

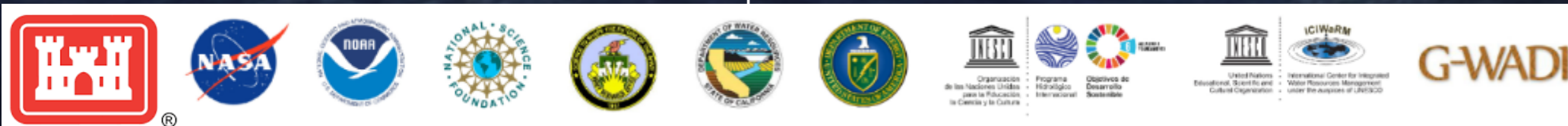
Fifth Workshop on Water Resources in Developing Countries: Hydroclimate Modeling and Analysis Tools May 27- June 7 2019

UC-Irvine CHRS's global satellite precipitation products and tools



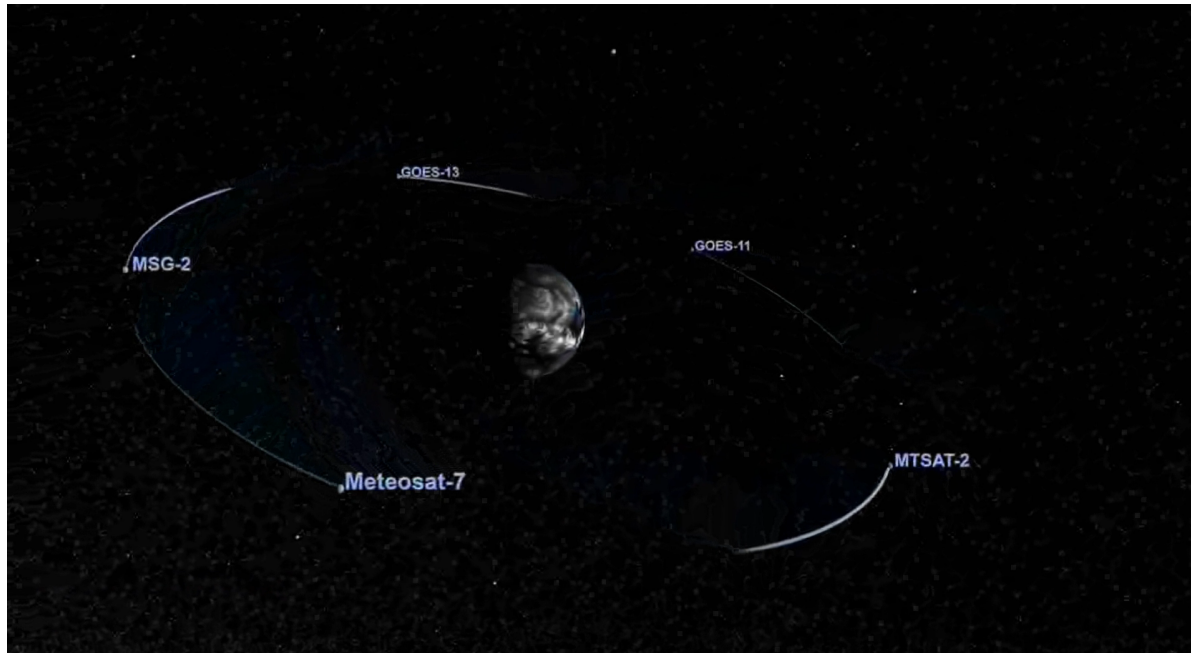
Phu Nguyen, Soroosh Sorooshian, Kuolin Hsu, Dan Braithwaite

