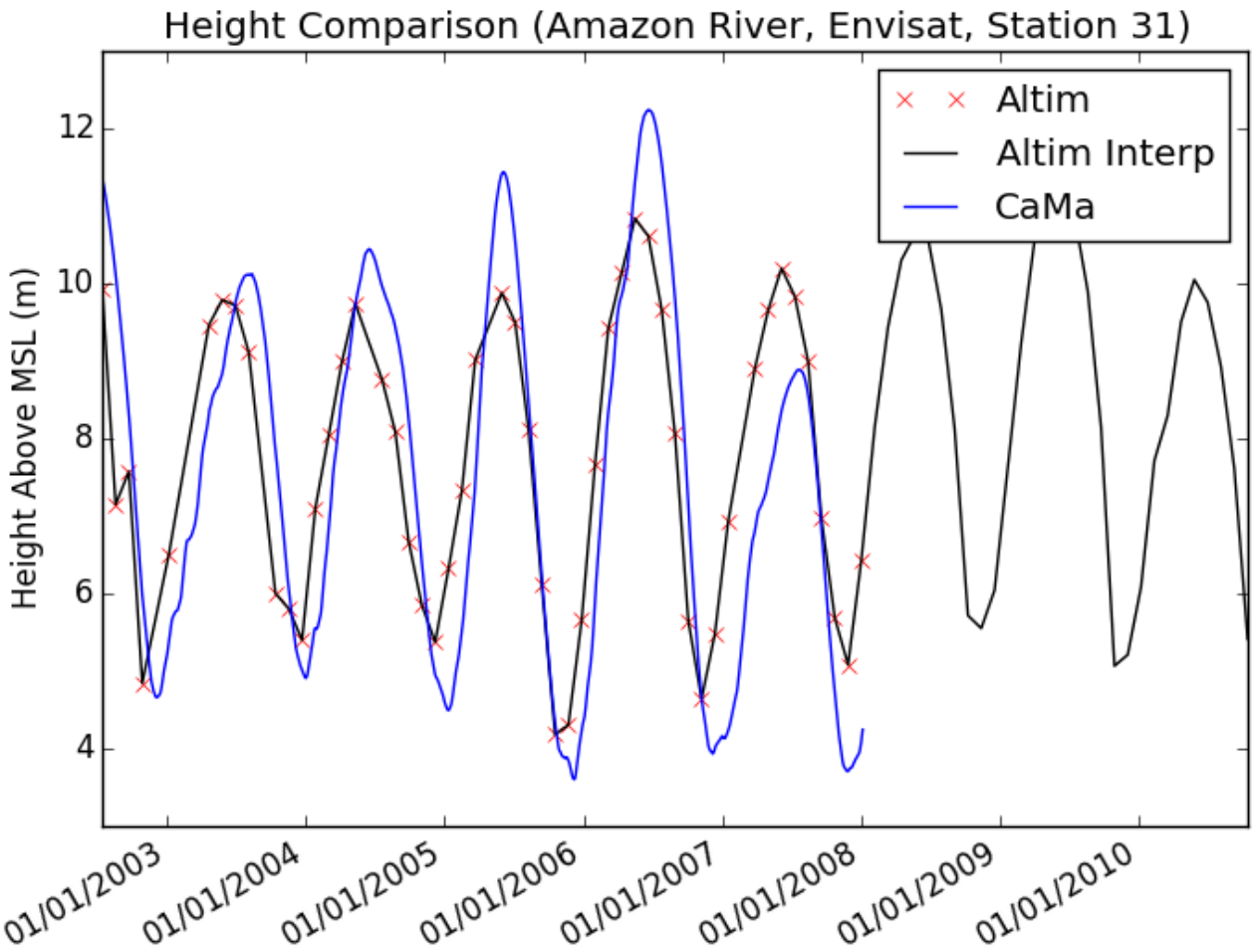
Future calibration may improve the land surface model's ability to reproduce measured discharge. Additional gauges will also be useful.

