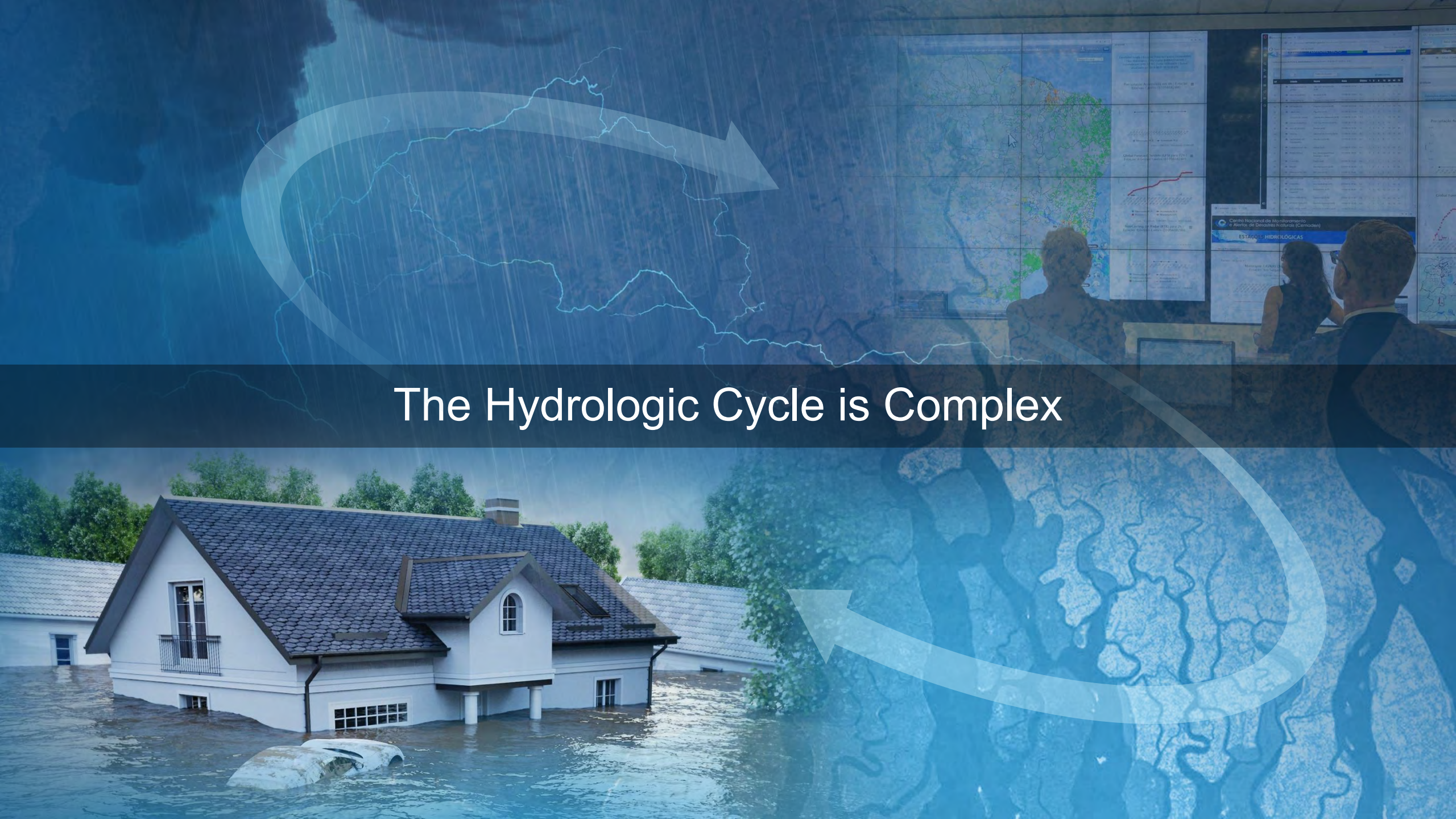
GEO GLOWS
GLOBAL WATER SUSTAINABILITY

Hydrologic Modeling as a Service: A New Paradigm in Streamflow Forecasting

Jim Nelson – Brigham Young University

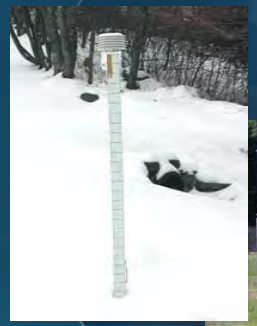


The Hydrologic Cycle is Complex

In Situ Streamflow Monitoring Systems

Water Quantity and Quality

Rainfall & Snow



Meteorology

Remote Sensing

Soil Water

Improving Water Intelligence…

- Understanding of the hydrologic system is incomplete
- Lack of information = Uninformed decisions
- It is our responsibility to find better solutions

Hydrologic Modeling Role

Understand

Predict

Manage

Hydrologic Model Development

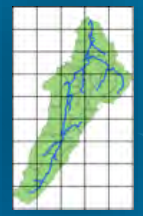
HydroMet Services

Local Governments

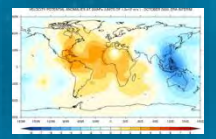
NGO's and GEO Partners

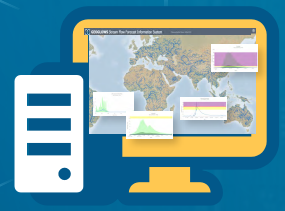
Land Use and Soils

Watershed Delineation



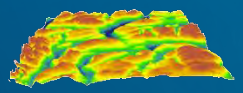
Precipitation

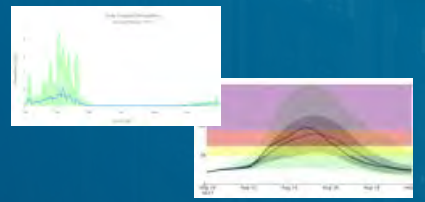




Observations

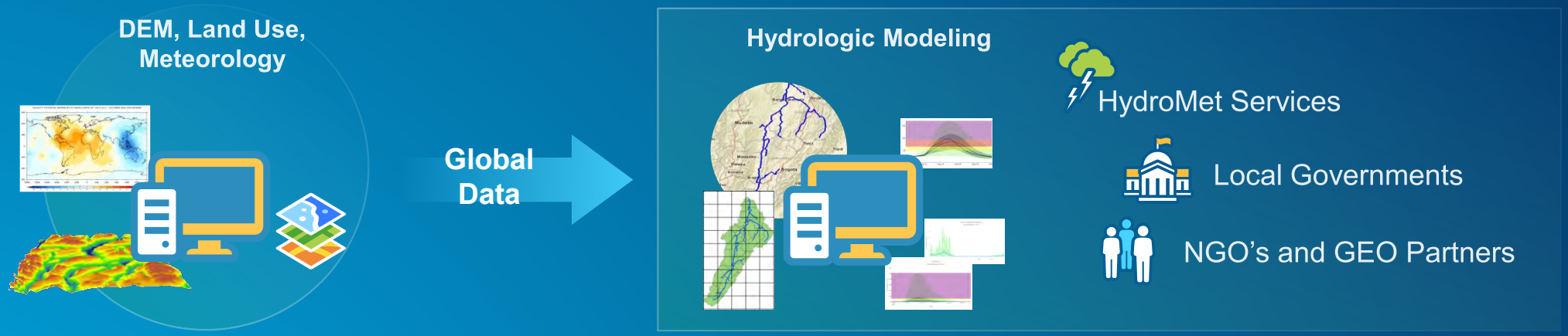
DEM



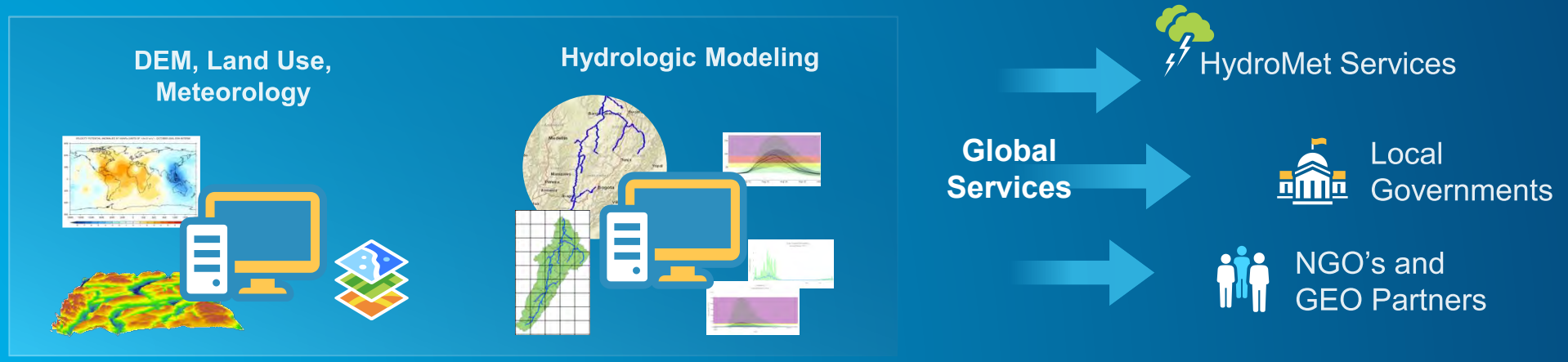


A Paradigm Shift – Disruptive Technologies that Enable

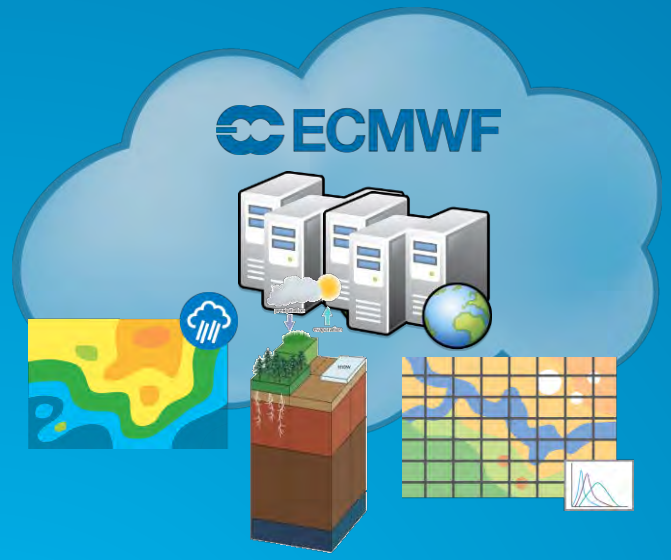
PAST – Capacity to build models/workflows and create actionable information

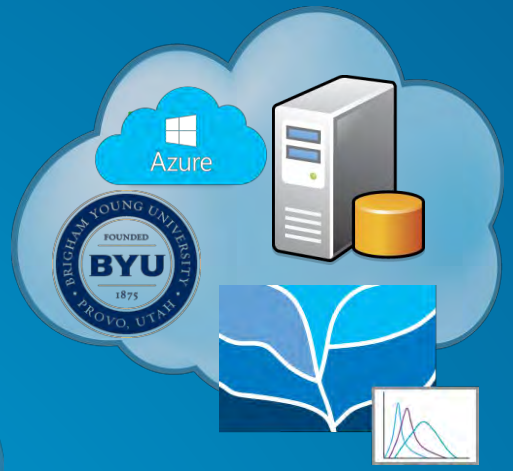


CURRENT – Capacity to use actionable information from trusted/proven models/workflows