Sponsors

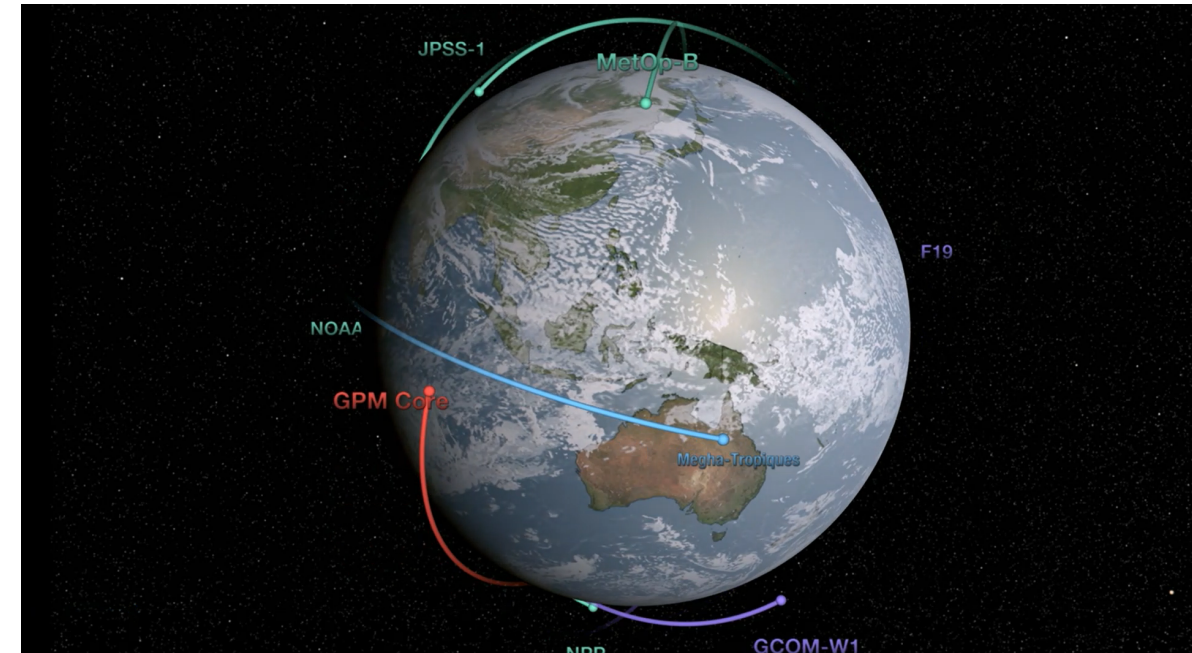


Satellite Precipitation Observation

Geo Satellites

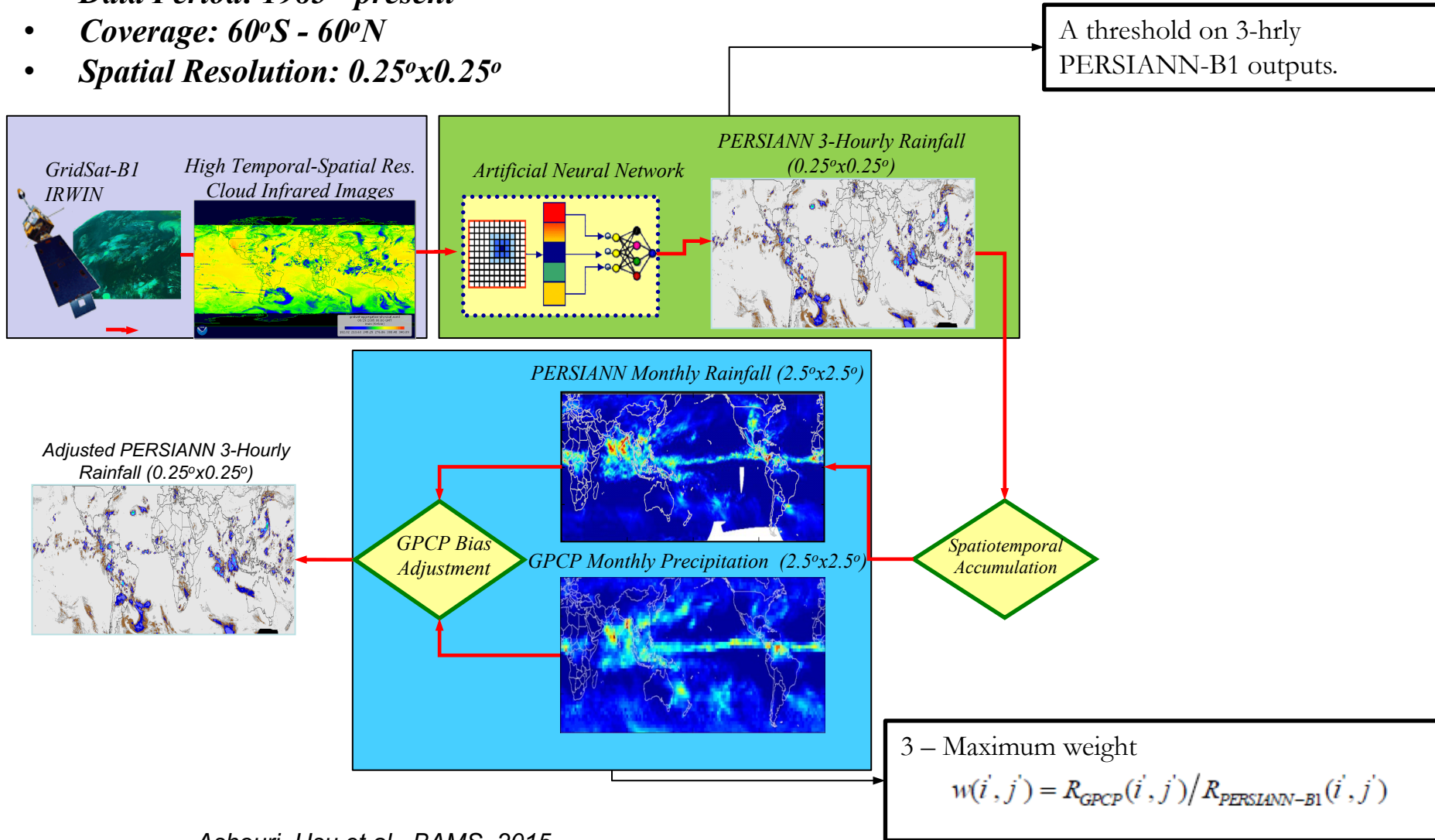


LEO Satellites



PERSIANN-CDR

- **Daily Precipitation Data**
- **Data Period: 1983 - present**
- **Coverage: 60°S - 60°N**
- **Spatial Resolution: 0.25°x0.25°**



Ashouri, Hsu et al., BAMS, 2015

PERSIANN-CDR Dataset

NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Formerly the National Climatic Data Center (NCDC)... [more about NCEI](#)

Home Climate Information Data Access Customer Support Contact About

Home > Climate Data Record Program > Atmospheric > Precipitation - PERSIANN-CDR

Precipitation - PERSIANN-CDR

This dataset provides a high quality Climate Data Record (CDR) of Precipitation.

This global precipitation dataset is intended to support Climatologists, Hydrologists, Hydrometeorologists, and Hydroclimatologists in various forms of climate research, including extreme event (flood and drought) analysis.

Principal Investigator: Soroosh Sorooshian, University of California - Irvine

Cite dataset when used as a source. See the dataset's DOI landing page for citation details at [doi:10.7289/V51V5BWQ](https://doi.org/10.7289/V51V5BWQ)



Index of /cdr/persiann/files/

Name	Size	Date Modified
[parent directory]		
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2016/		7/22/16, 4:47:00 PM