More Detailed Data Products

Floodplain Flow Depth (m) during May 23, 2008 flooding in Chile
We are able to see some evidence of flooding at coarse resolution. Color indicates height above the river top. More could be gained at a higher model resolution (see last slide)

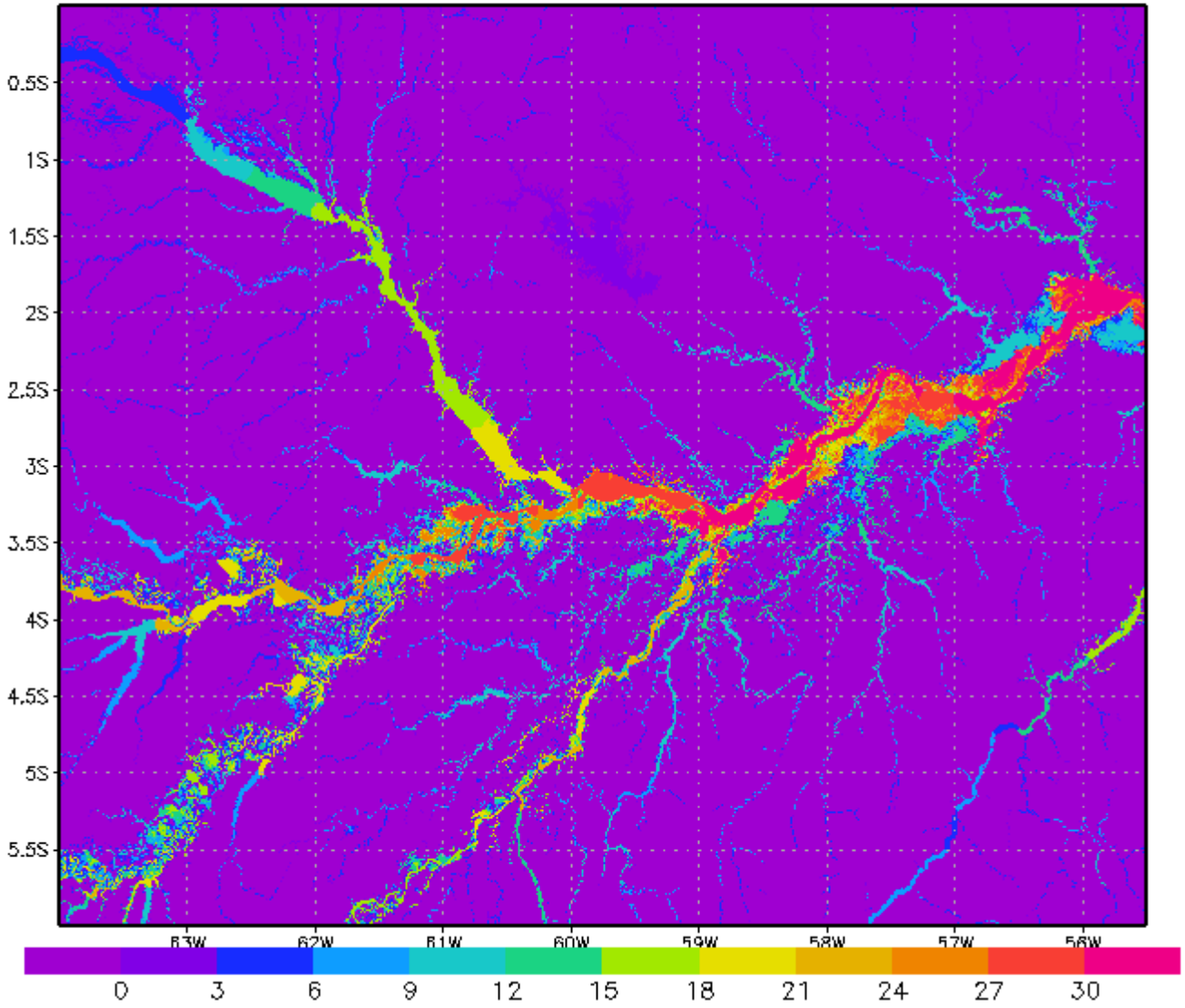


Altimeter Comparisons

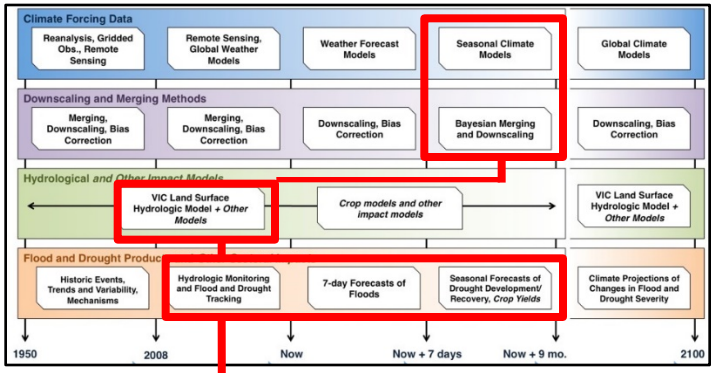


Downscaled Water Surface Elevations

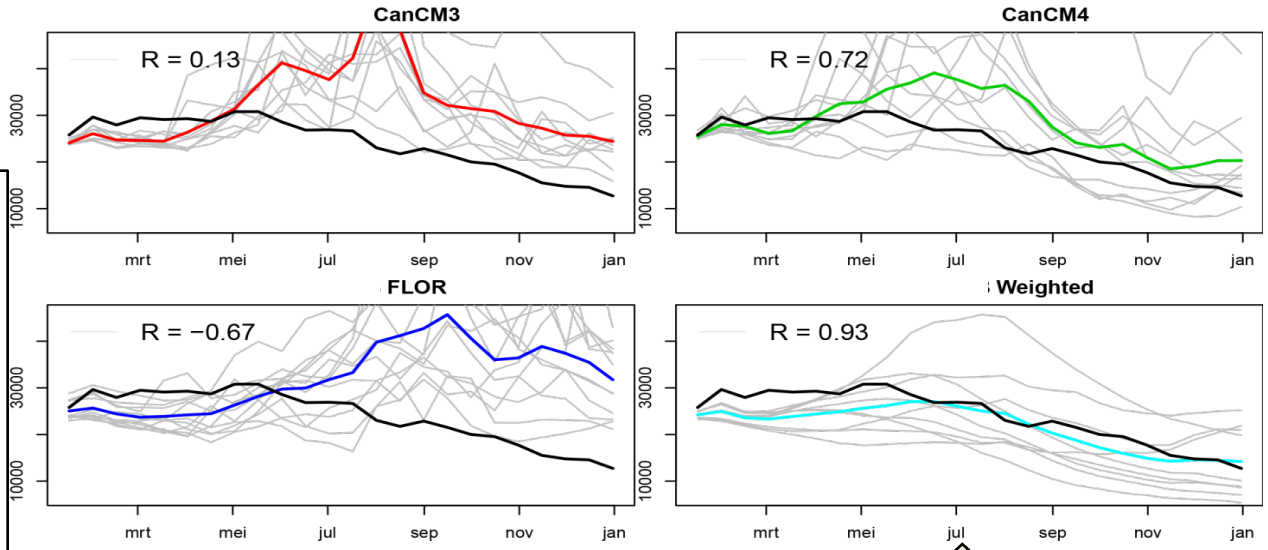
River Levels (m) for the Amazon near Manaus at 500m res. (daily)



Seasonal Forecasts of Flooding:



Seasonal forecasting of Mississippi River Flows (initialized Jan 1, 1997) using three seasonal climate models (CanM3, CanM4 and FLOR) and our optimally weighted multi-model seasonal forecasts.



Example Applications
- Reservoir management
- Energy management
- Crop forecasting
- Irrigation water supply
- Recreation (summer/winter)
- Personalized climate data
- Snow-melt related water management

Initial Conditions

Sub-seasonal to seasonal forecasts

Land surface (hydrology) models

Discharge Forecast

Applications of the LAFDM:

- Download Tutorial from:

  http://www.cazalac.org/mwar_lac/index.php?id=129

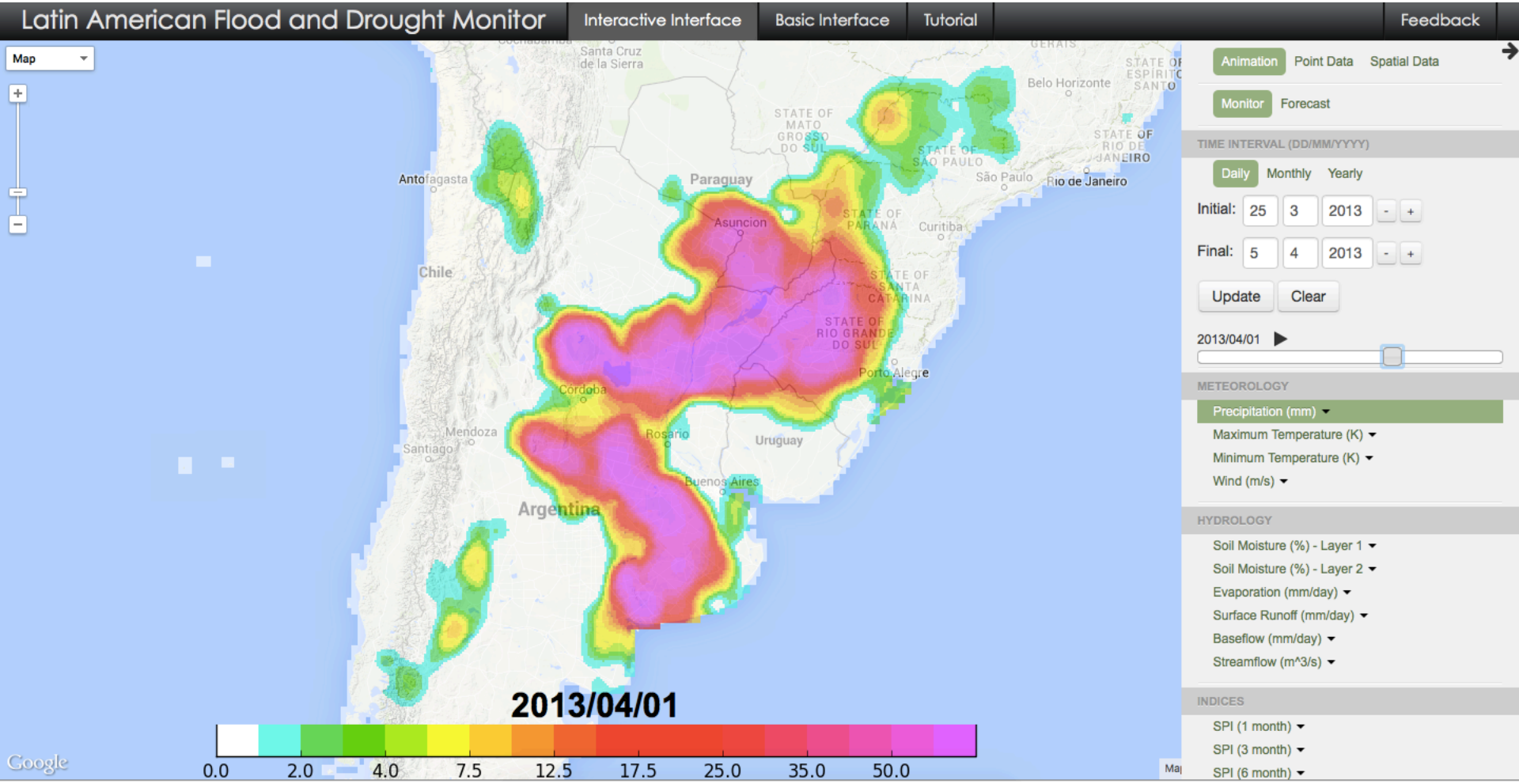
- Follow tutorial to learn all functions of monitor website

- Investigate flood events:
  - 2013, Early May – Argentina
  - 2008, Late May – Chile
  - 2015, Late March – Northern Chile
  - Any other event of local interest to you

- Consider streamflow, precipitation and SM impacts on flooding

- How can the monitor aid in forecasting flood events?