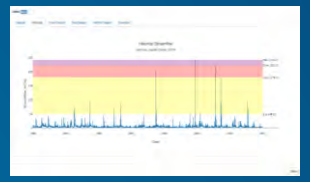


GEOGloWS ECMWF Global Streamflow Services

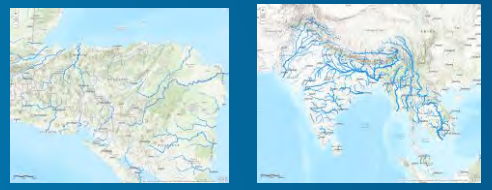


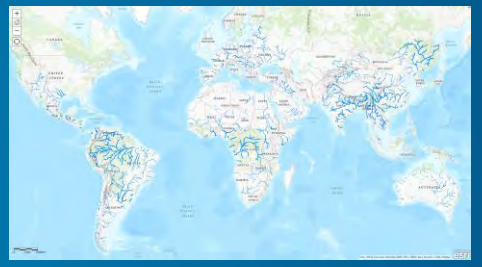


Web Services



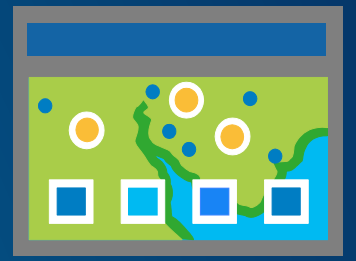
Streamflow API at Azure

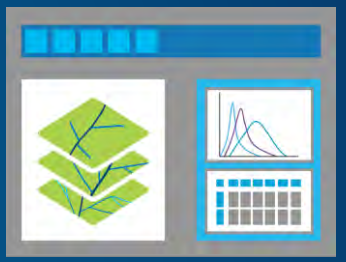




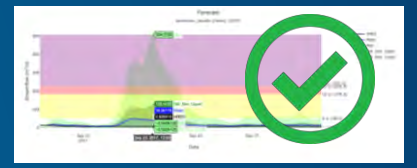
Global WMS at Living Atlas

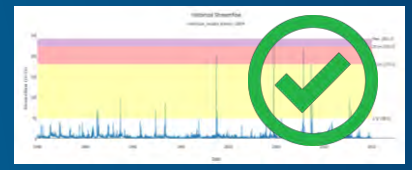
Custom Web Apps





Overcoming Global Modeling Barriers





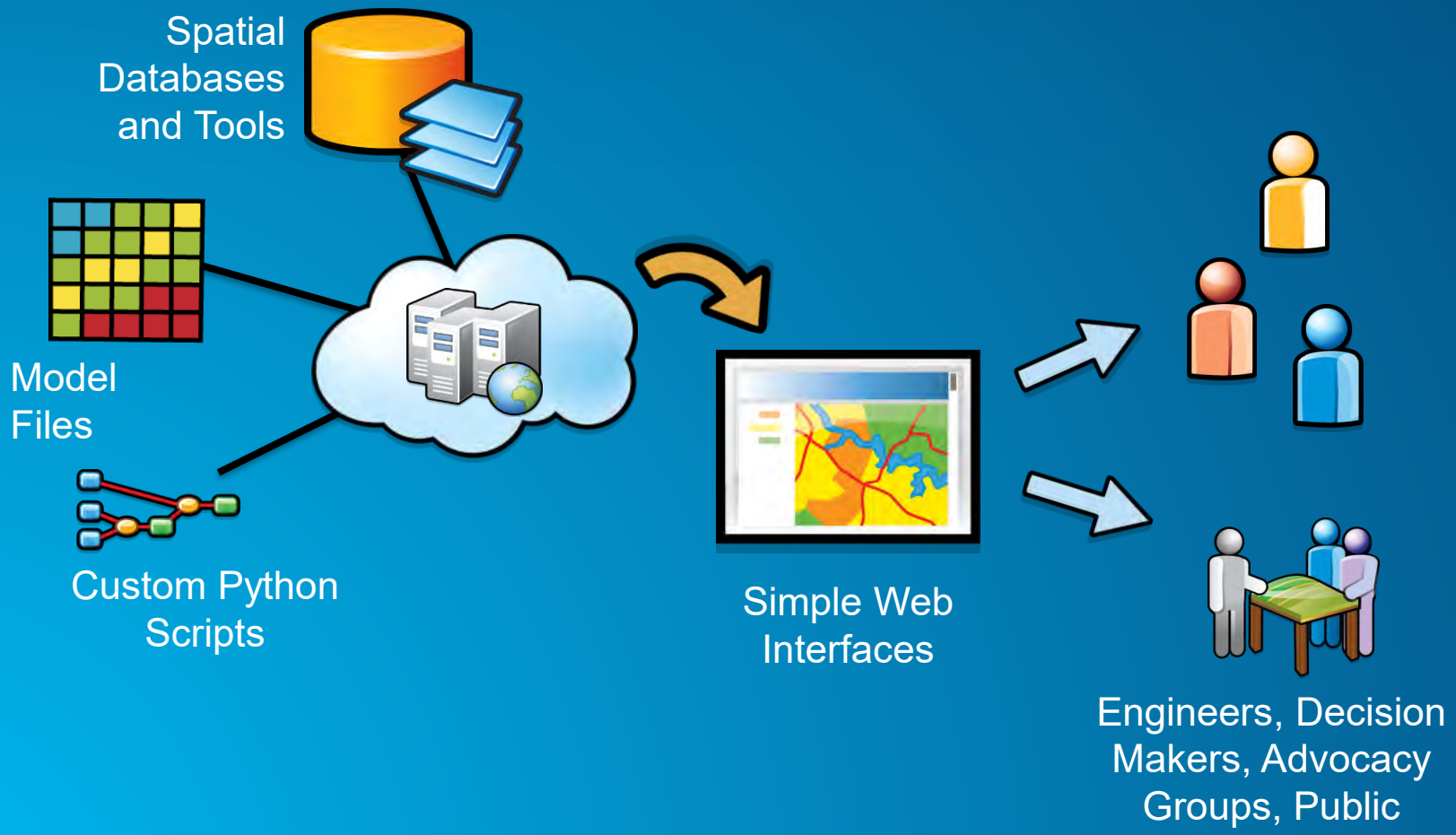
Cyberinfrastructure and Workflows

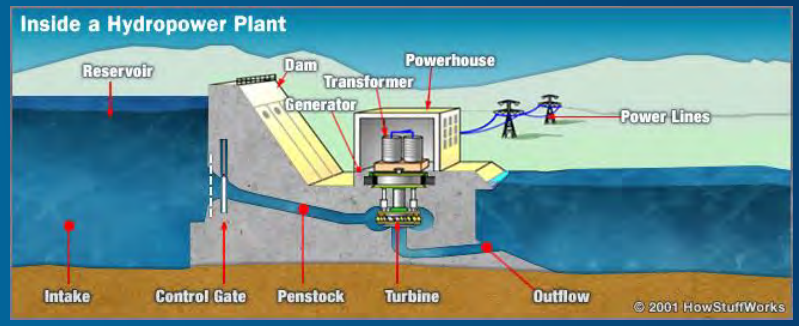
Web apps and web services

Partnerships, trainings, and collaboration

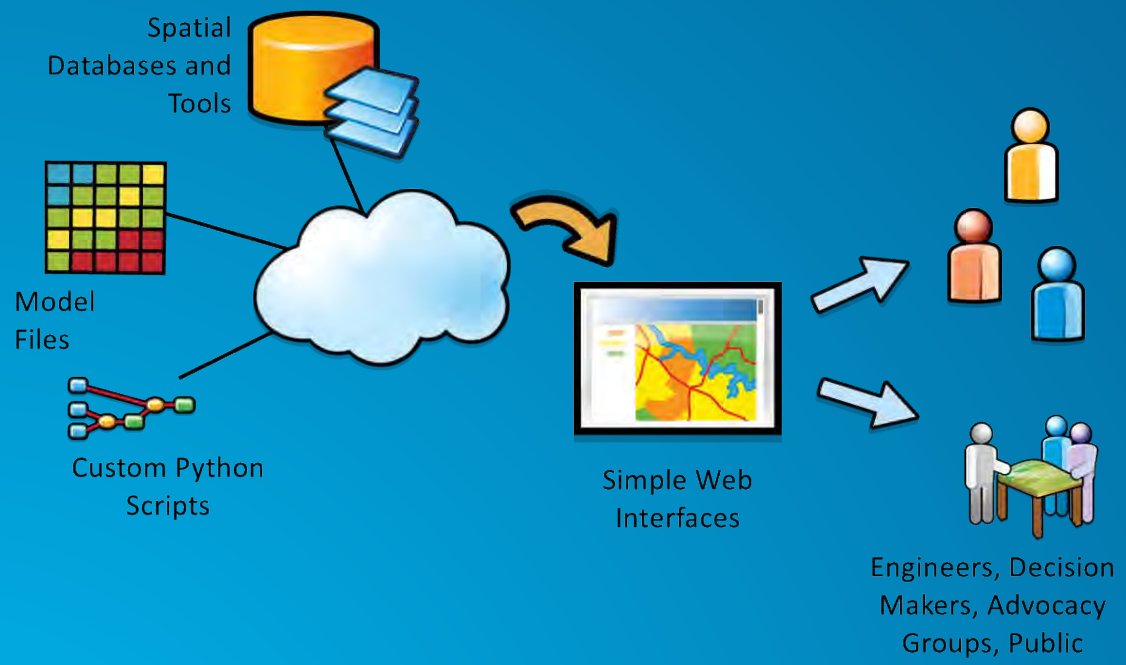
Accessibility tools and programmatic extraction

Web Service Enabling Technologies

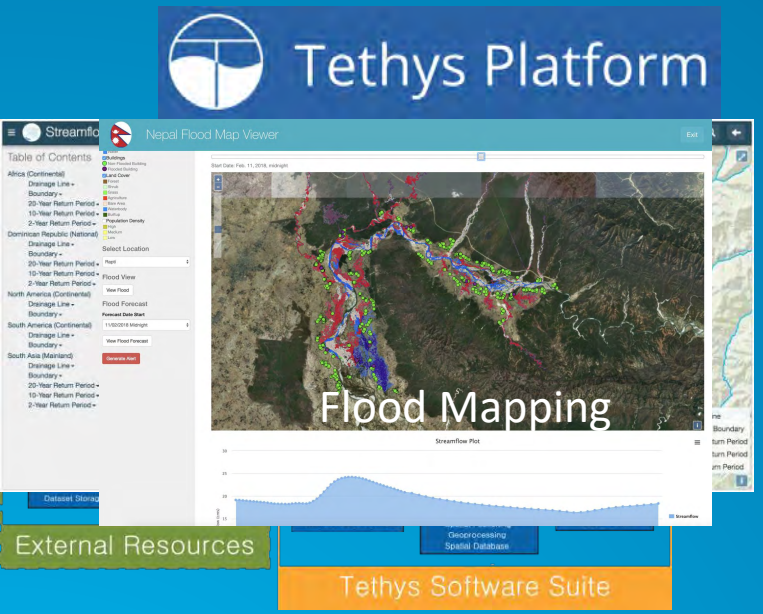


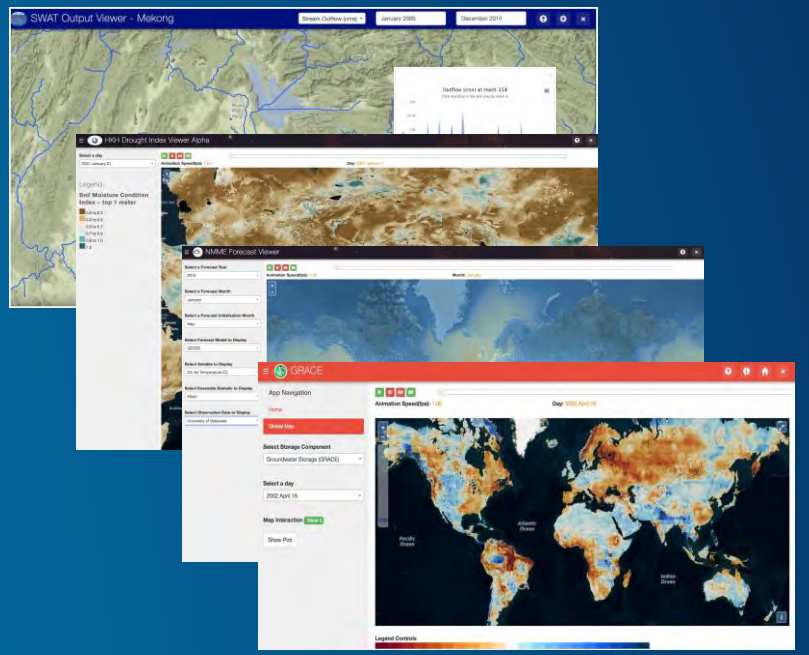


Tethys – Lowers Barrier for Web App Development

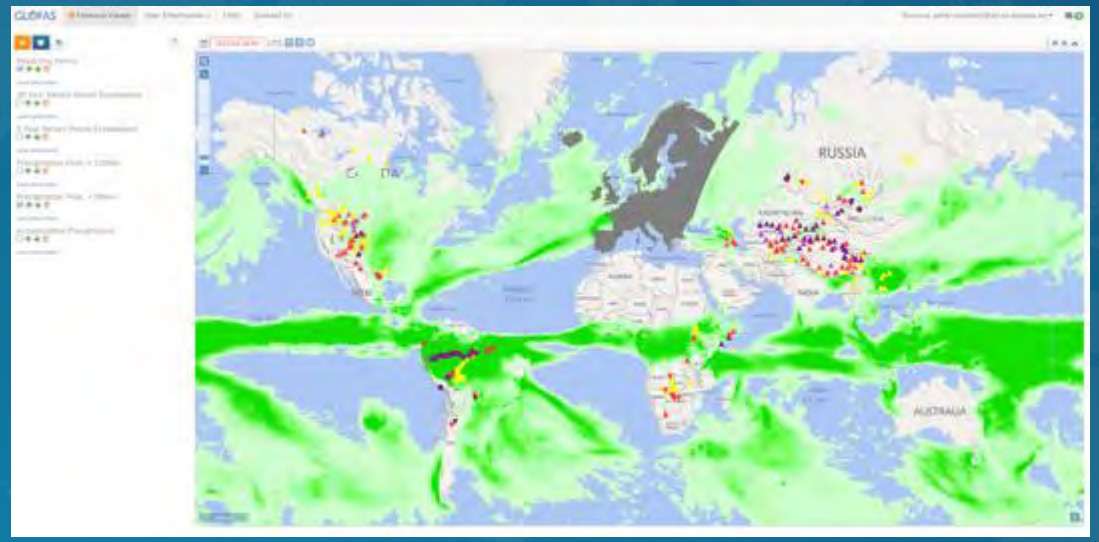


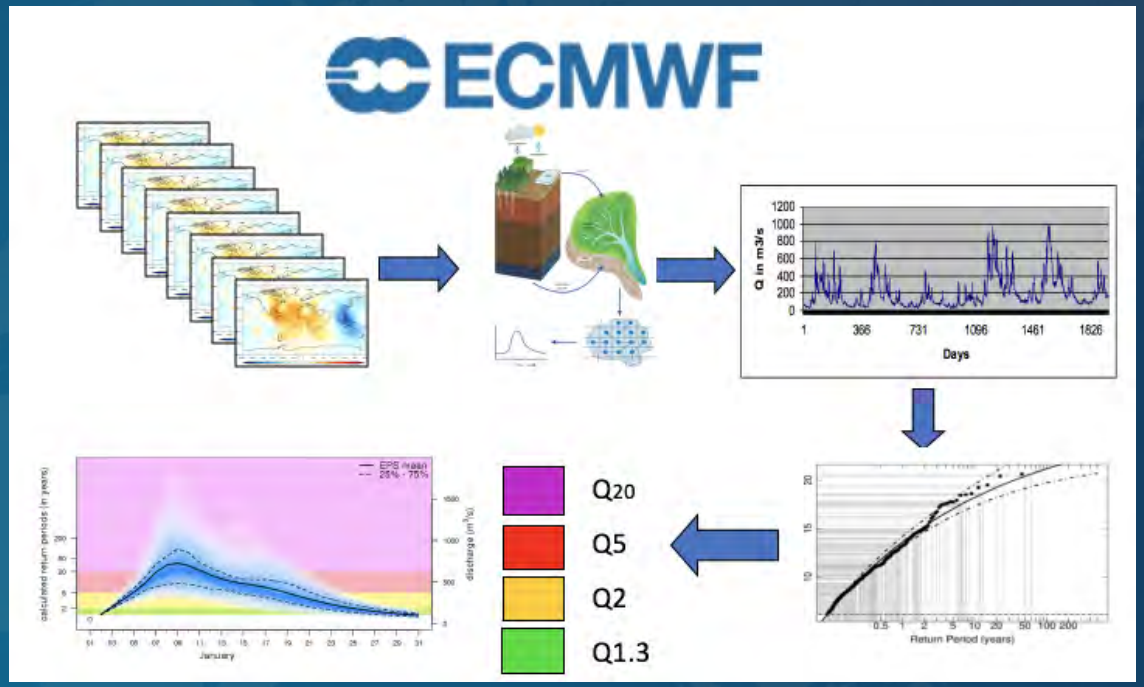
Tethys App Development for SERVIR - HKH

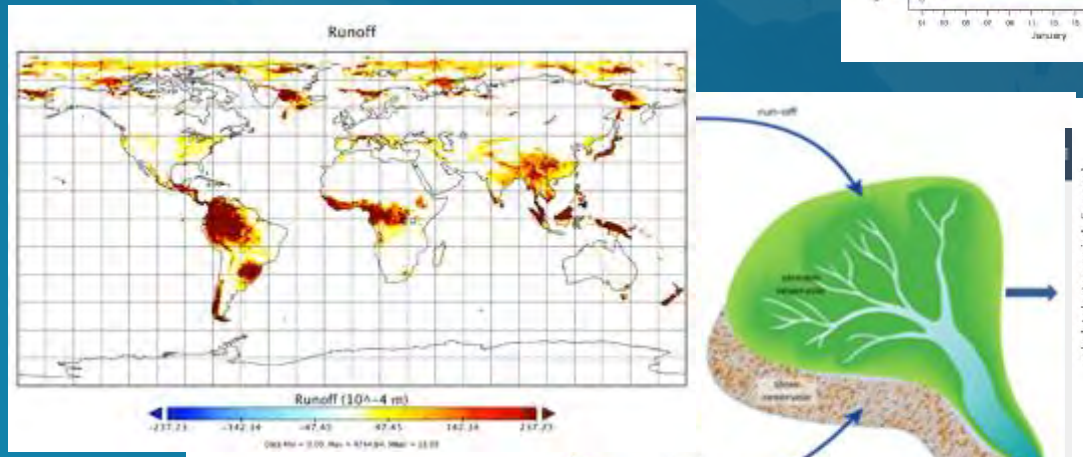


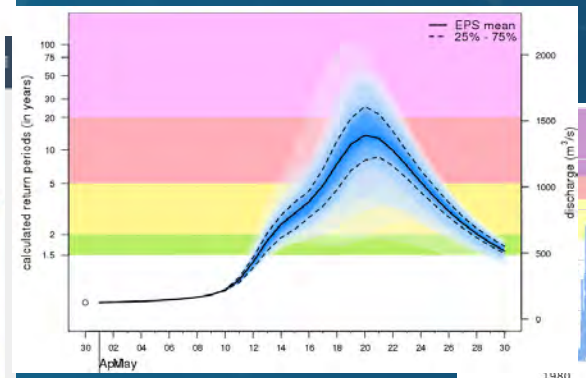


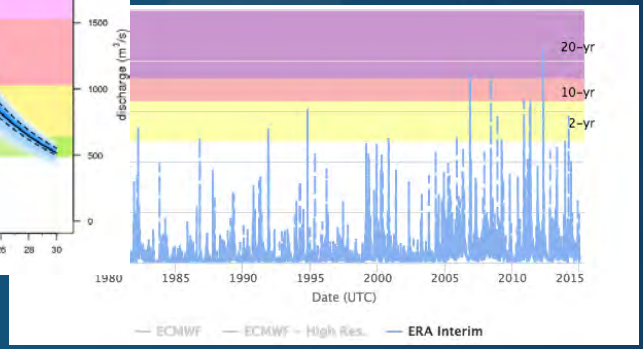
ECMWF – GloFAS Global Runoff Forecasting