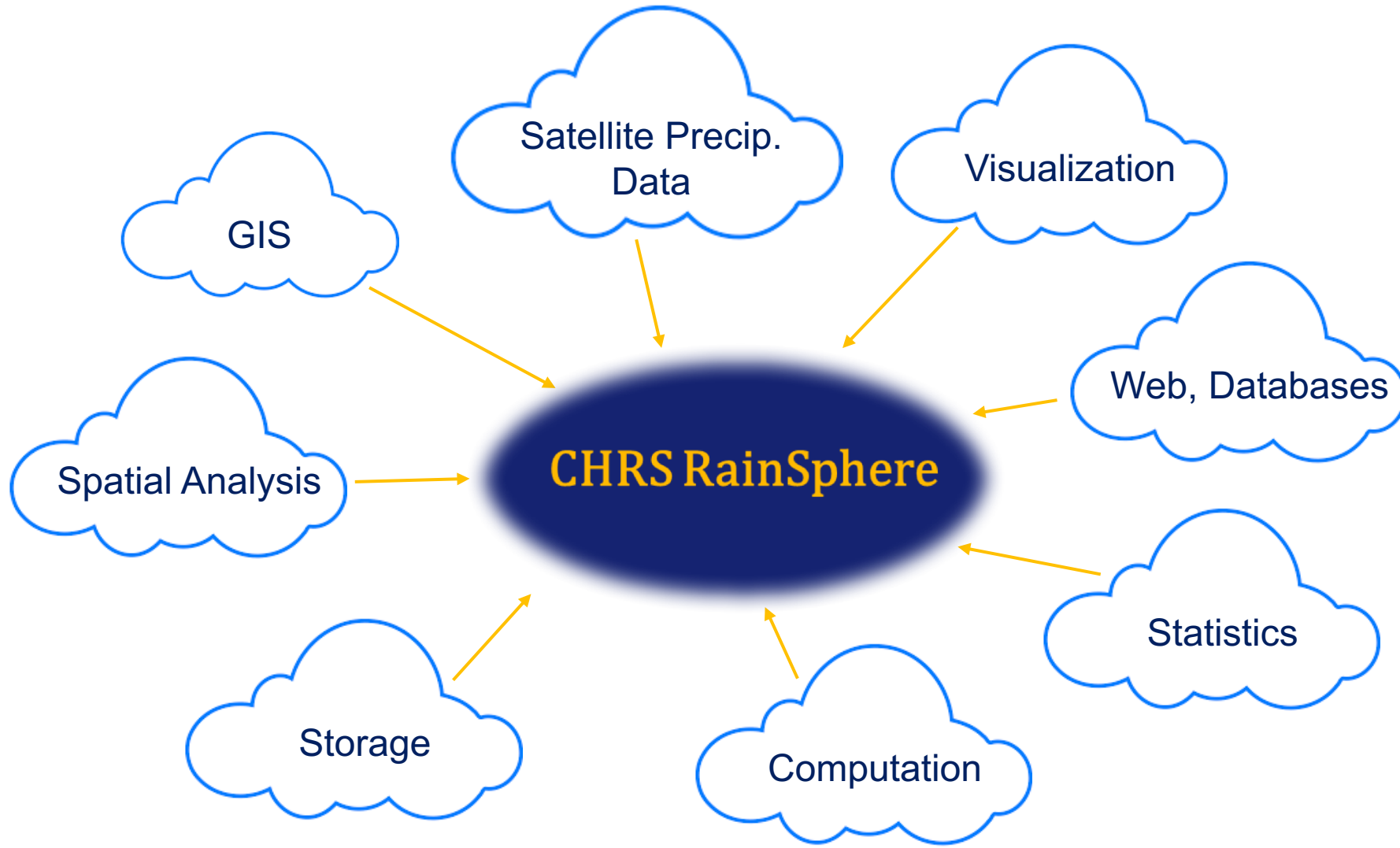


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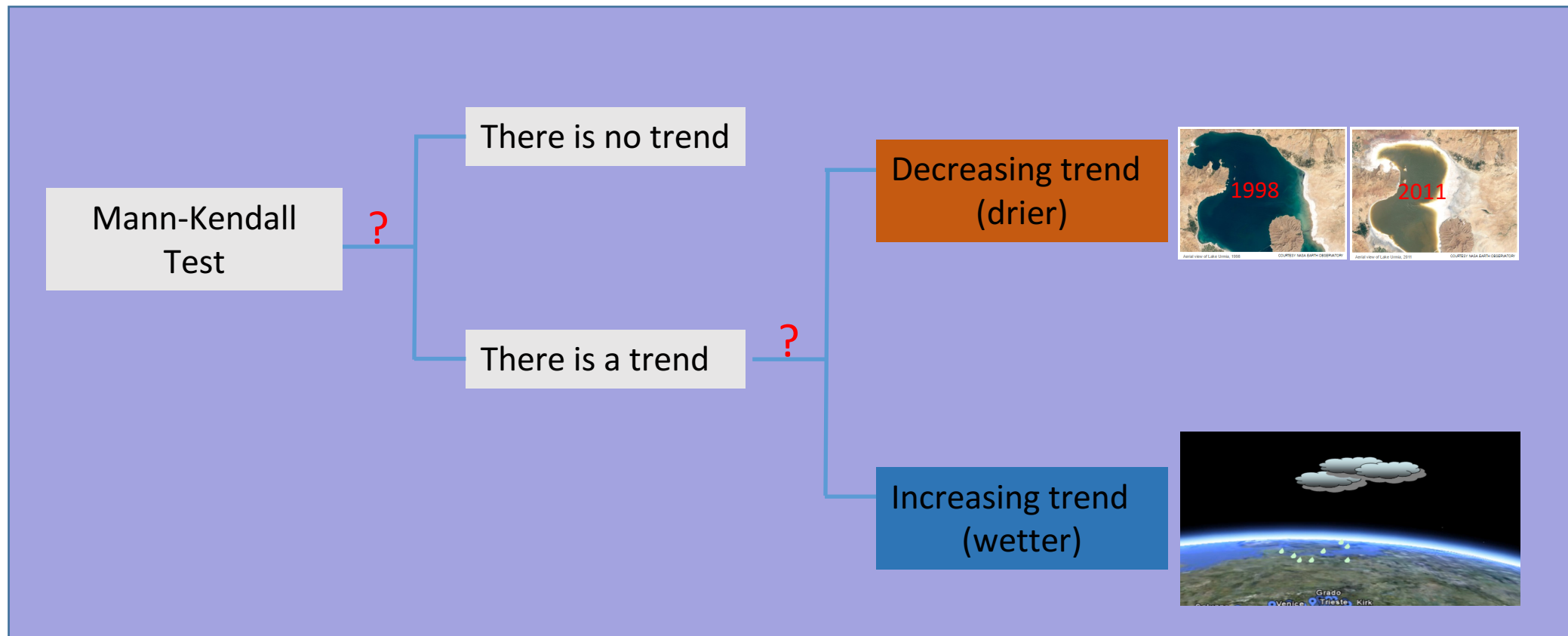
Methods



Rain Trend Analysis

Mann-Kendall Test

We test the null hypothesis H_0 that there is no significant trend in the data at significance level $\alpha=0.05$ (or 95% confidence level)



RainSphere Interface

<http://rainsphere.eng.uci.edu>

The screenshot displays the CHRS RainSphere web interface. At the top left is the CHRS logo with the text "CHRS RainSphere" and "An Integrated System for Global Satellite Precipitation Data and Information". A navigation menu includes "Home", "Info", "Tutorial", and "About Us". The current location is "Lat: 40.313, Lon: -114.609". A search bar is labeled "Search Location". The main map area shows a global satellite precipitation map with a "Satellite" dropdown menu in the top right. On the left side, there are several control panels: "Map Layers" with checkboxes for "Country", "Pol. Division", "Cont. Basin", "Major River", "Tributary", and "Watershed"; "Rain Information" with radio buttons for "Historical Satellite Observation" and "Future IPCC Projection"; "Rain Layers" with radio buttons for "Accumulative", "Yearly", "Average", and "Monthly"; "Rain Layers Comparison" with a "Side by Side" dropdown and a "Compare" button; and "Rain Statistics" with "Query By: Location" and "Date Type: Select Type" dropdowns. A small inset map in the bottom left shows a zoomed-in view of a region. The bottom of the interface contains a "Google" logo and a copyright notice: "Copyright © 2015 CHRS, UC Irvine. All rights reserved. | Map data ©2016 INEGI Imagery ©2016 NASA, TerraMetrics | 500 km | Terms of Use".