May 2013 - Argentina



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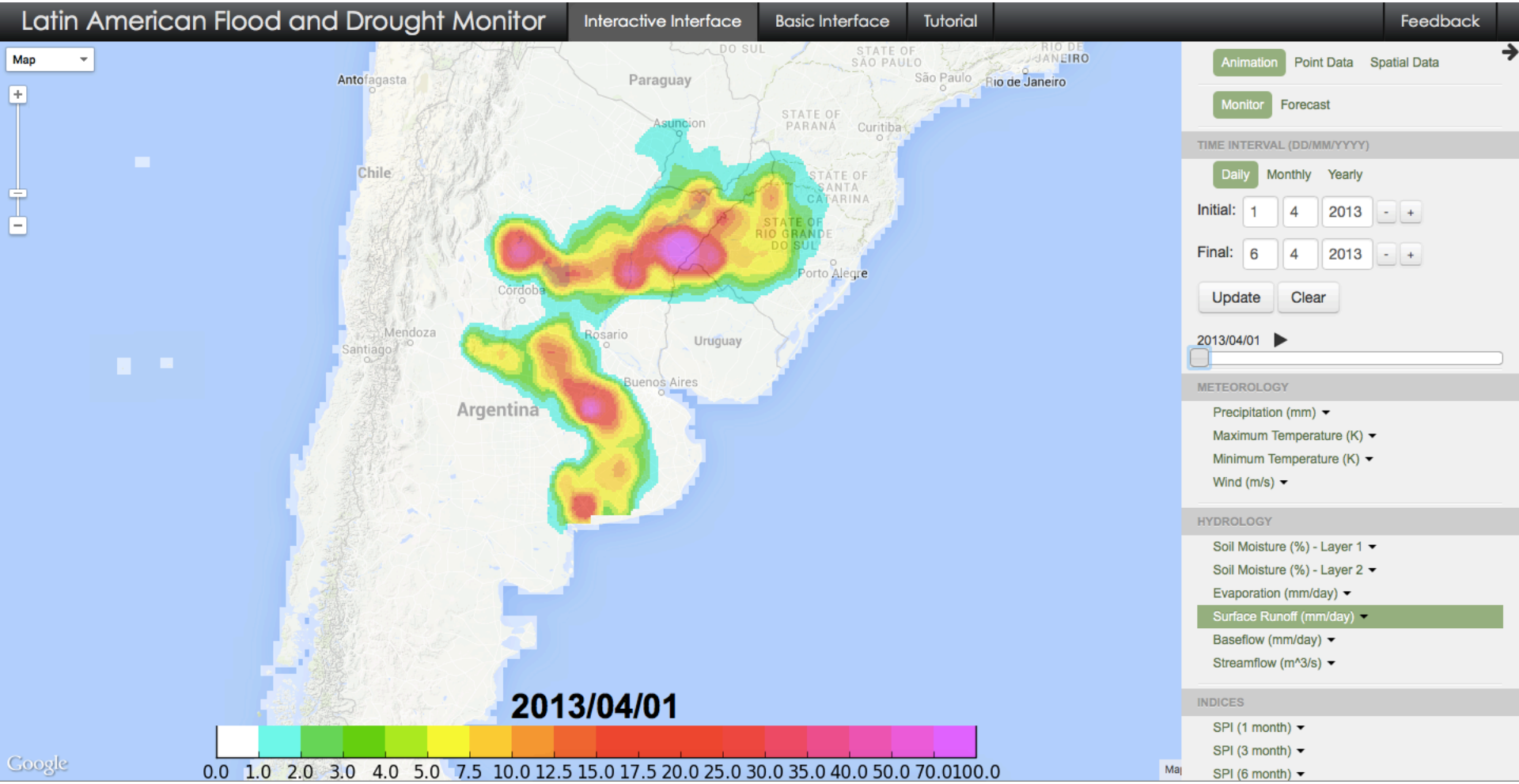