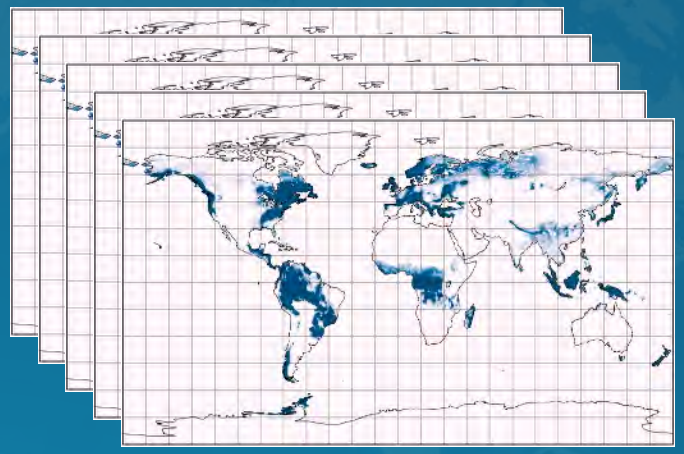






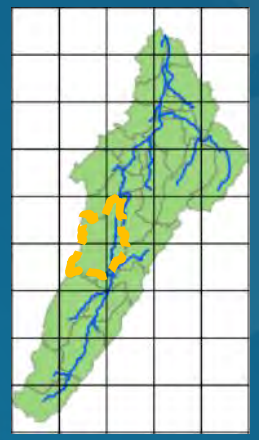


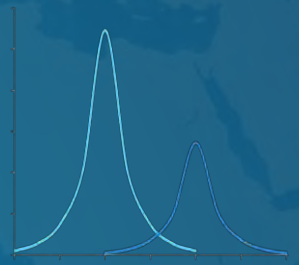
Historical Simulation

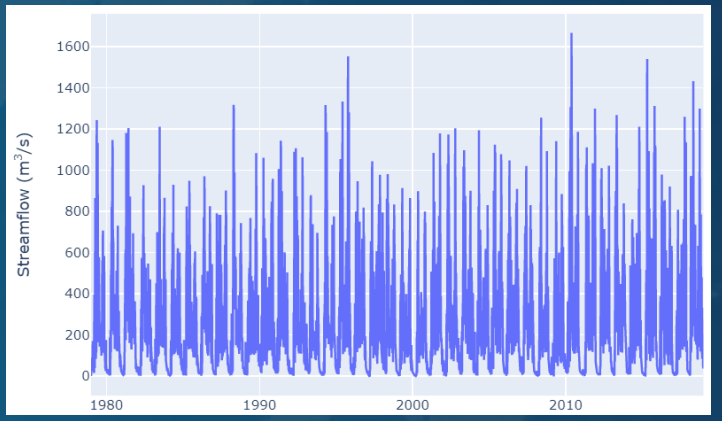


ECMWF

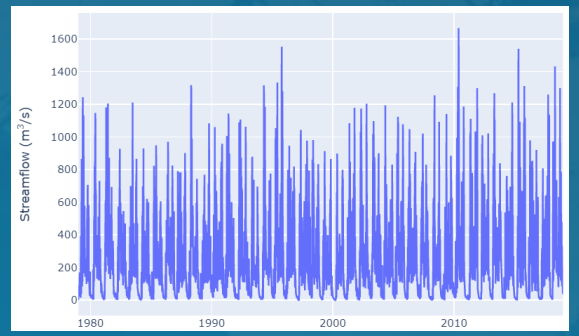
1979-2018

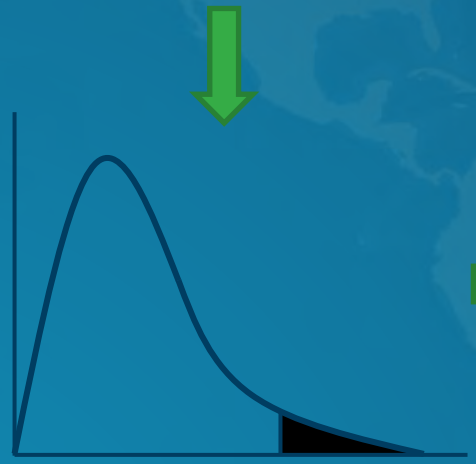




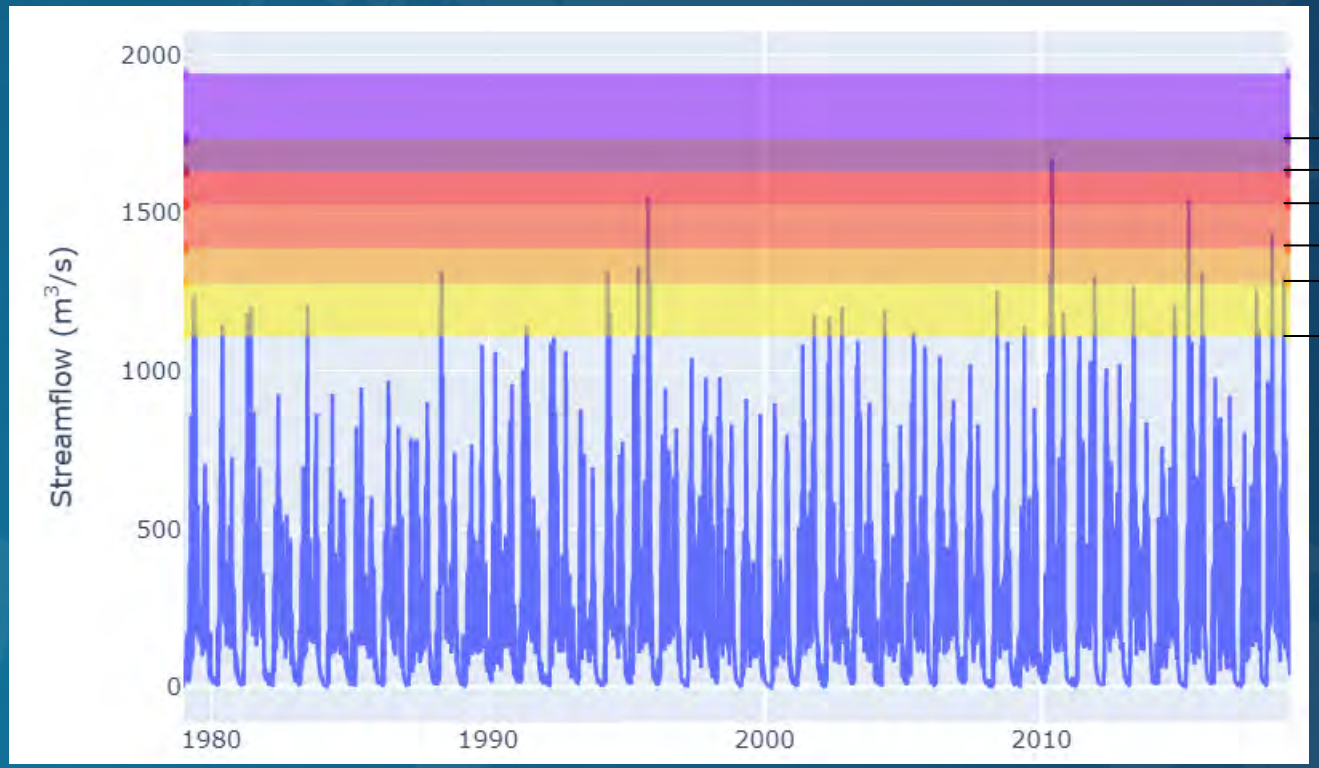


Return Periods

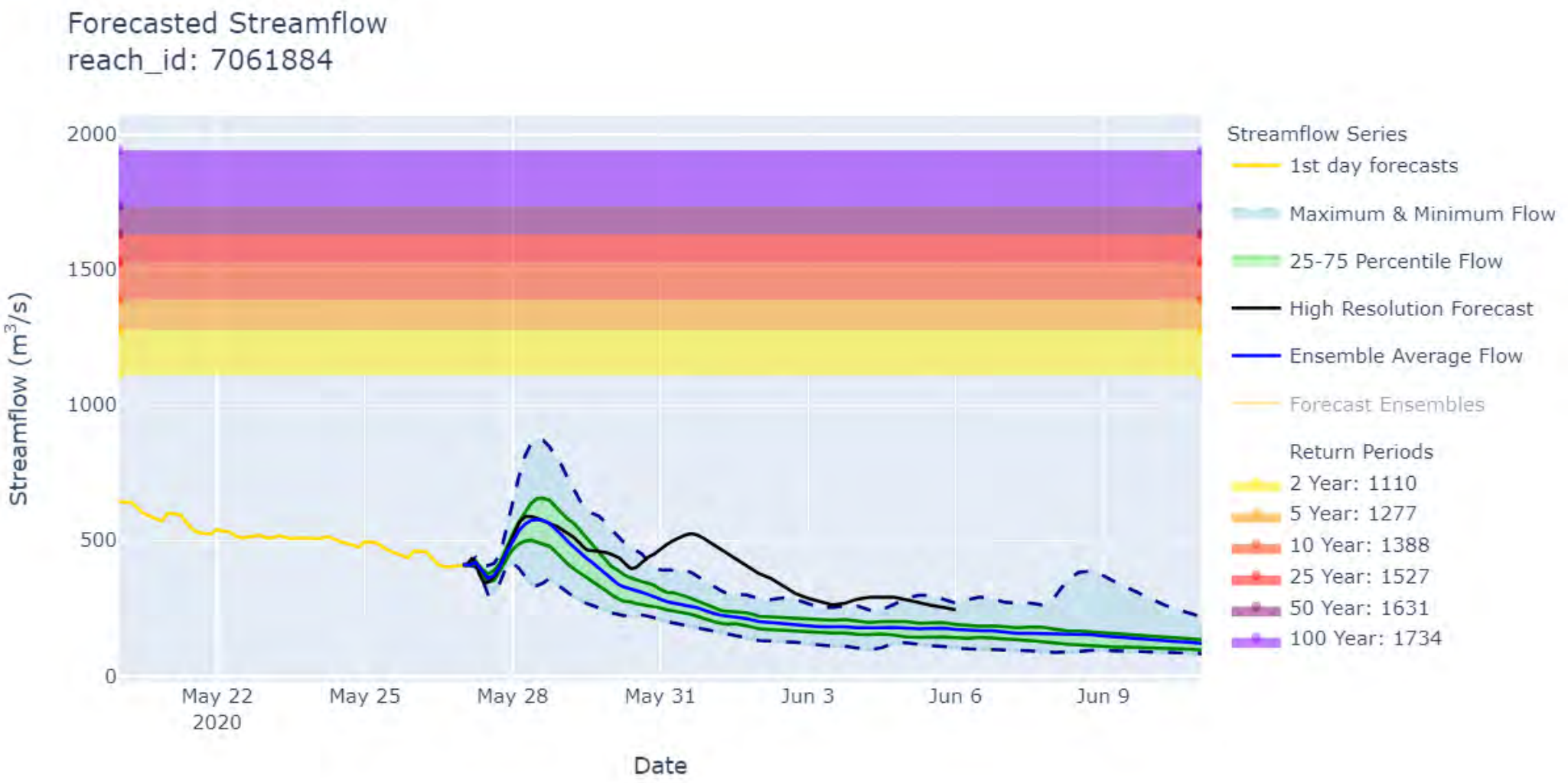