RainSphere

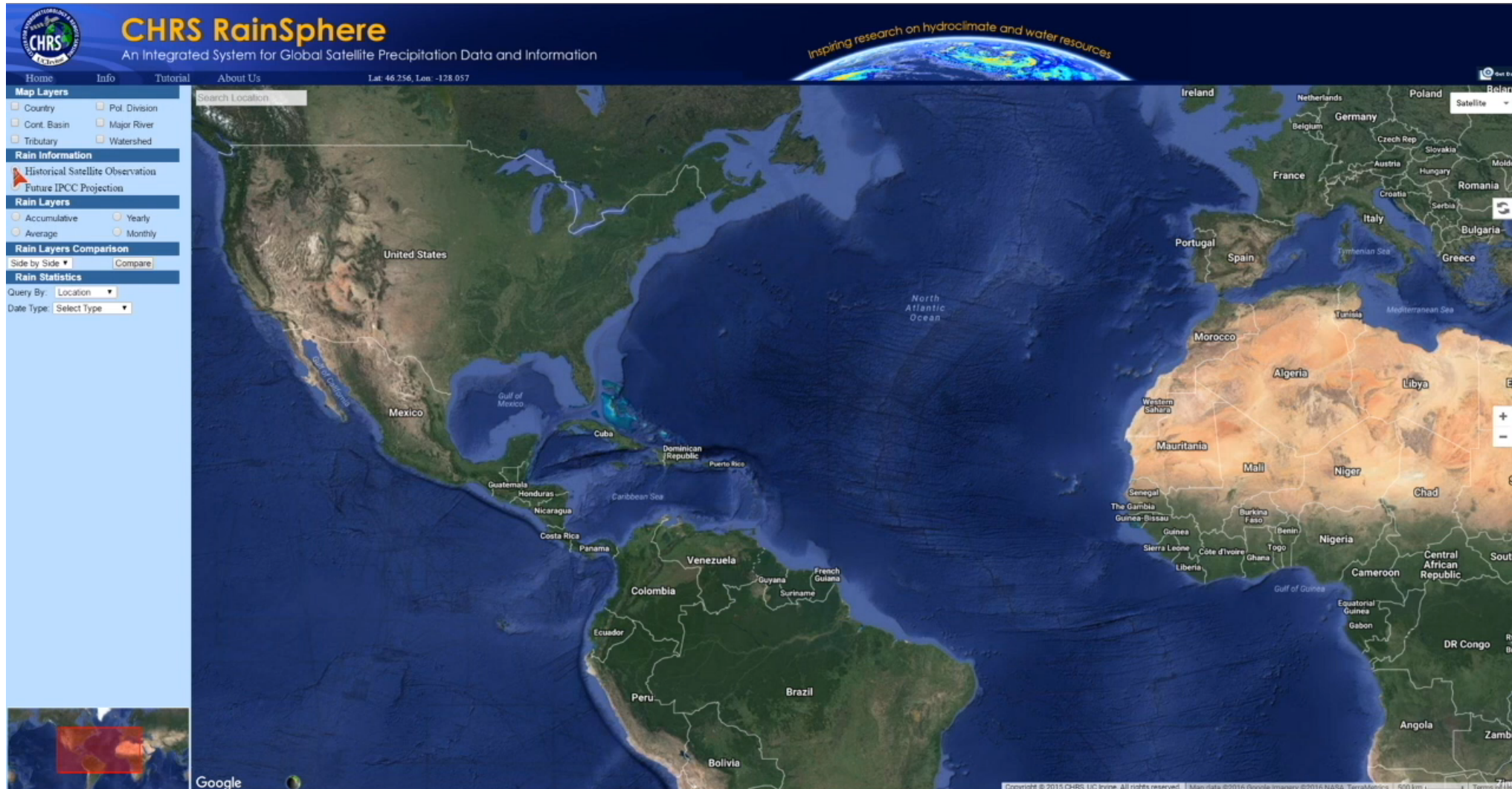
Map Layers

The screenshot displays the CHRS RainSphere web application interface. At the top left is the CHRS logo and the text "CHRS RainSphere" and "An Integrated System for Global Satellite Precipitation Data and Information". Navigation links for Home, Info, Tutorial, and About Us are present. The current location is shown as Lat: 55.279, Lon: -147.129. A search bar for "Search Location" is located above the map. The map itself is a global satellite view with various map layers overlaid, including country boundaries, political divisions, continental basins, major rivers, tributaries, and watersheds. A legend on the left side of the map lists these layers. Below the legend are sections for "Rain Information" (Historical Satellite Observation, Future IPCC Projection), "Rain Layers" (Accumulative, Average, Yearly, Monthly), "Rain Layers Comparison" (Side by Side, Compare), and "Rain Statistics" (Query By: Location, Date Type: Select Type). A "Satellite" dropdown menu is visible in the top right corner of the map area. The Google logo is visible in the bottom left corner of the map area. A copyright notice at the bottom of the map area reads: "Copyright © 2015 CHRS, UC Irvine. All rights reserved. | Map data © 2016 INEGI, Imagery © 2016 NASA, TerraMetrics | 500 km | Terms of Use".