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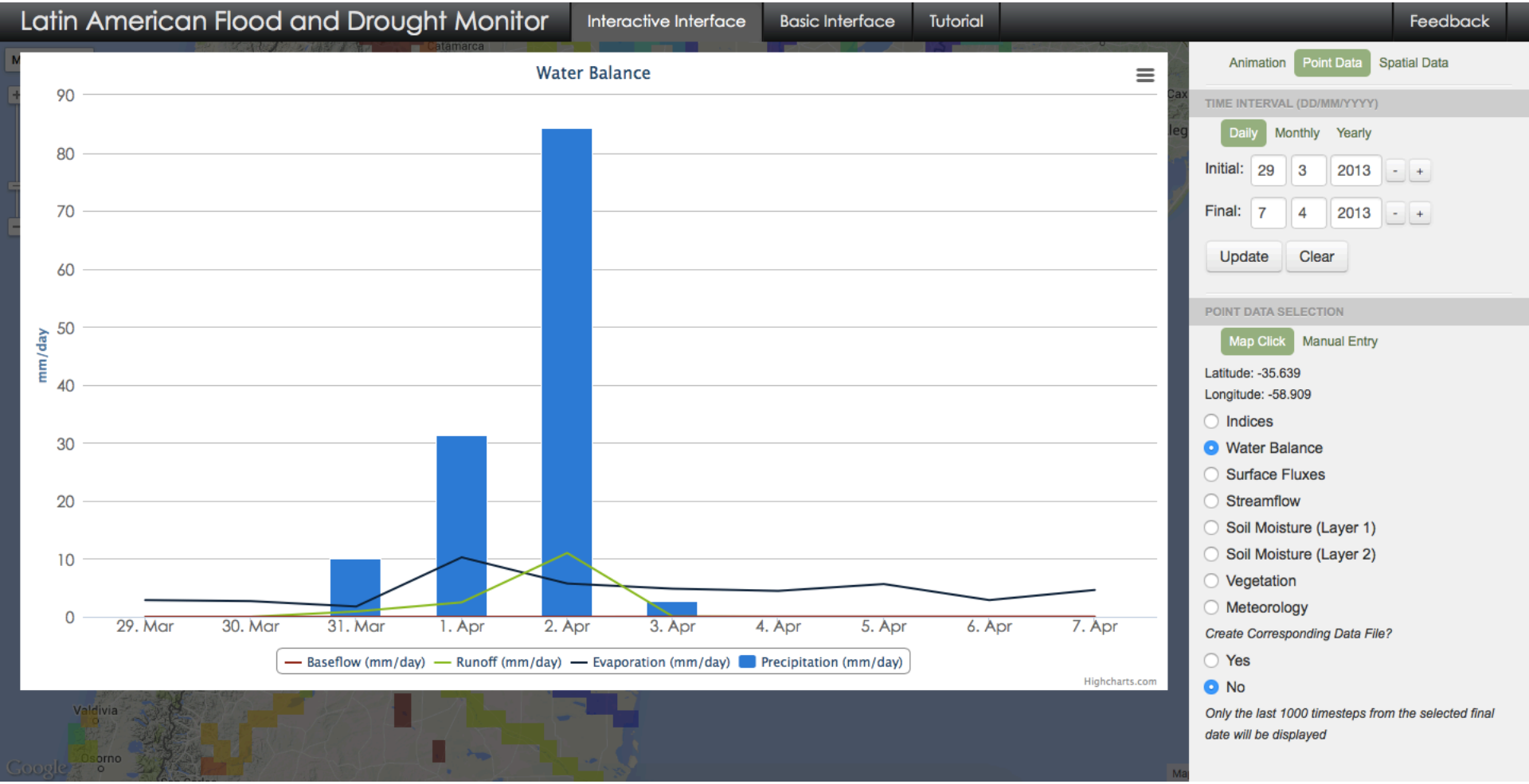