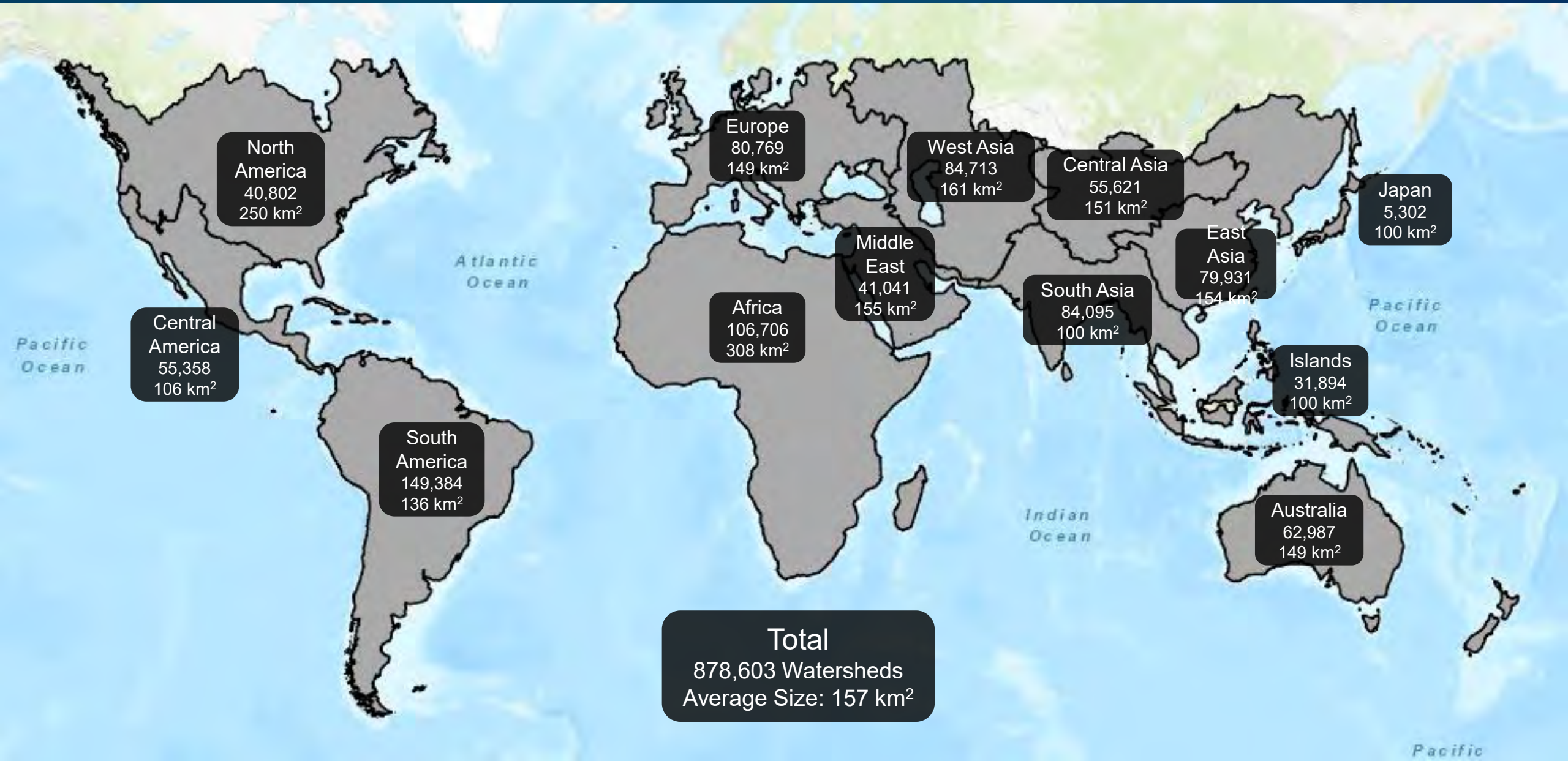
Gumbel Distribution



Streamflow Forecasts

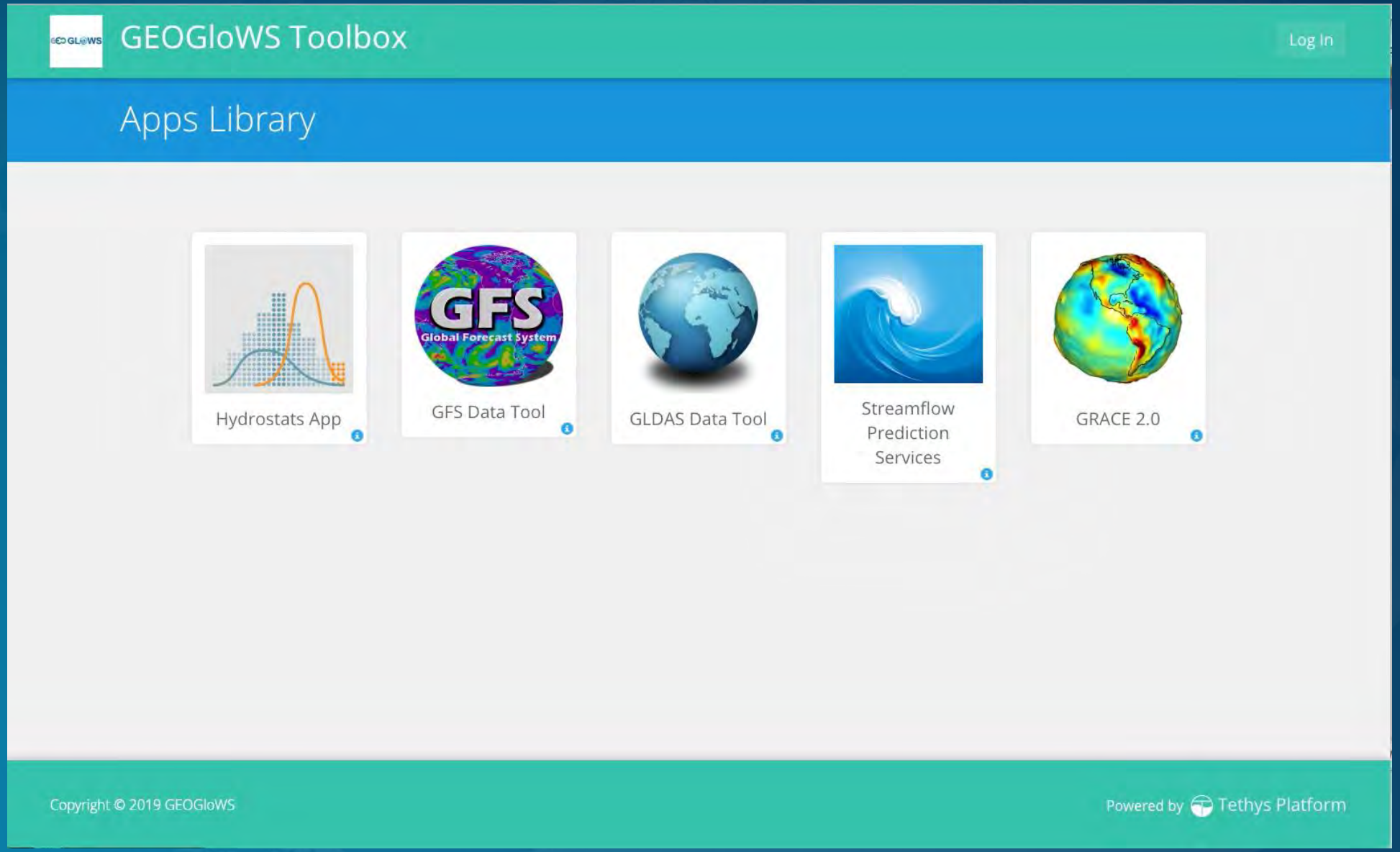


Global Network

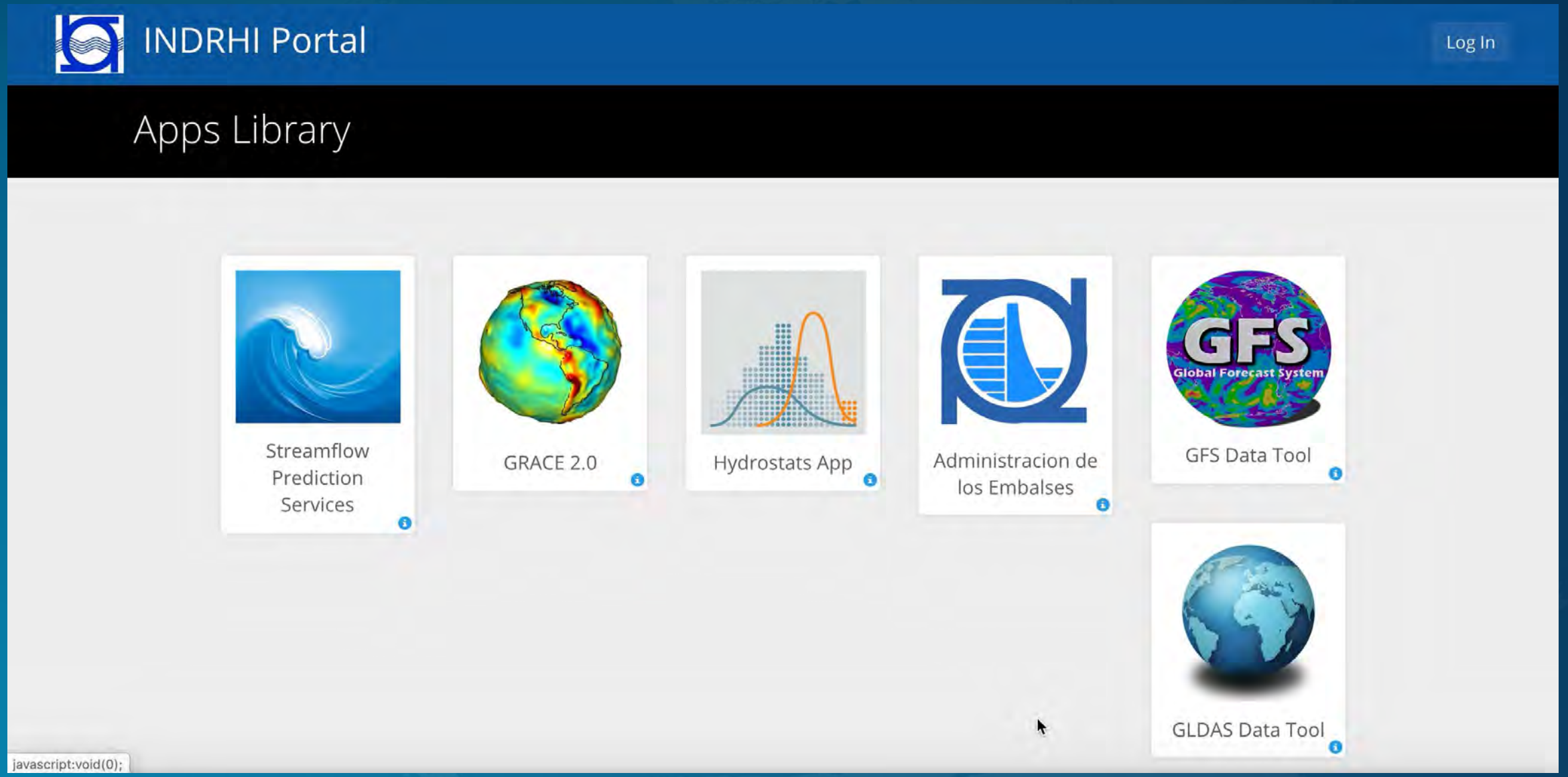


Total
878,603 Watersheds
Average Size: 157 km²

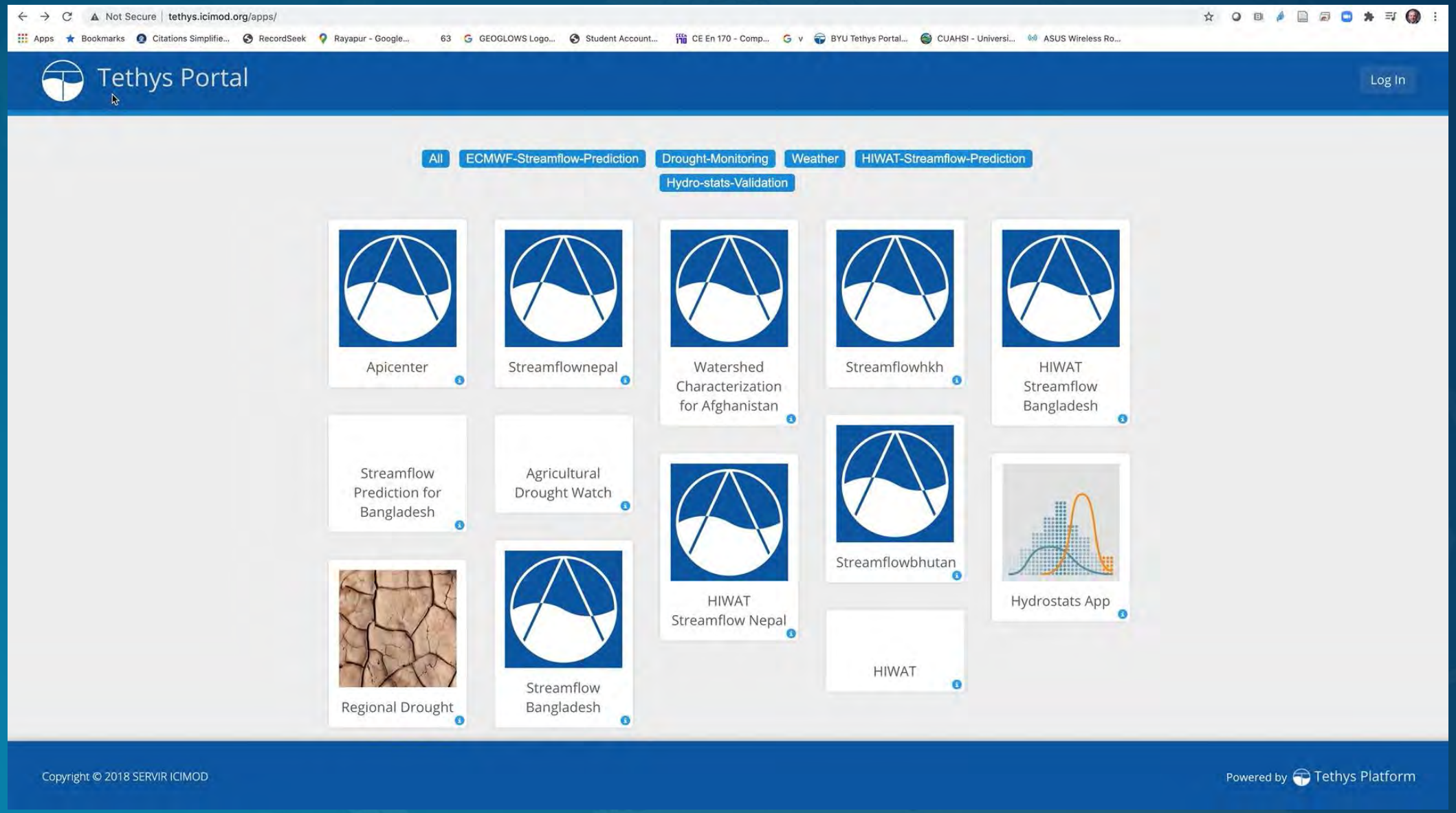
Tethys Deploys and Manages Apps



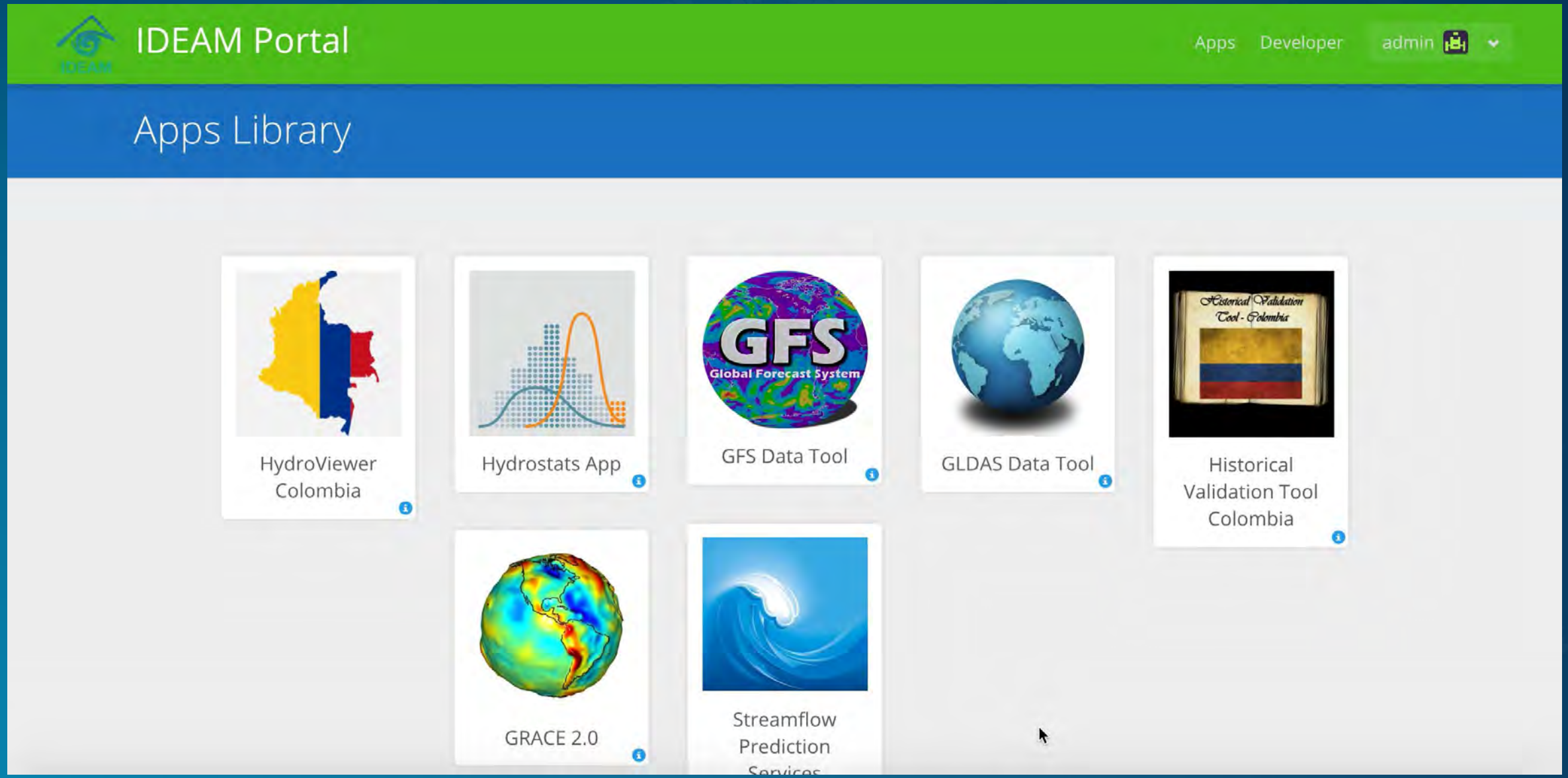
Dominican Republic HydroViewer with Validation