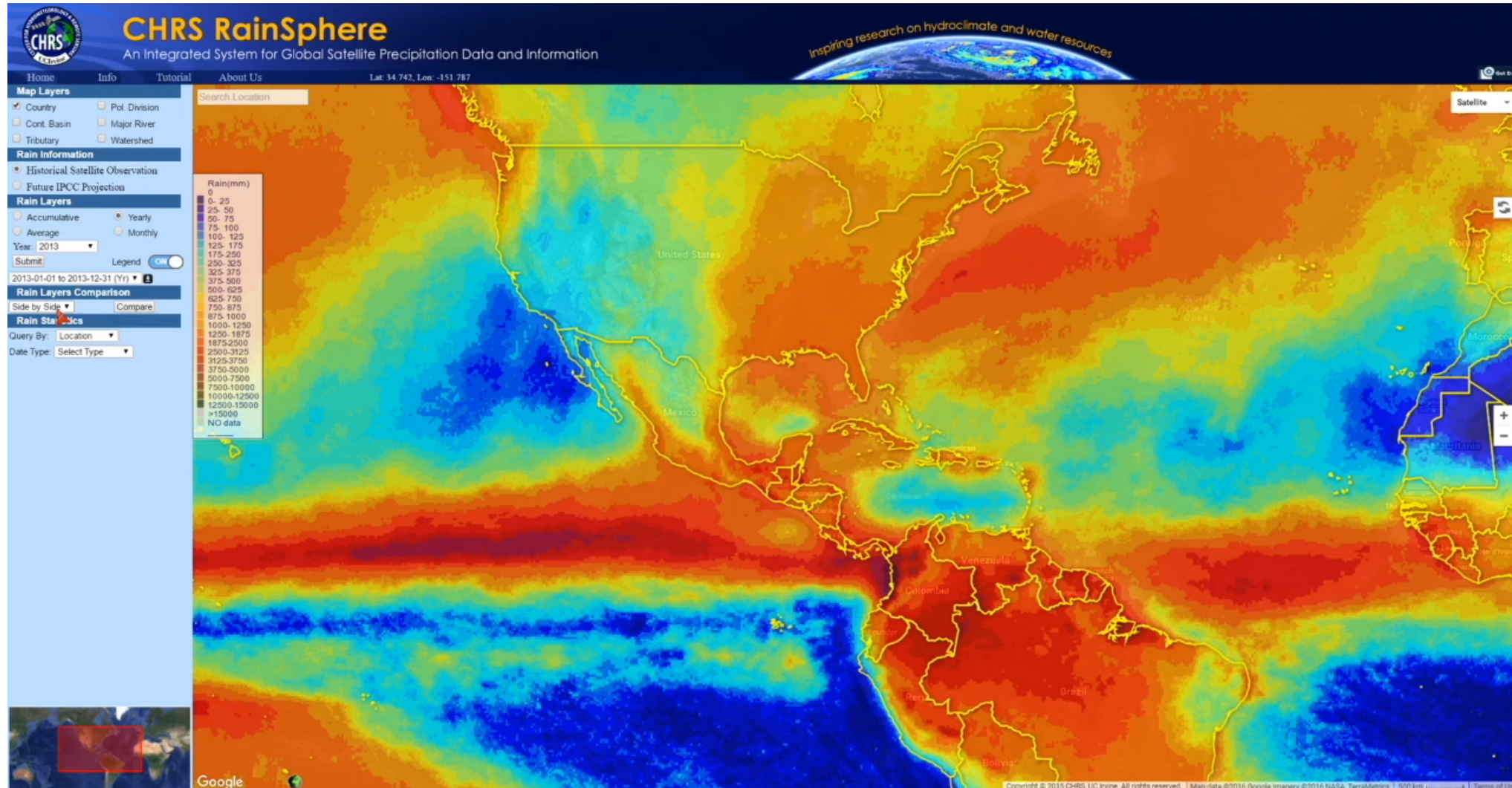
RainSphere

Rain Layers



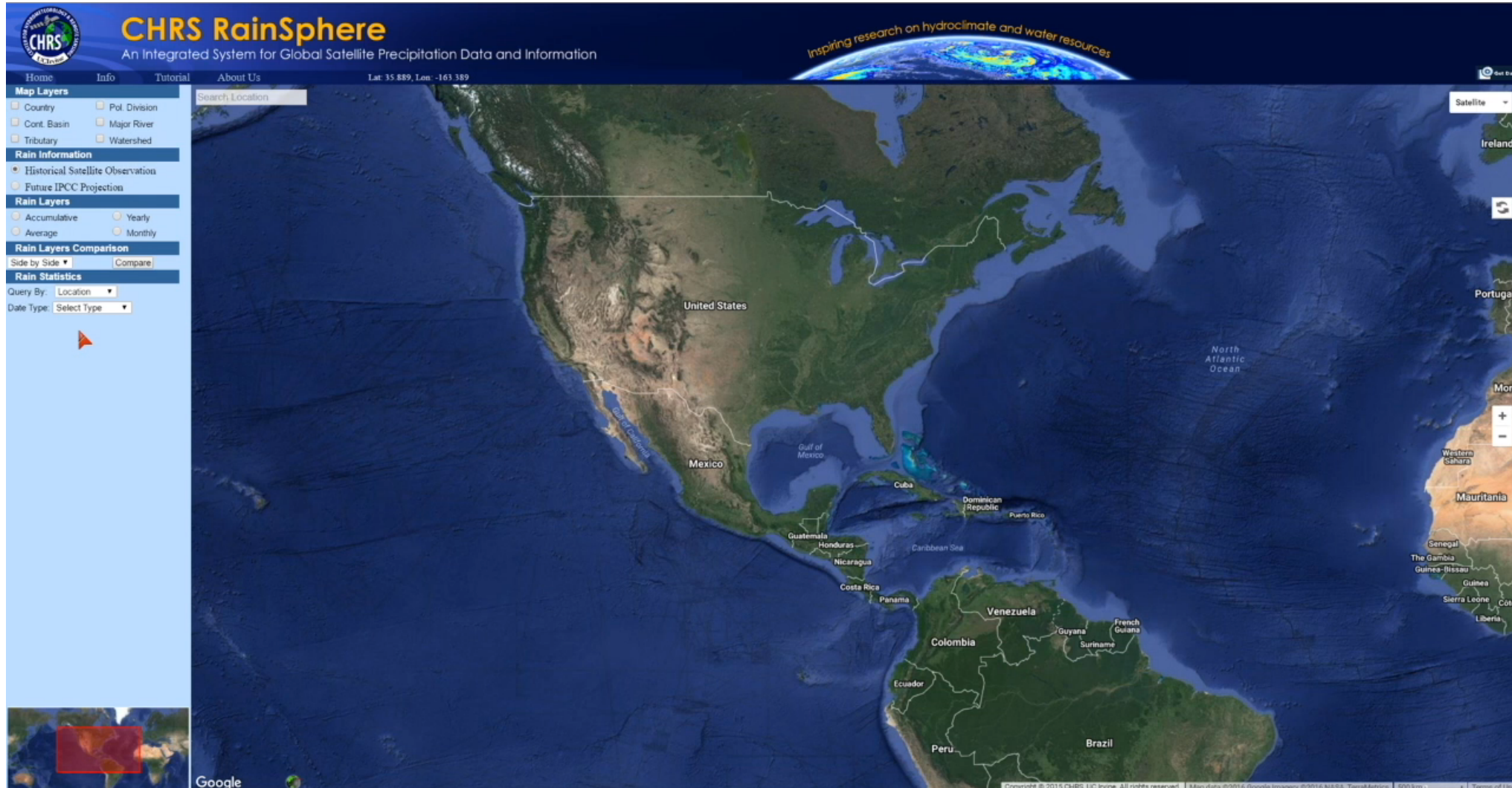
RainSphere

Rain Comparisons



RainSphere

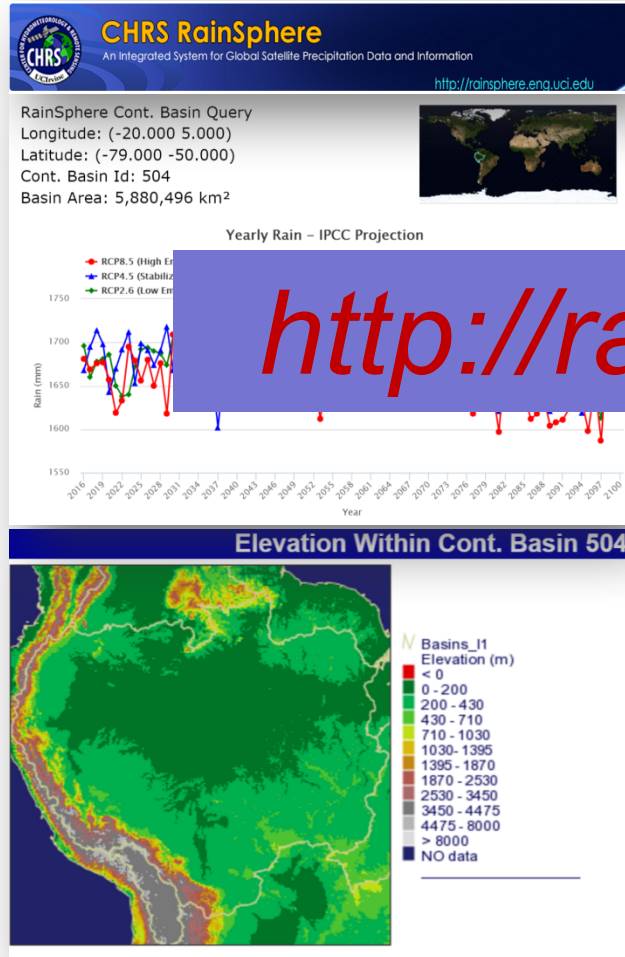
Spatiotemporal Rain Trend Analysis



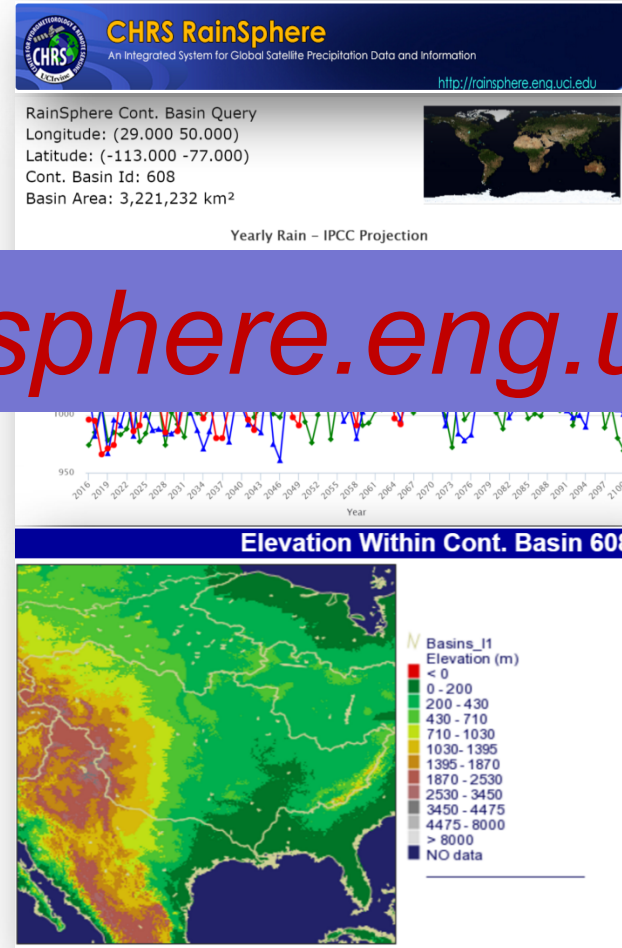
RainSphere

Future Projection