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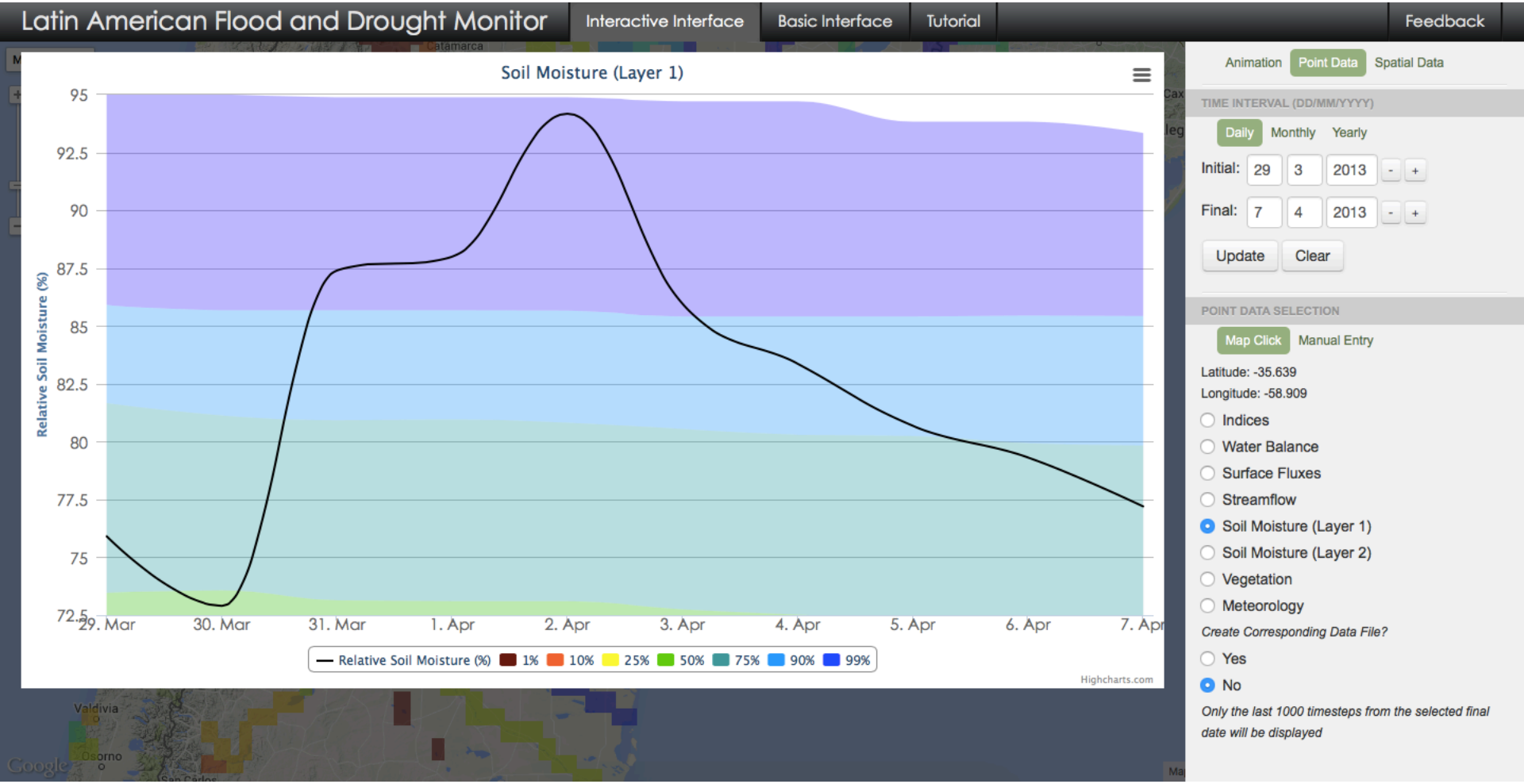