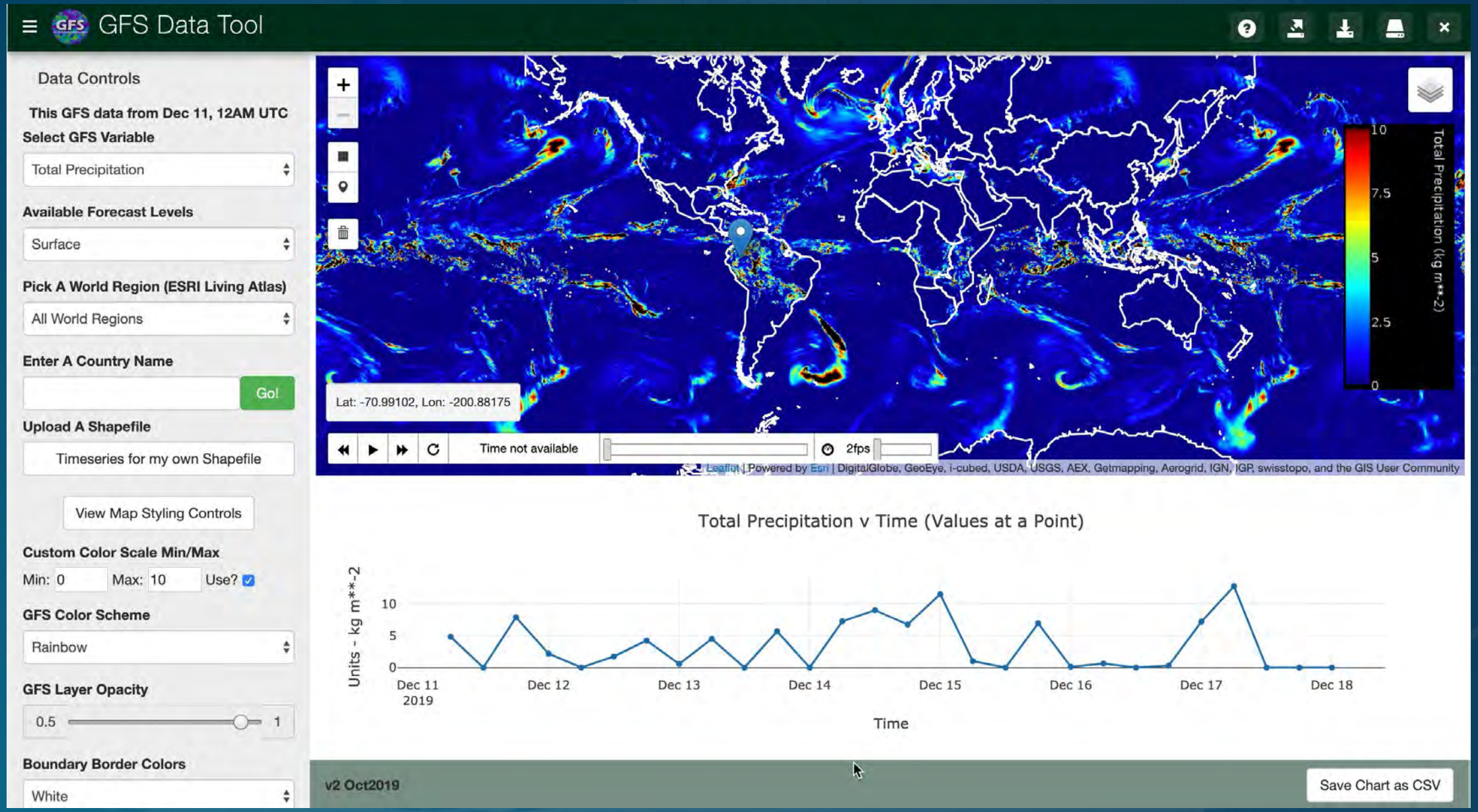
ICIMOD Portal



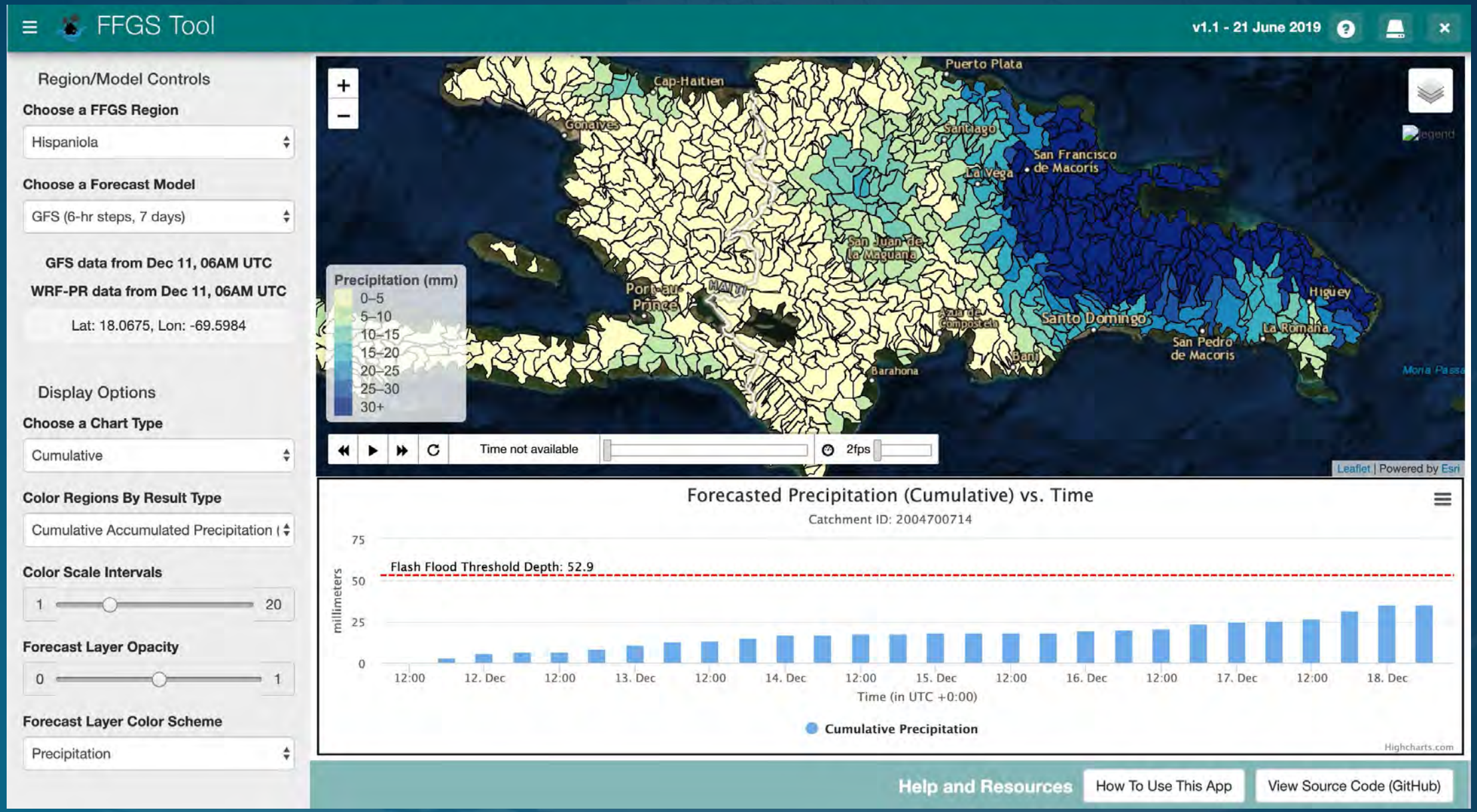
Colombia HydroViewer with Validation



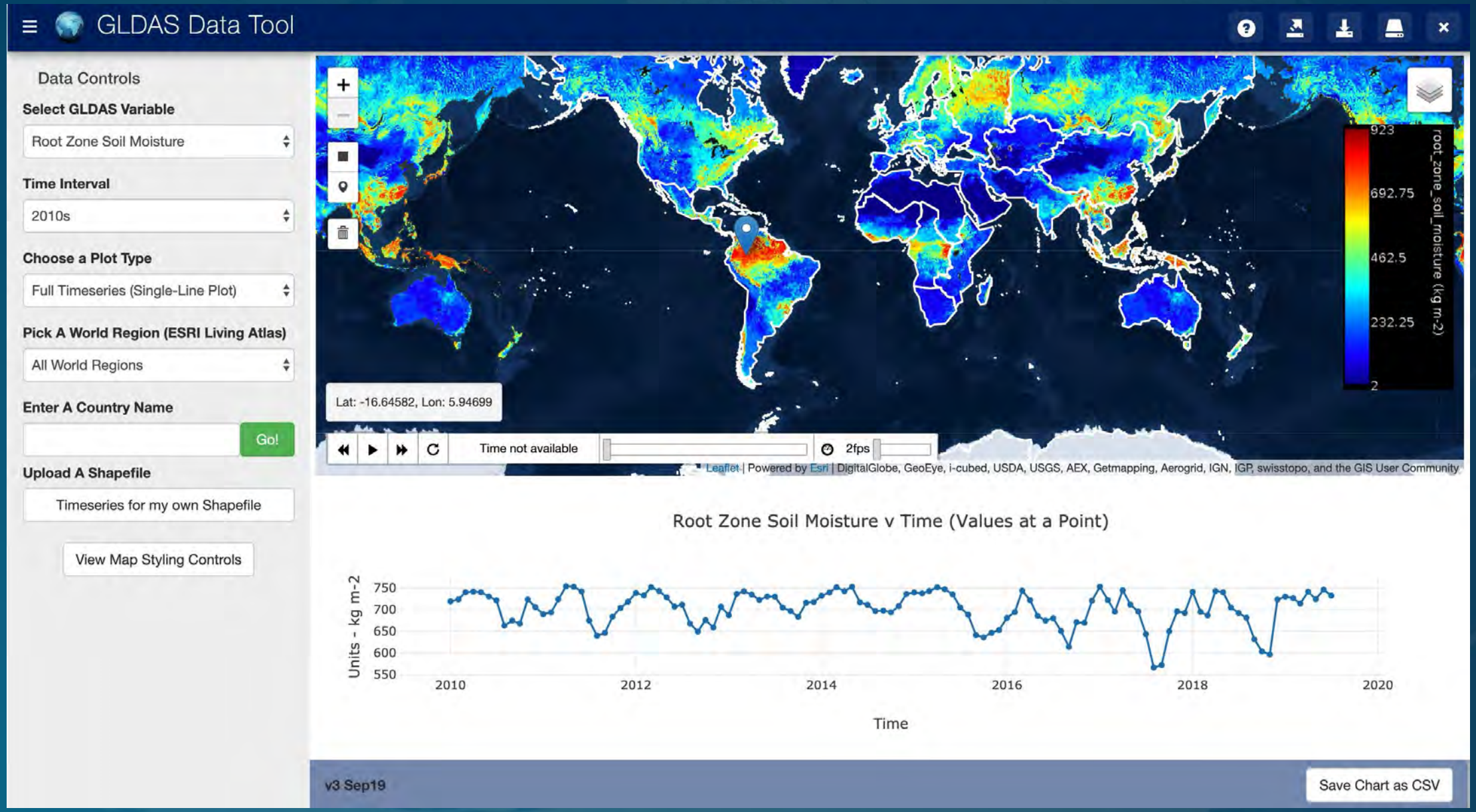
NOAA Global Forecast System (GFS)



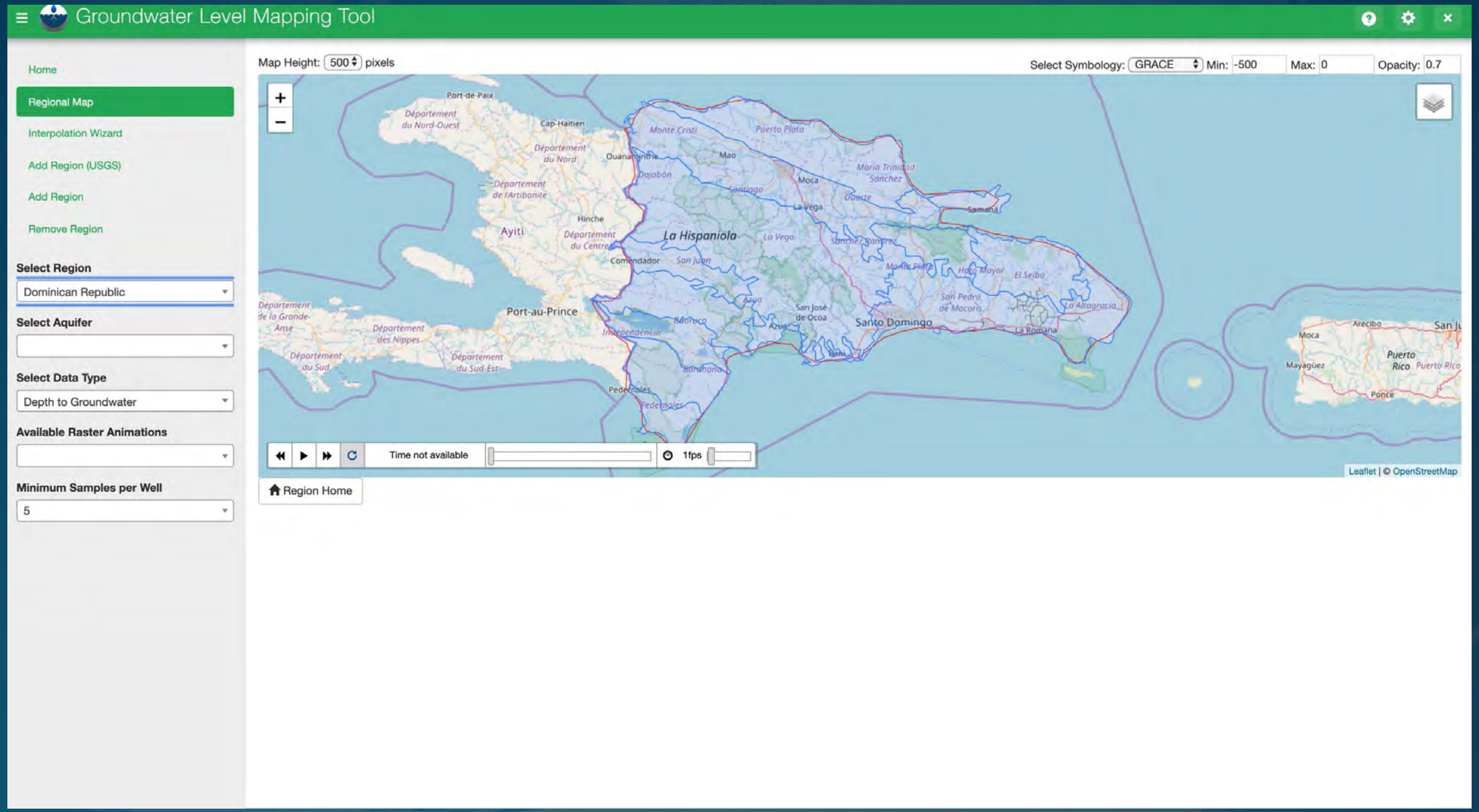
Flash Flood Guidance Application of Aggregated Rainfall