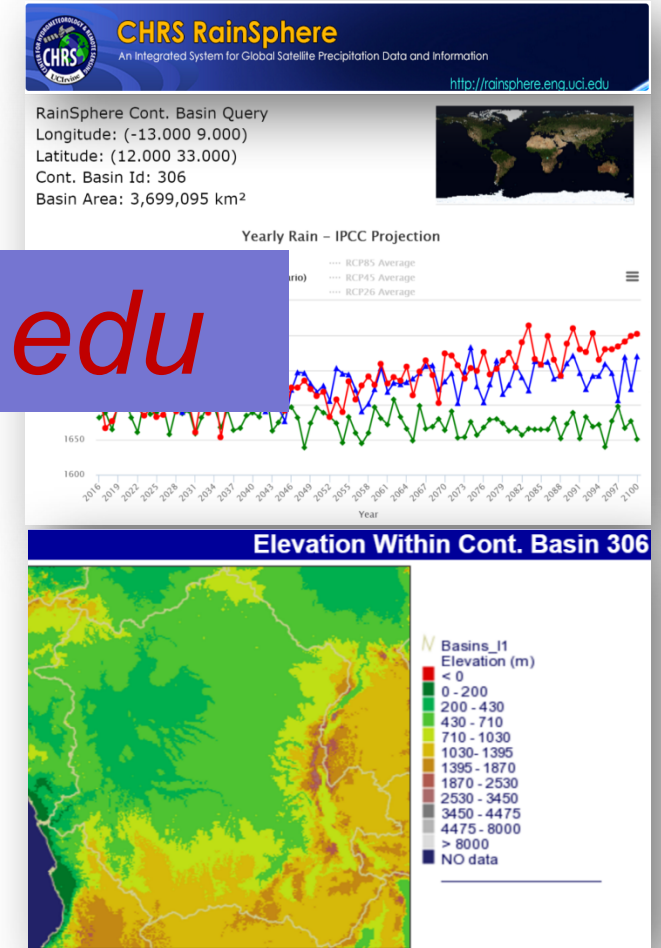
Amazon



Mississippi



Congo



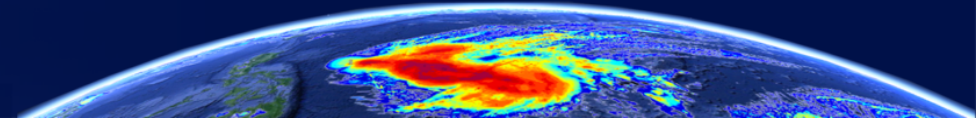
<http://rainsphere.eng.uci.edu>



CHRS CONNECT

A Global Extreme Precipitation Event Database

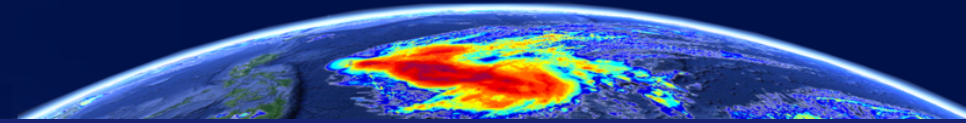
Inspiring research on climate and water resources