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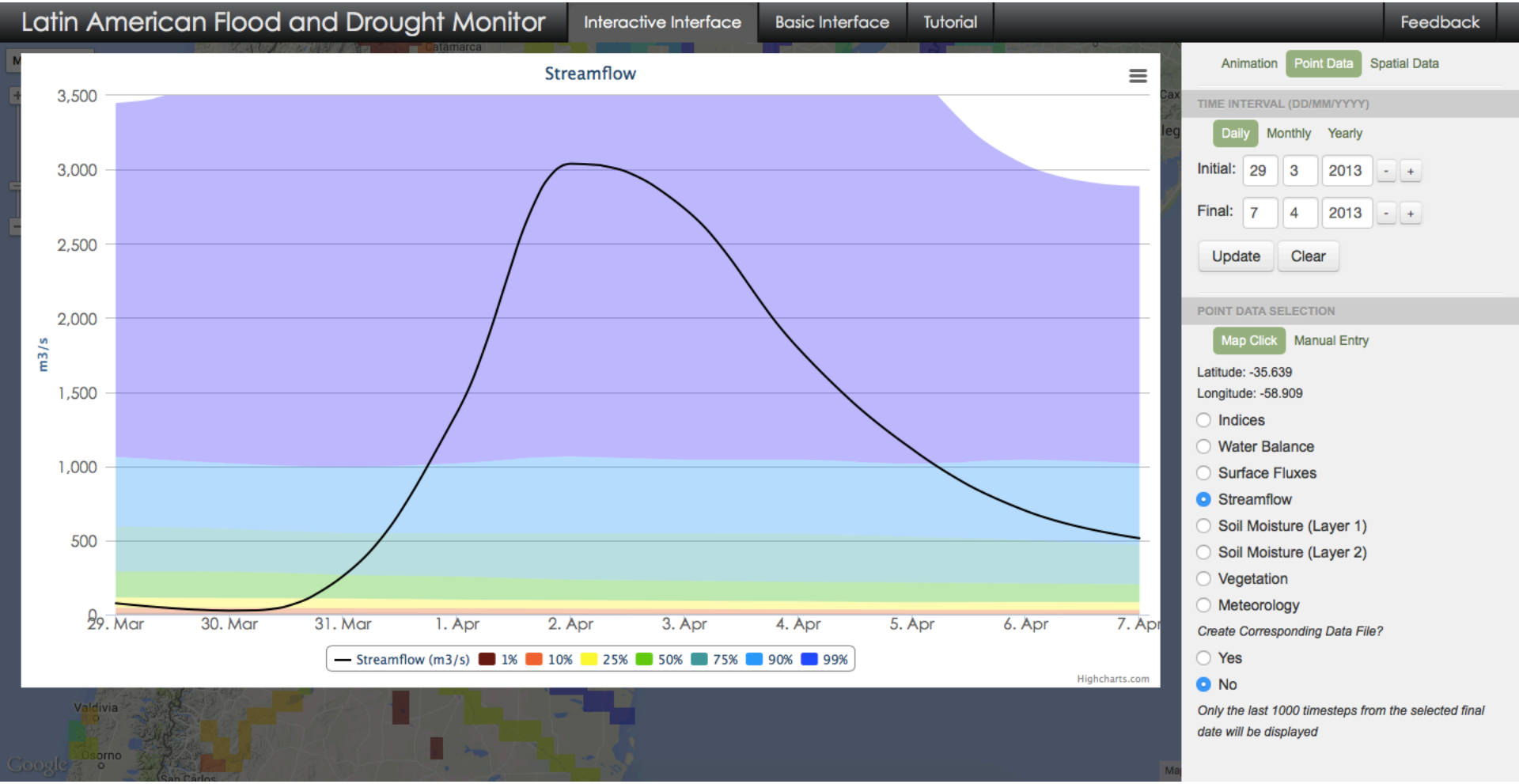
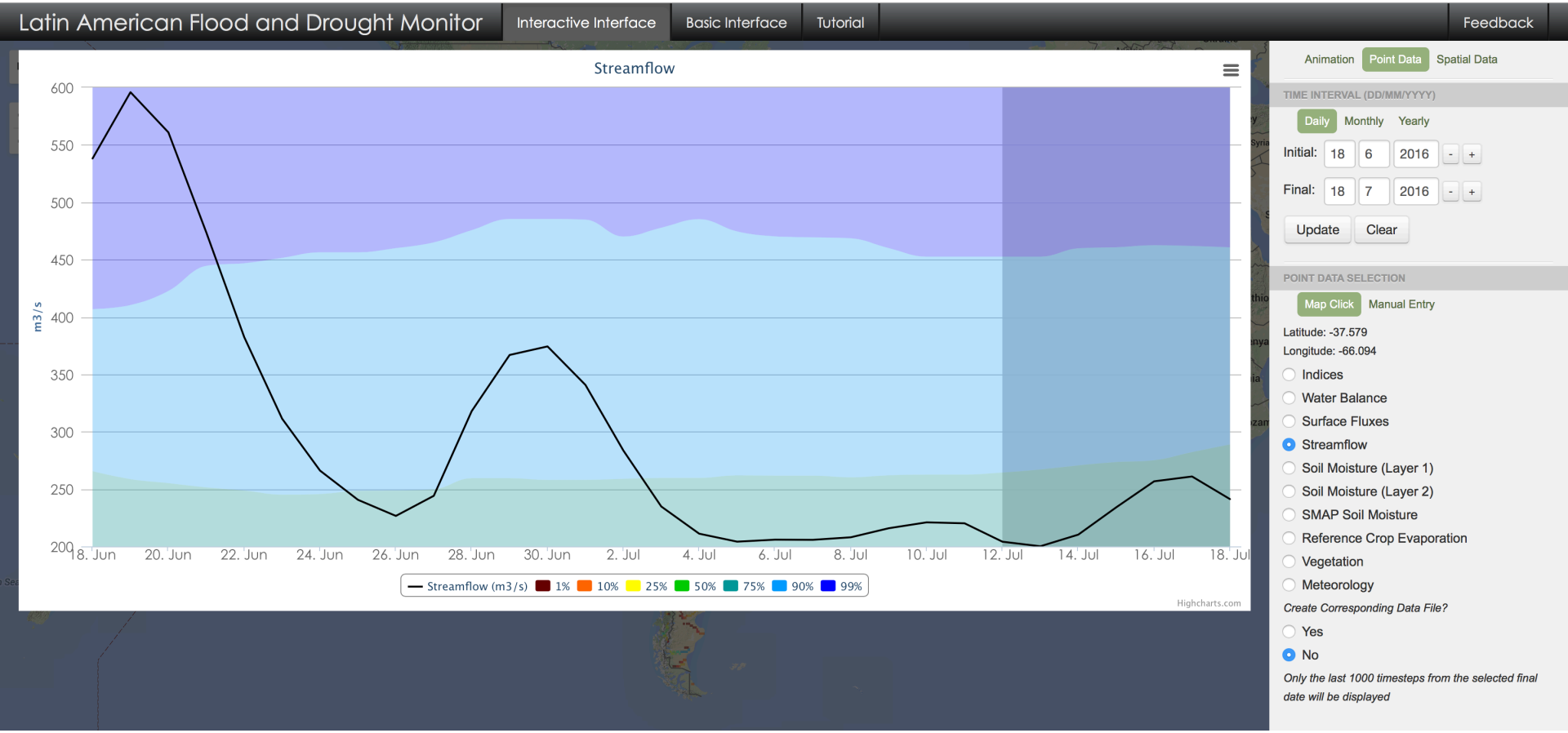


Streamflow Forecasts:



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Thank you for your attention!
Questions or comments?