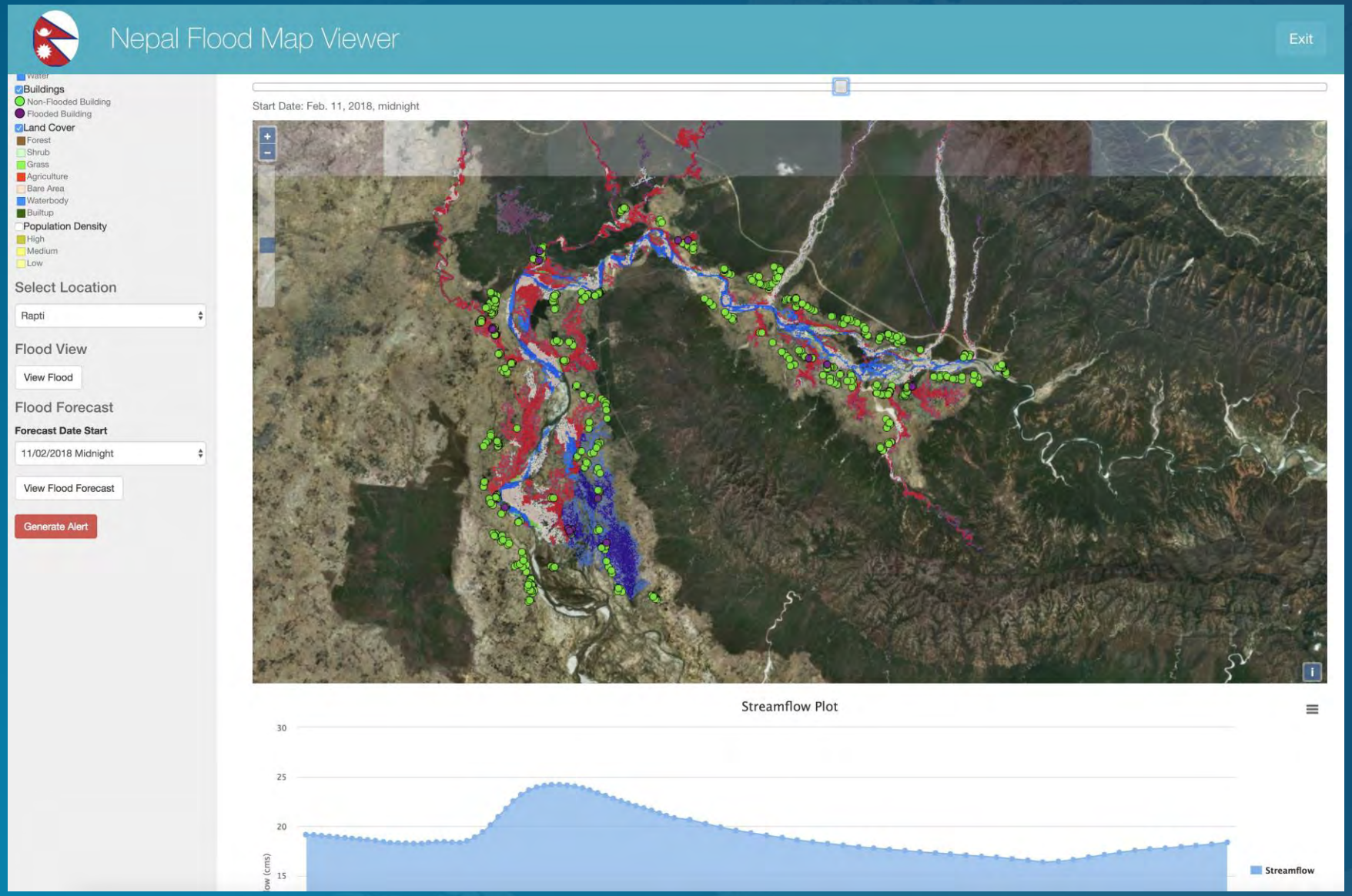
Global Land Data Assimilation



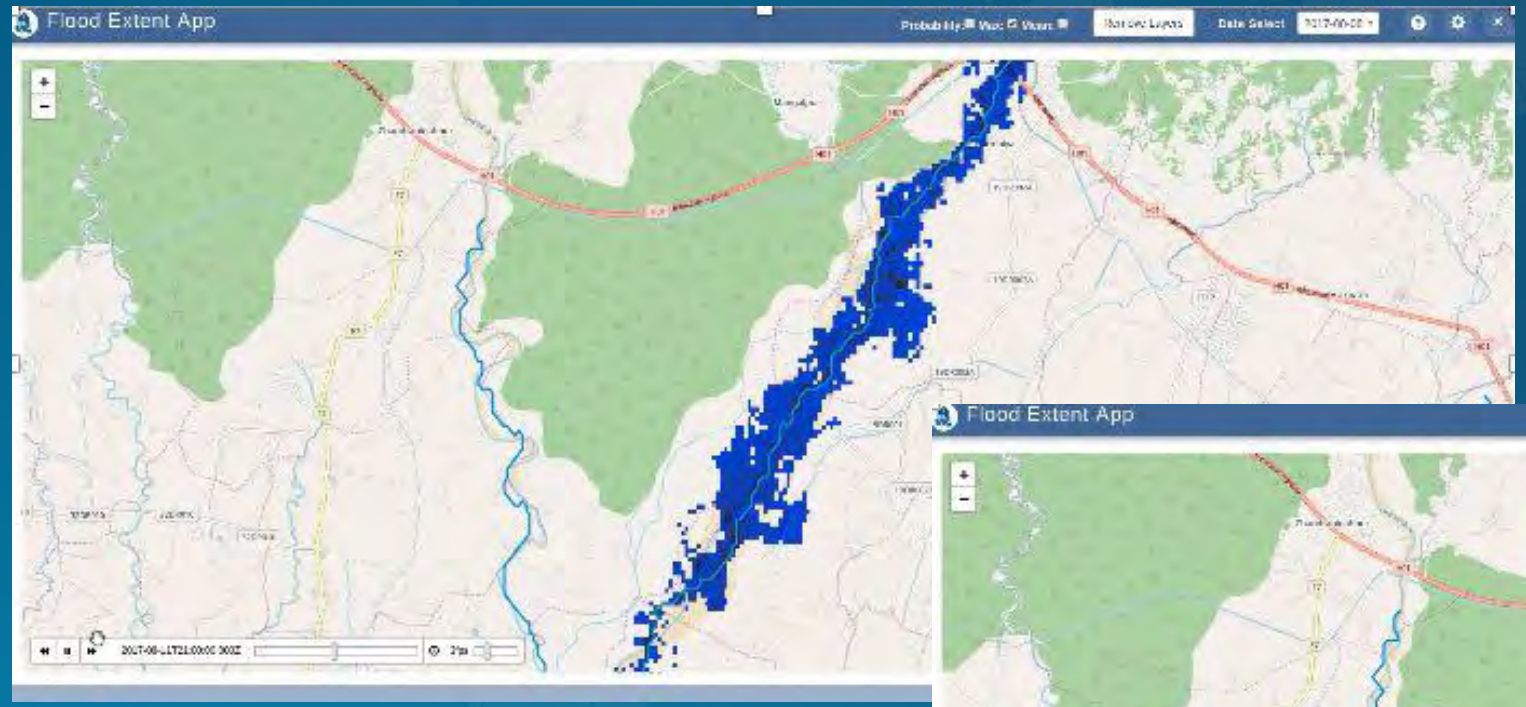
Groundwater Mapping from Well Logs

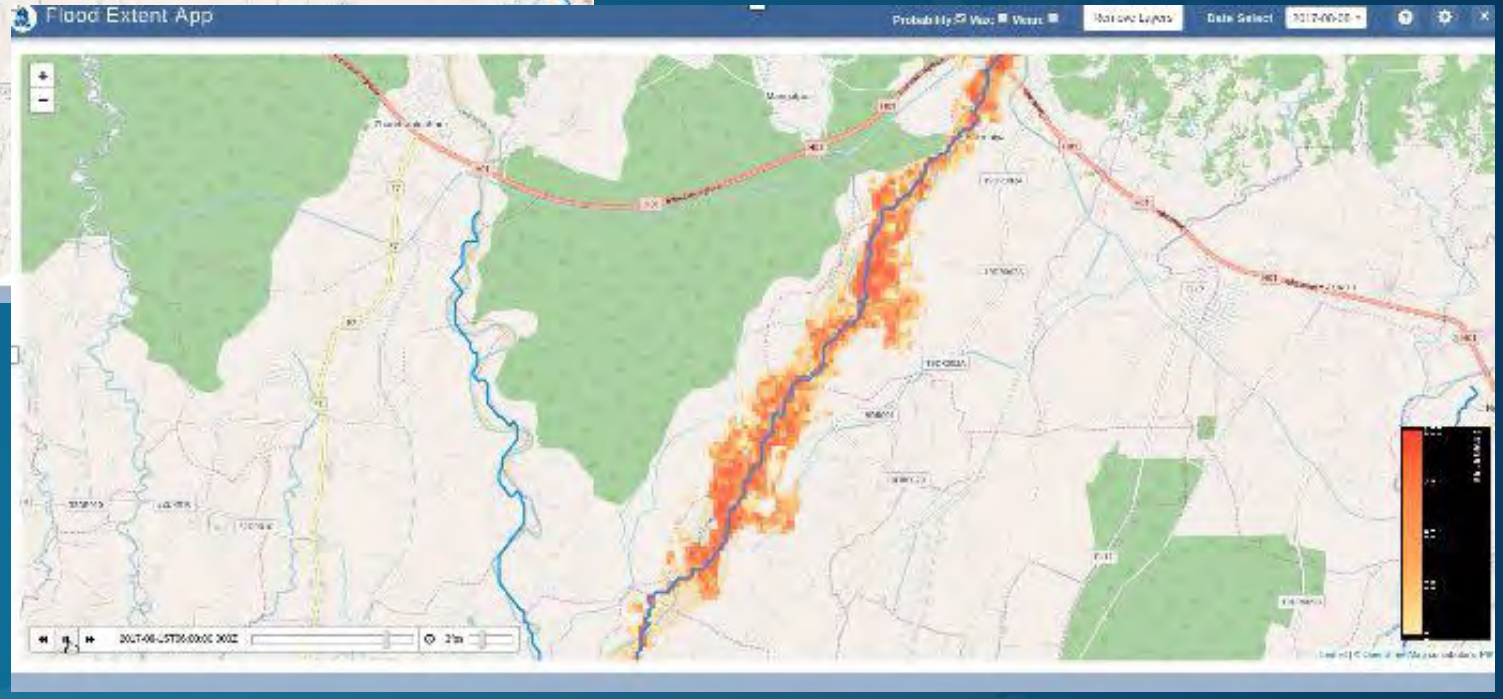


Nepal Flood Map Viewer



Flood Extent App





HydroStats Validation Tool

Statistics Calculator

Navigation

- Home
- Process a Time Series Dataset
- Merge Two Time Series Datasets
- Validate Historical Data
- Create a Persistence Benchmark Forecast
- Process an Ensamble Forecast
- Merge a Forecast for Analysis
- Validate a Forecast

Examples

- Example Time Series CSV
- Example Merged Time Series CSV
- Example Forecast CSV
- Example Merged Forecast CSV

Validate Historical Data

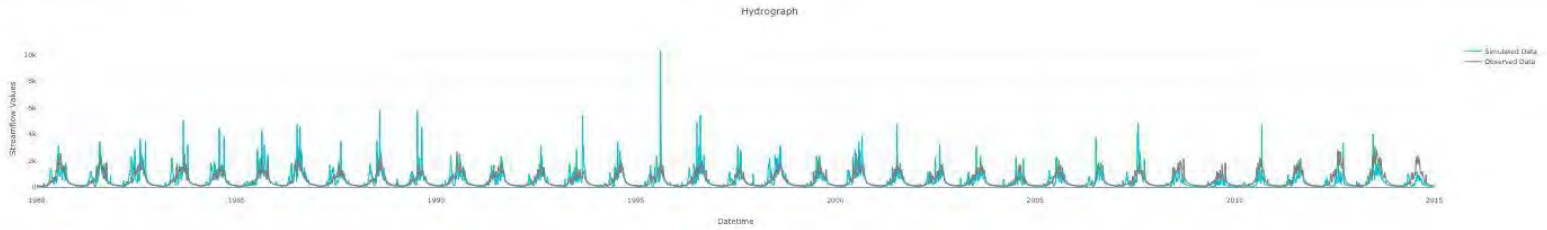
Merged Data Upload

CSV File Upload | Asaraghat_merged.csv

Visualization

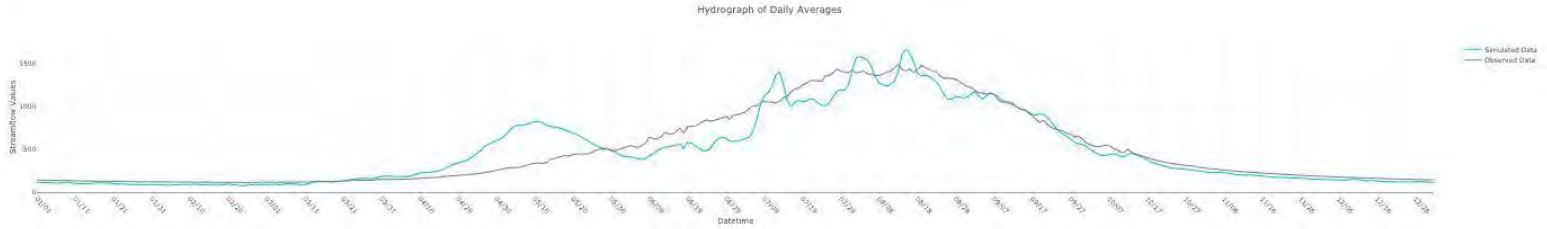
Hydrograph of Entire Time Series

Create Hydrograph



Hydrograph of Daily Averages

Create Hydrograph of Daily Averages



Scatter Plot

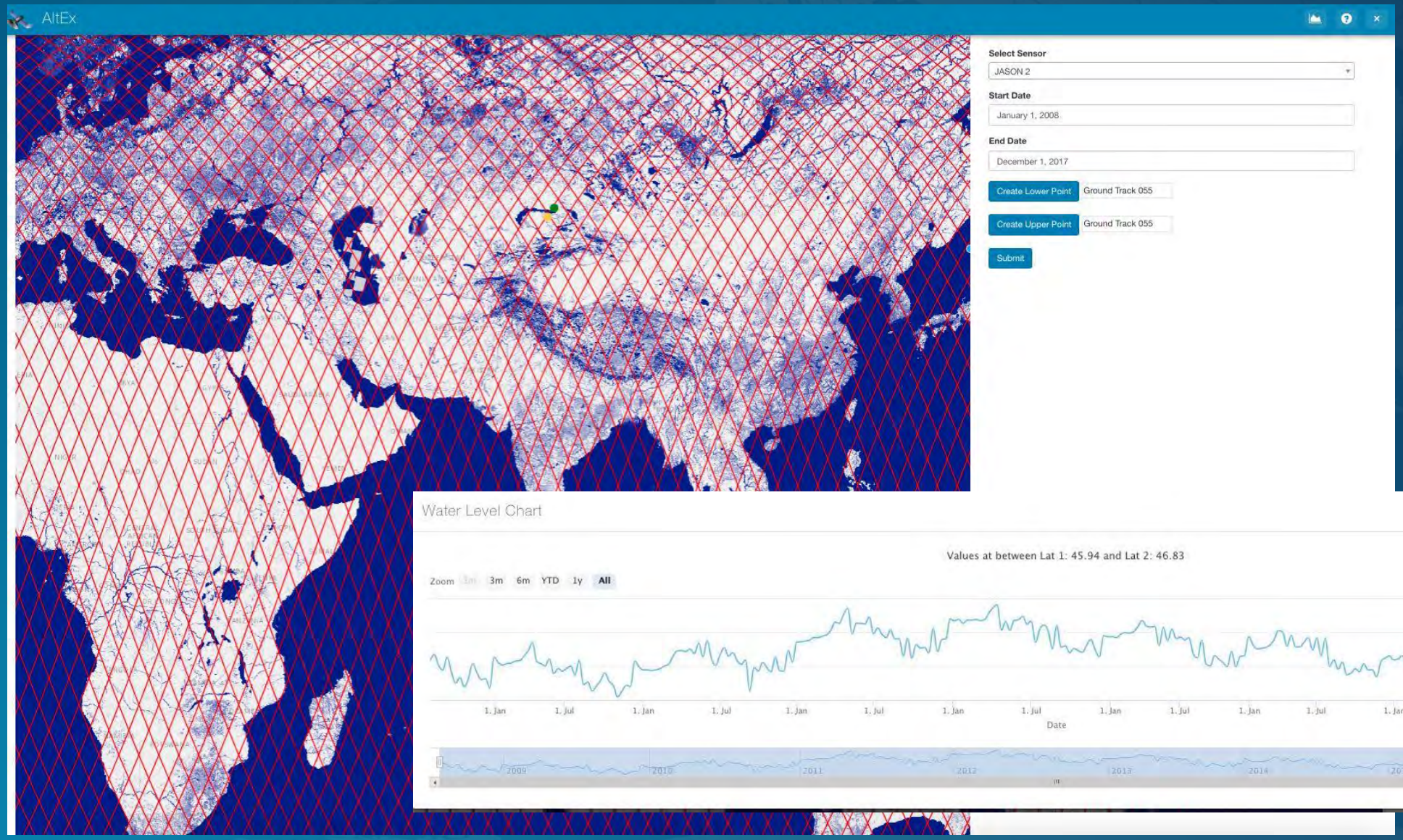
Create Scatter Plot

Scatter Plot with Log-Log Scale

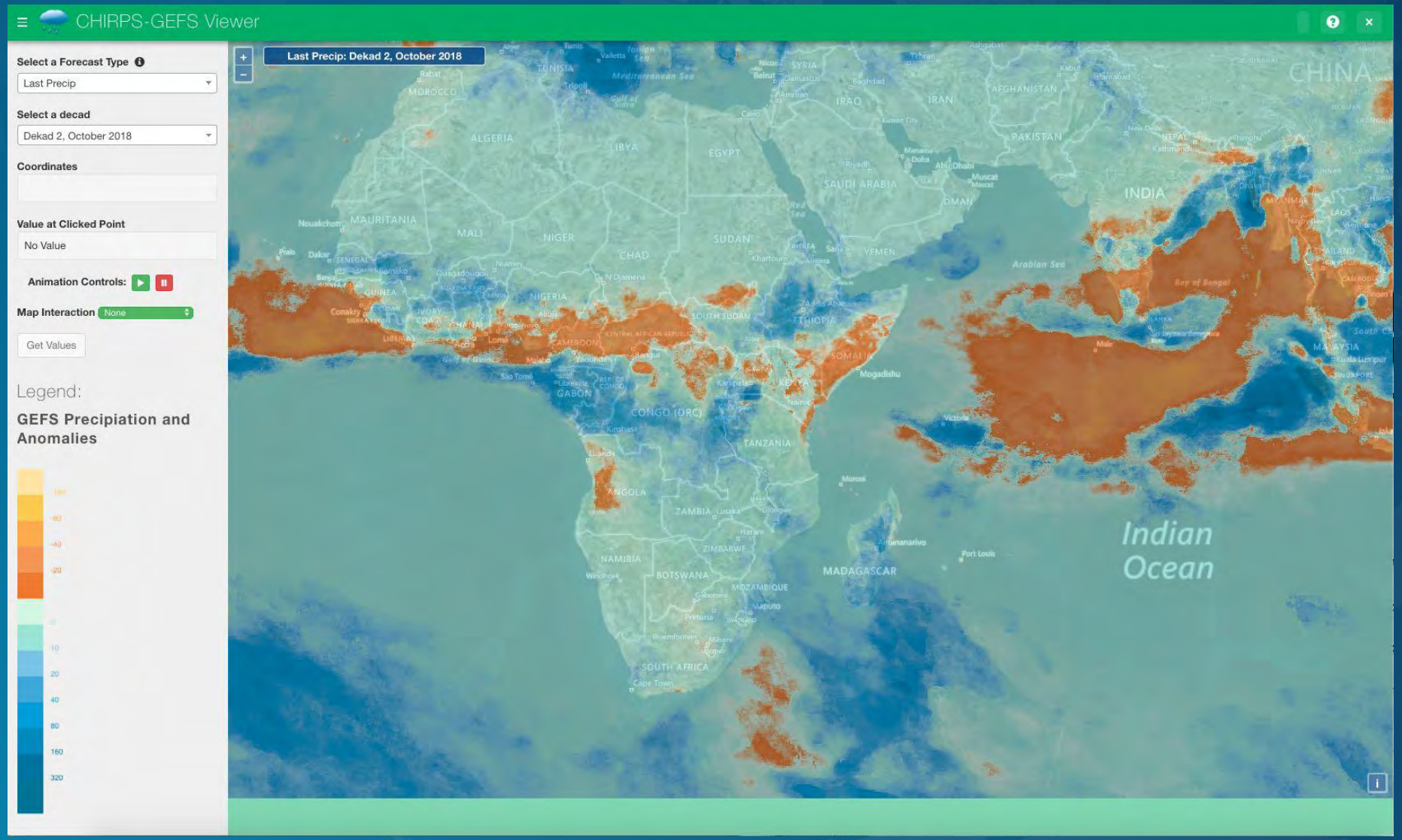
Create Scatter Plot with Log-Log Scale

AltEx

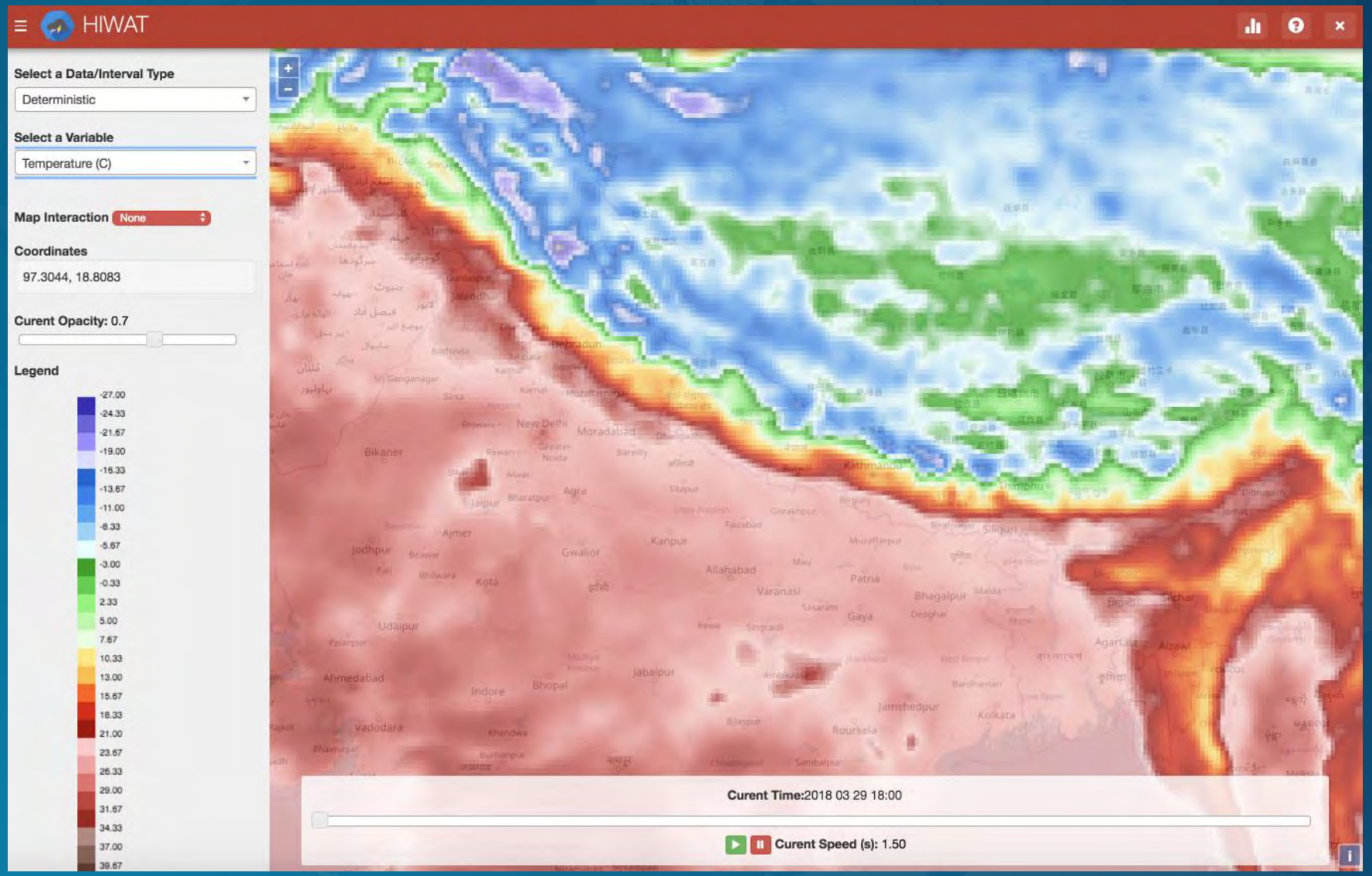
AltEx


AltEx
Select Sensor
JASON 2
Start Date
January 1, 2008
End Date
December 1, 2017
Create Lower Point
Ground Track 055
Create Upper Point
Ground Track 055
Submit
Water Level Chart
Values at between Lat 1: 45.94 and Lat 2: 46.83
Zoom
1m
3m
6m
YTD
1y
All
From
Jul 14, 2008
To
Feb 25, 2017
343.5
343
342.5
Water Height (m)
1. Jan
1. Jul
Date
2009
2010
2011
2012
2013
2014
2015
2016
2017

CHIRPS/GEFS

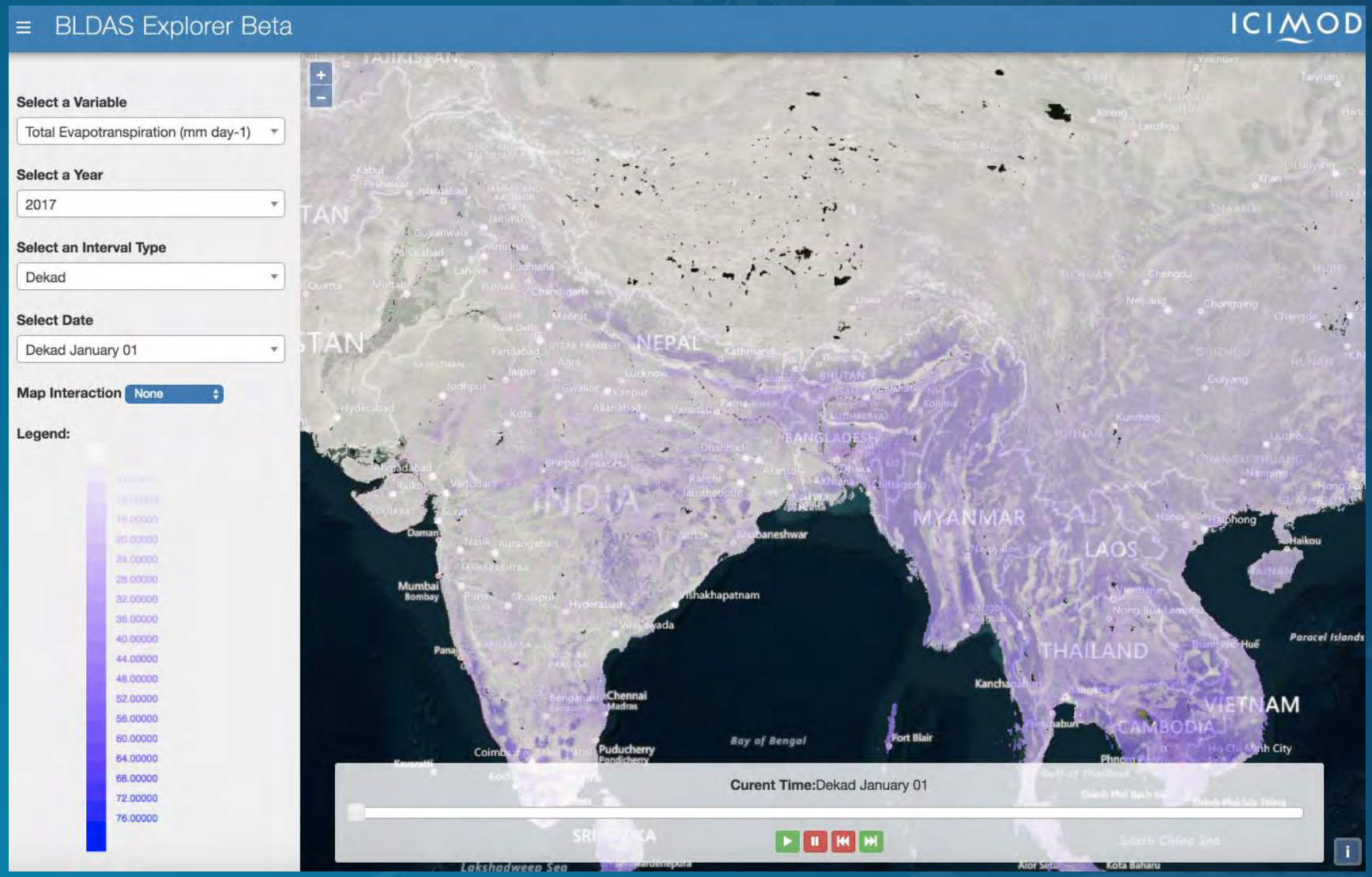

CHIRPS-GEFS Viewer
Select a Forecast Type
Last Precip
Select a decad
Dekad 2, October 2018
Coordinates
Value at Clicked Point
No Value
Animation Controls:
Map Interaction
None
Get Values
Legend:
GEFS Precipiation and Anomalies
Last Precip: Dekad 2, October 2018
Indian Ocean

HIWAT


HIWAT
Select a Data/Interval Type
Deterministic
Select a Variable
Temperature (C)
Map Interaction None
Coordinates
97.3044, 18.8083
Curent Opacity: 0.7
Legend
-27.00
-24.33
-21.67
-19.00
-16.33
-13.67
-11.00
-8.33
-5.67
-3.00
-0.33
2.33
5.00
7.67
10.33
13.00
15.67
18.33
21.00
23.67
26.33
29.00
31.67
34.33
37.00
39.67
New Delhi
Moradabad
Bikaner
Jaipur
Agra
Kanpur
Allahabad
Varanasi
Patna
Gwalior
Jodhpur
Udaipur
Ahmedabad
Indore
Bhopal
Jabalpur
Vadodara
Jamshedpur
Kolkata
Rourkela
Curent Time:2018 03 29 18:00
Curent Speed (s): 1.50

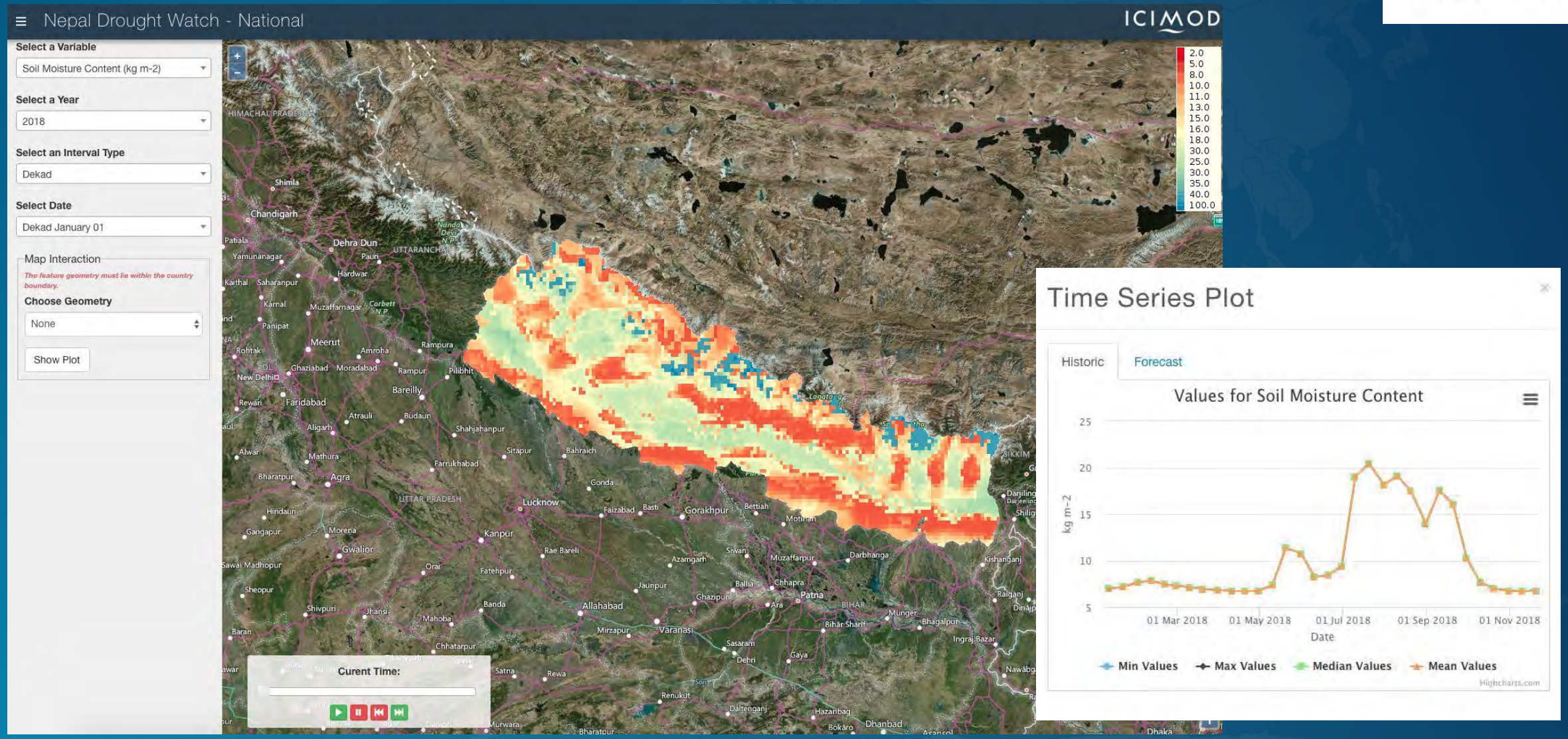
BALDAS

Regional Drought Monitoring System Beta



Nepal Drought Watch (SALDAS)

Nepal Drought Watch - National

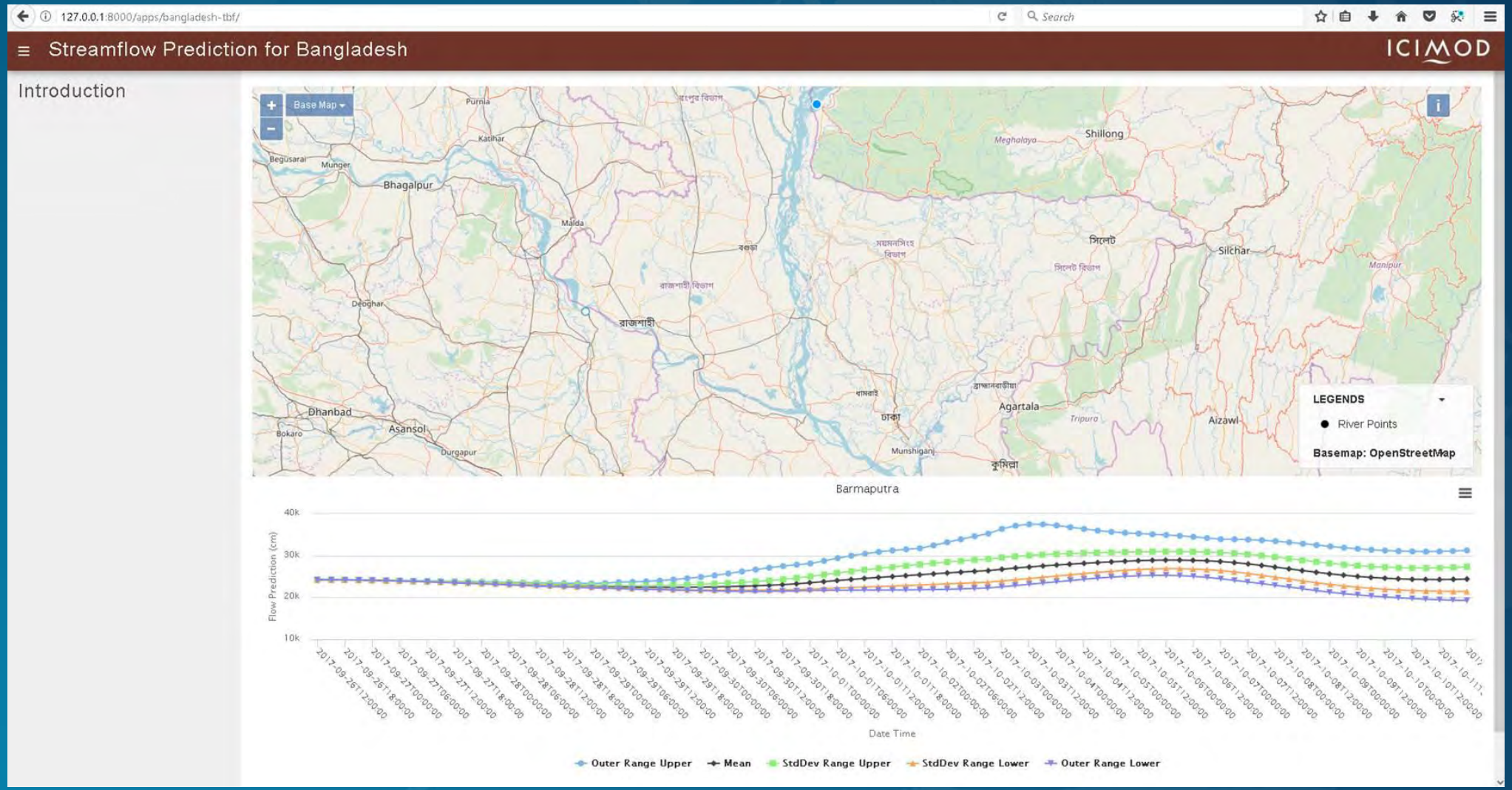


Agricultural Drought Watch

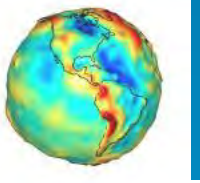
Agricultural Drought Watch

Bangladesh Transboundary Streamflow

HydroViewer Bangladesh



Tethys Apps for SERVIR AST Projects



GRACE 2.0

Agricultural Drought Watch

AltEx

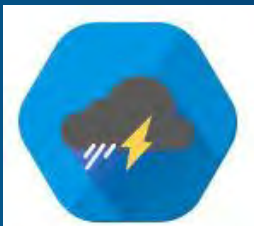
EcoDash

DARWIN Viewer

Herramientas de Operaciones de los Embalses

Historical Validation Tool Colombia

Regional Drought Monitoring System Beta



HIWAT

Nepal Flood Map Viewer

CHIRPS-GEFS Viewer

HydroViewer Nepal

Lower Mekong - SWAT

Flood Extent App

nasaaccess

RHEAS Viewer

HydroViewer Bangladesh

Ferlo Ephemeral Water Body Monitoring Dashboard

Streamflow Prediction Tool

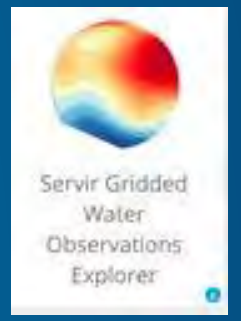
GLDAS Data Visualizer

Groundwater Level Mapping Tool

HydroViewer Hispaniola

Statistics Calculator

Nepal Drought Watch - National



Servir Gridded Water Observations Explorer

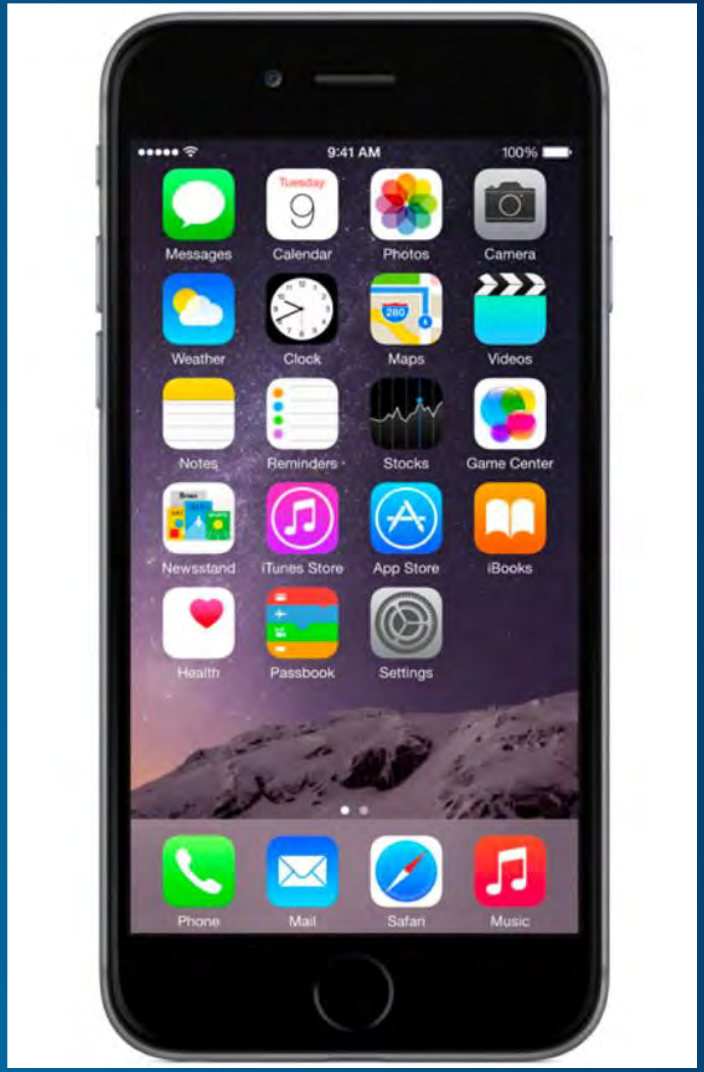
Veg. Viewer Africa

GEOGloWS Tethys App Warehouse

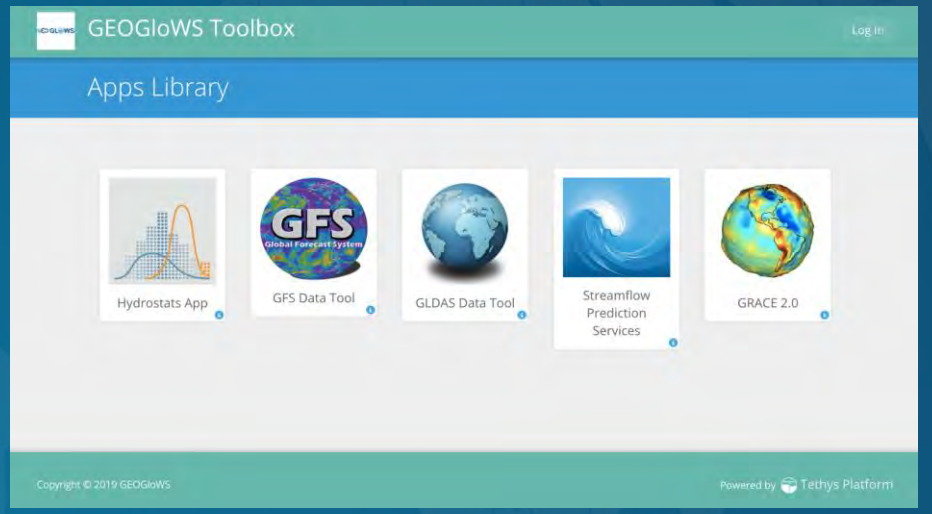
App Store

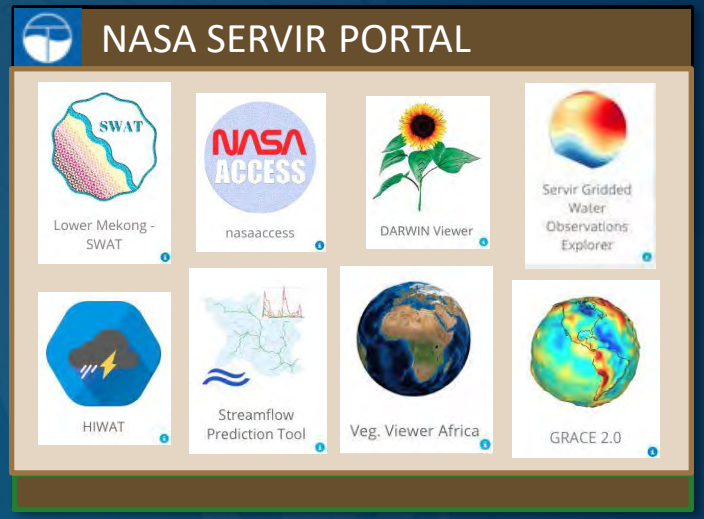
ANDROID APP ON Google play

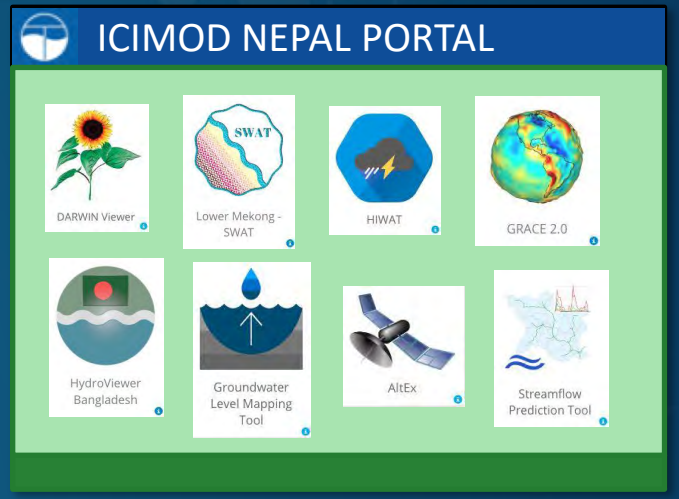
APP WAREHOUSE



APP WAREHOUSE



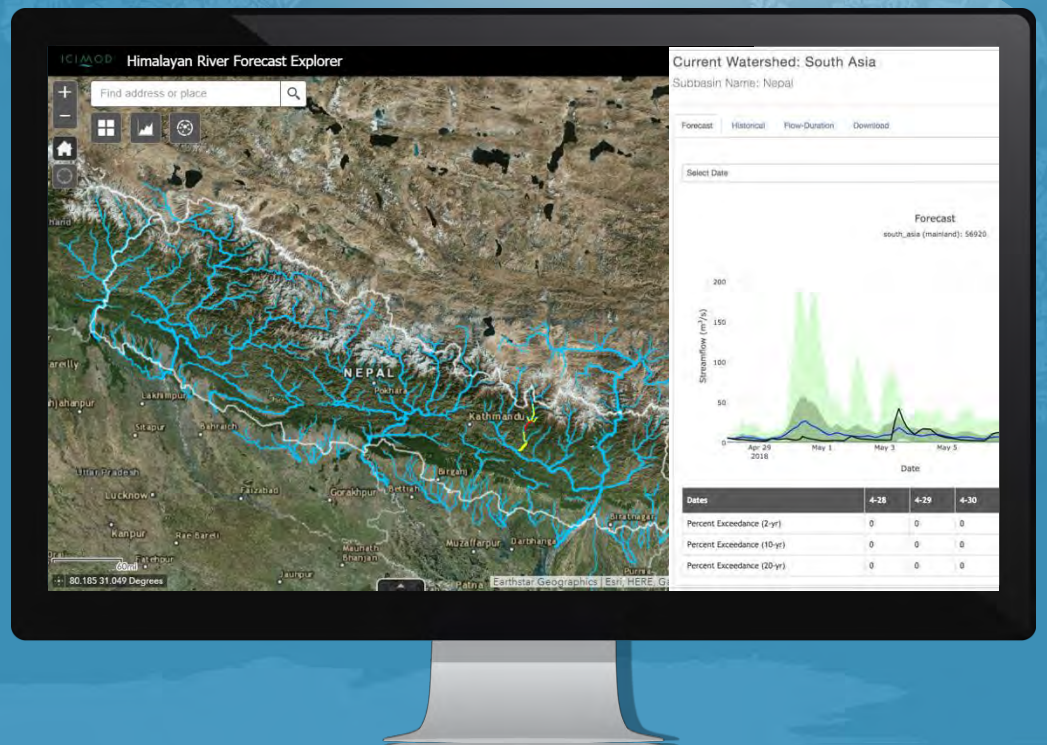




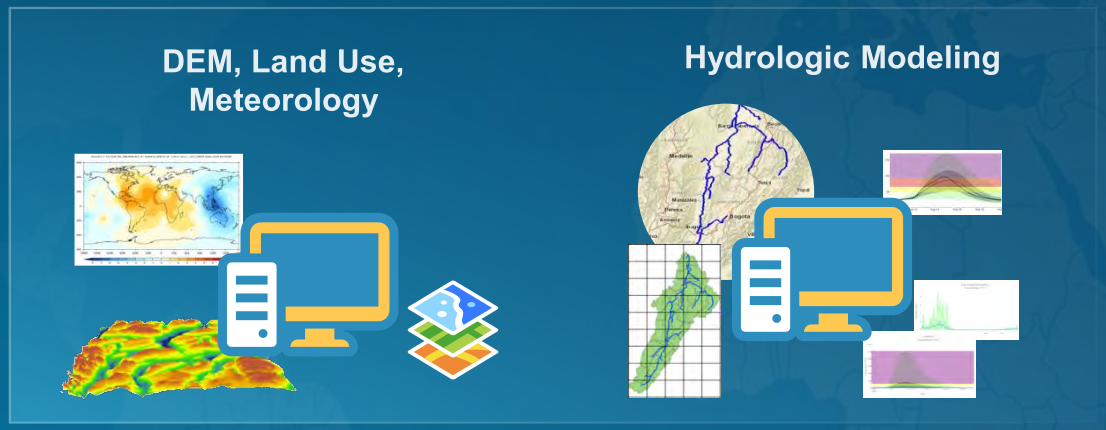
Nepal

"... important supplement to other data and models used by DHM, with the real possibility of saving lives and property"

Ram Gopal
Deputy Director DHM



Global Streamflow Services – A Paradigm Shift



Global Services

- HydroMet Services
- Local Governments
- NGO's and GEO Partners

GEOGLOWS GLOBAL WATER SUSTAINABILITY

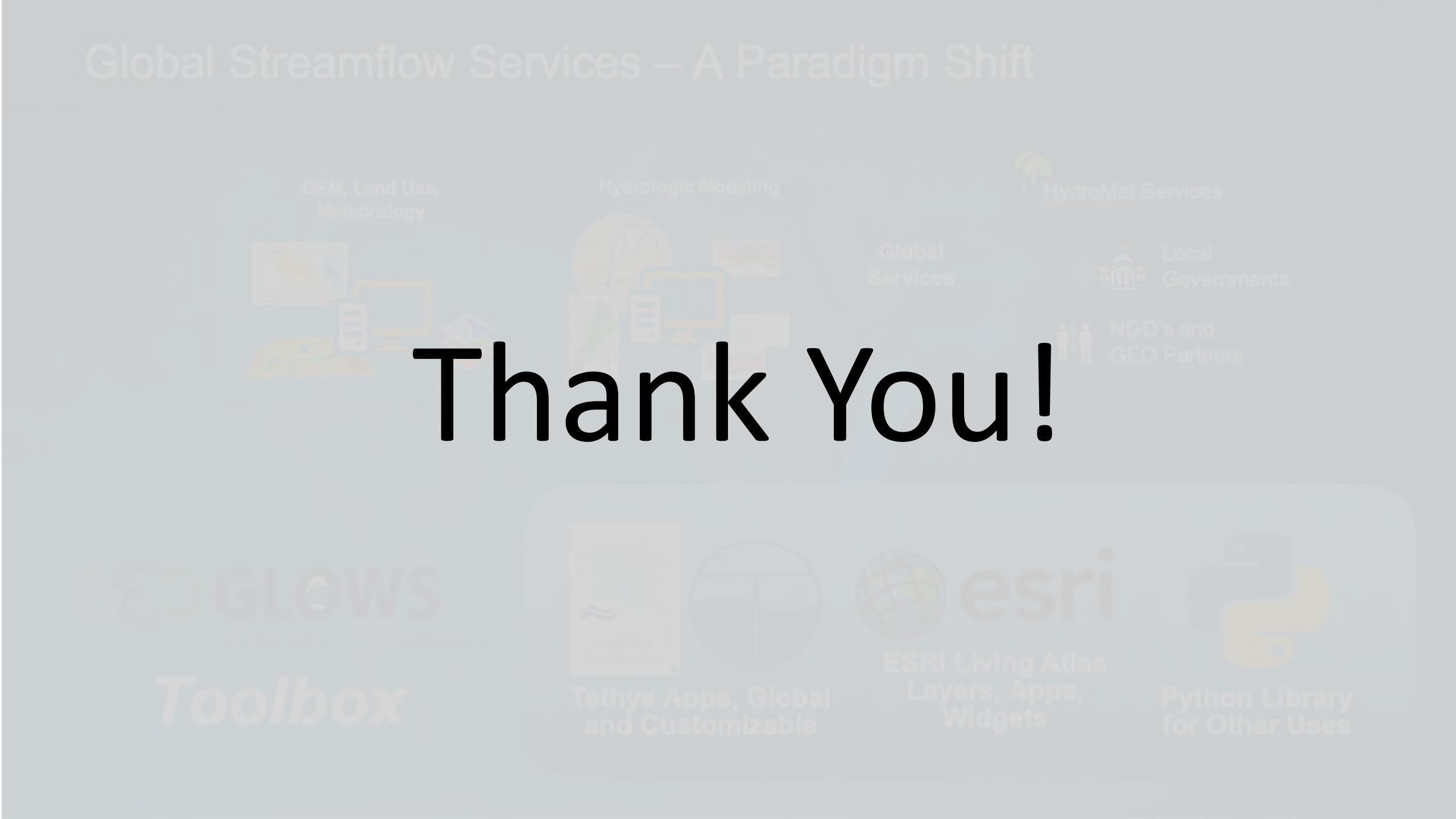
Toolbox

Tethys Apps, Global and Customizable

esri

ESRI Living Atlas Layers, Apps, Widgets

Python Library for Other Uses


Global Streamflow Services – A Paradigm Shift
DEM, Land Use, Meteorology
Hydrologic Modeling
HydroMet Services
Global Services
Local Governments
NGO's and GEO Partners
Thank You!
GLOWS
Toolbox
Tethys Apps, Global and Customizable
esri
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Python Library for Other Uses