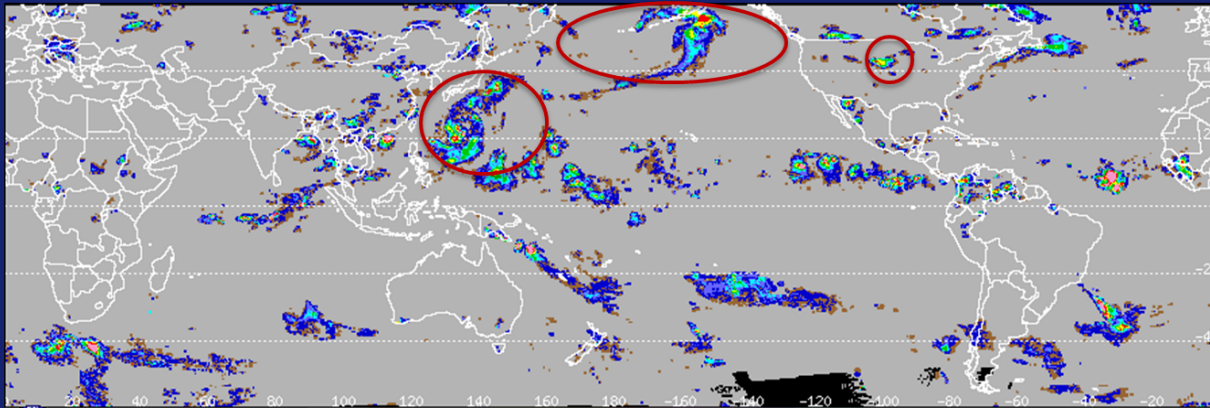
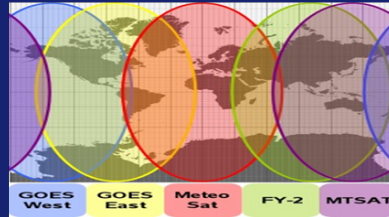
CHRS CONNECT

A Global Extreme Precipitation Event Database

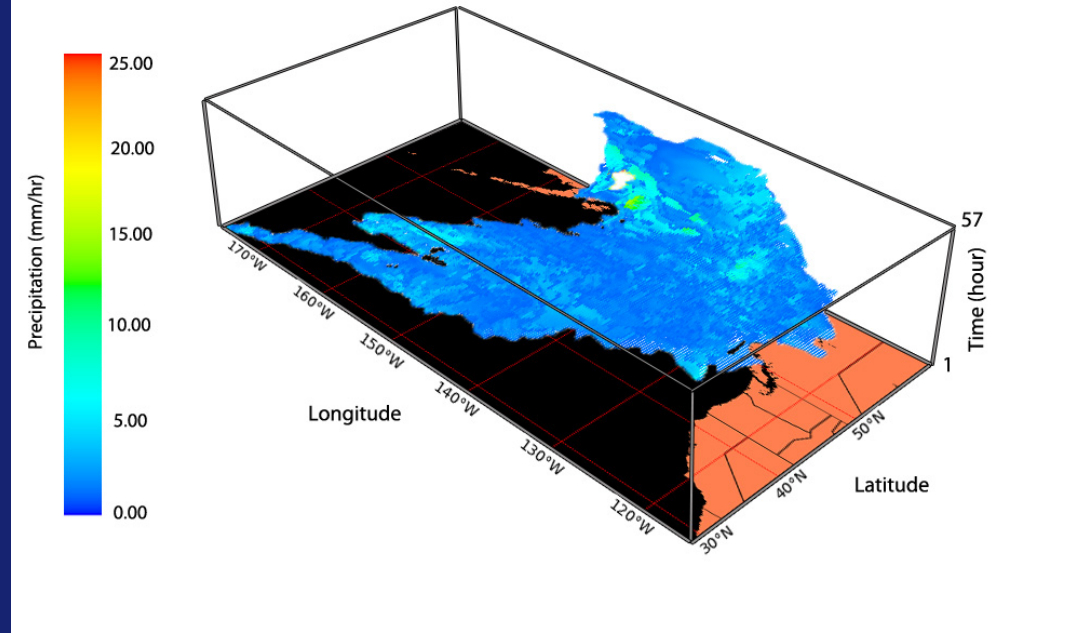




- Data set: Hourly bias corrected PERSIANN data
- 0.25 degree
- 480 rows x 1440 columns
- 60° North - 60° South
- March 2000 – June 2015
- Exist for 24hr and 1mm threshold (71,000+ events)



Atmospheric River: Dec 28th, 2005 - Dec 30, 2005



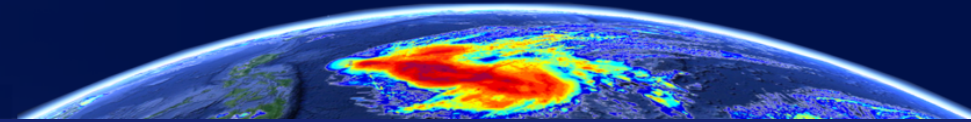
Sellers, S., P. Nguyen, W. Chu, X. Gao, K. Hsu, and S. Sorooshian (2013), Computational Earth Science: Big Data Transformed Into Insight, EOS Trans. AGU, 94(32),277



CHRS CONNECT

A Global Extreme Precipitation Event Database

Inspiring research on climate and water resources



Navigation Bar

Dataset Selection

Search Method

Spatial Selection

Time Period

Define Extreme Event

Search by Features

Search Location

Base maps

Visualization Tools

List of Events Found

Download Results

The screenshot shows the CHRS CONNECT web application interface. On the left is a navigation sidebar with sections: Navigation Bar (Home, Info, Tutorial, About Us), Dataset Selection (PERSIANN-CONNECT), Search Method (Event Name/ID, Event Features), Spatial Selection (California), Coordinate (32.500, 42.000, 55.000, 66.000), Date (Start Date, End Date), Define Extreme Event (Min of Max Intensity, Min Duration), and Search by Features (Add Features). The main area features a map of the United States with a red box highlighting California. A search bar at the top left contains 'Search Location'. On the right, a 'Visualization' panel includes a 'Satellite' dropdown, a speed slider set to 'Medium', and toggle switches for Tracking (OFF), Show Marker(s) (ON), Rain Total (OFF), and Boundary (OFF). Below this is a 'Results' section with a 'Download' button. The bottom of the page includes 'OUR SPONSORS' with logos for NASA, NOAA, and others, and a 'Download Results' button.





CHRS CONNECT

A Global Extreme Precipitation Event Database

Inspiring research on hydroclimate and water resources

Home Info Tutorial About Us

Select Dataset

PERSIANN-CONNECT

metric units US units

Search Method

Event Name/ID:

Event Features:

Spatial Selection

Date

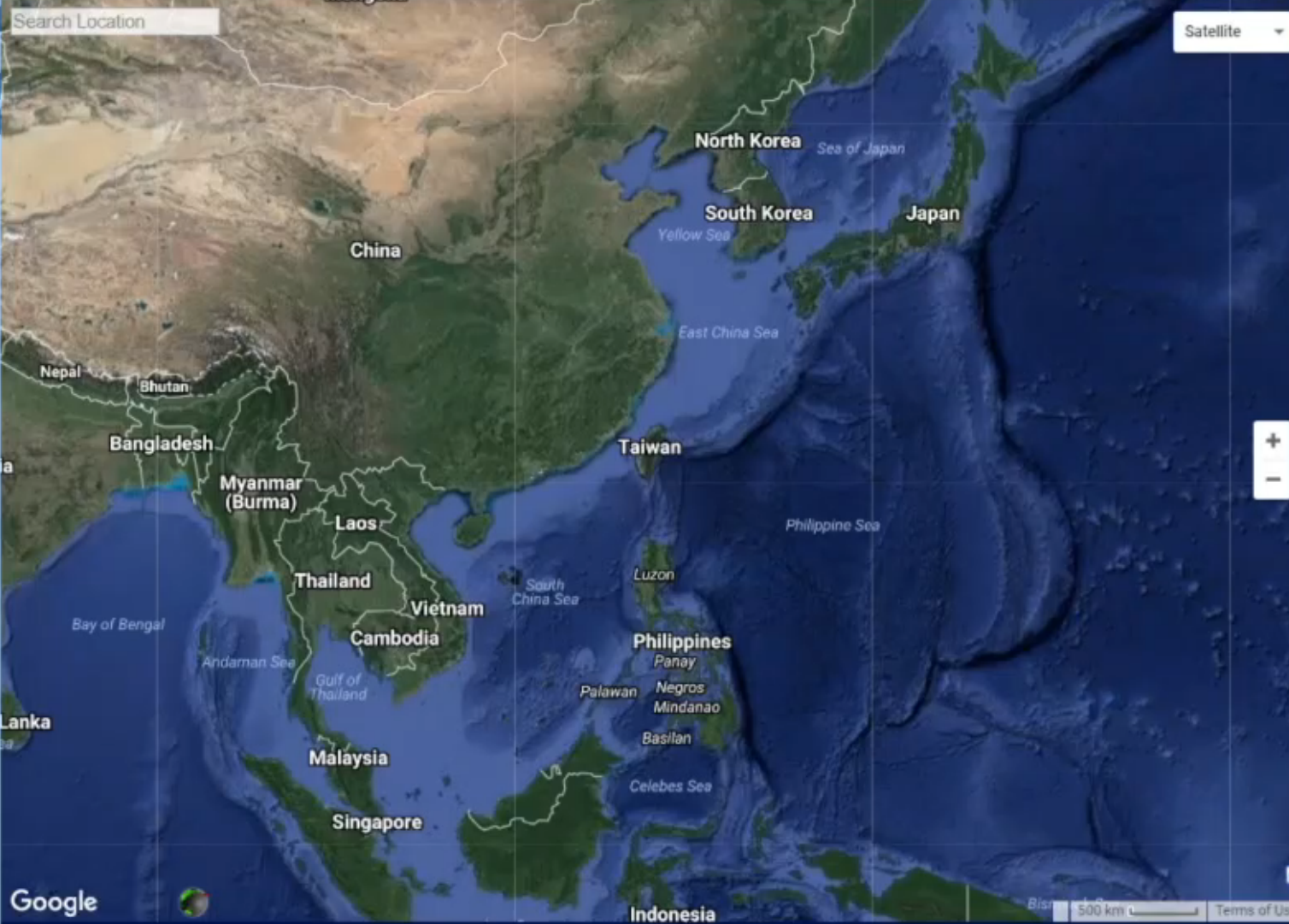
Start Date

End Date

Min of Max Intensity
1 mm/hr

Min Duration
24 hr

Add Features +



Visualization



Speed Medium

Tracking OFF

Centroids ON

Rain Total OFF

Boundary OFF

Results

Download

SPONSORS



Submit

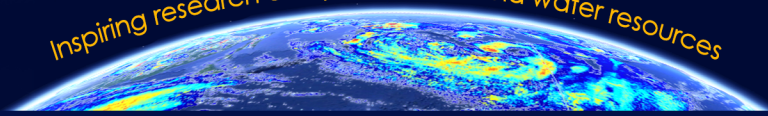
Clear



CHRS iRain

An Integrated System for Global Real-time Precipitation Observation

Inspiring research on hydroclimate and water resources

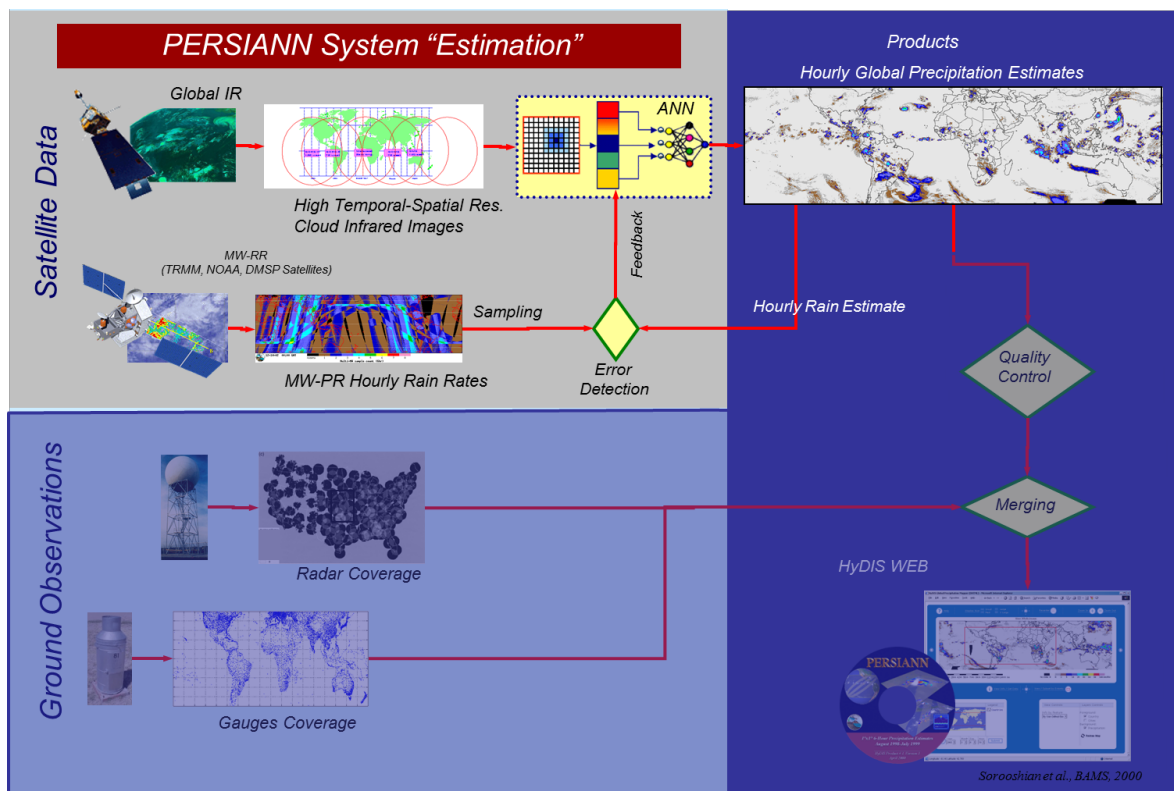


CHRS iRain

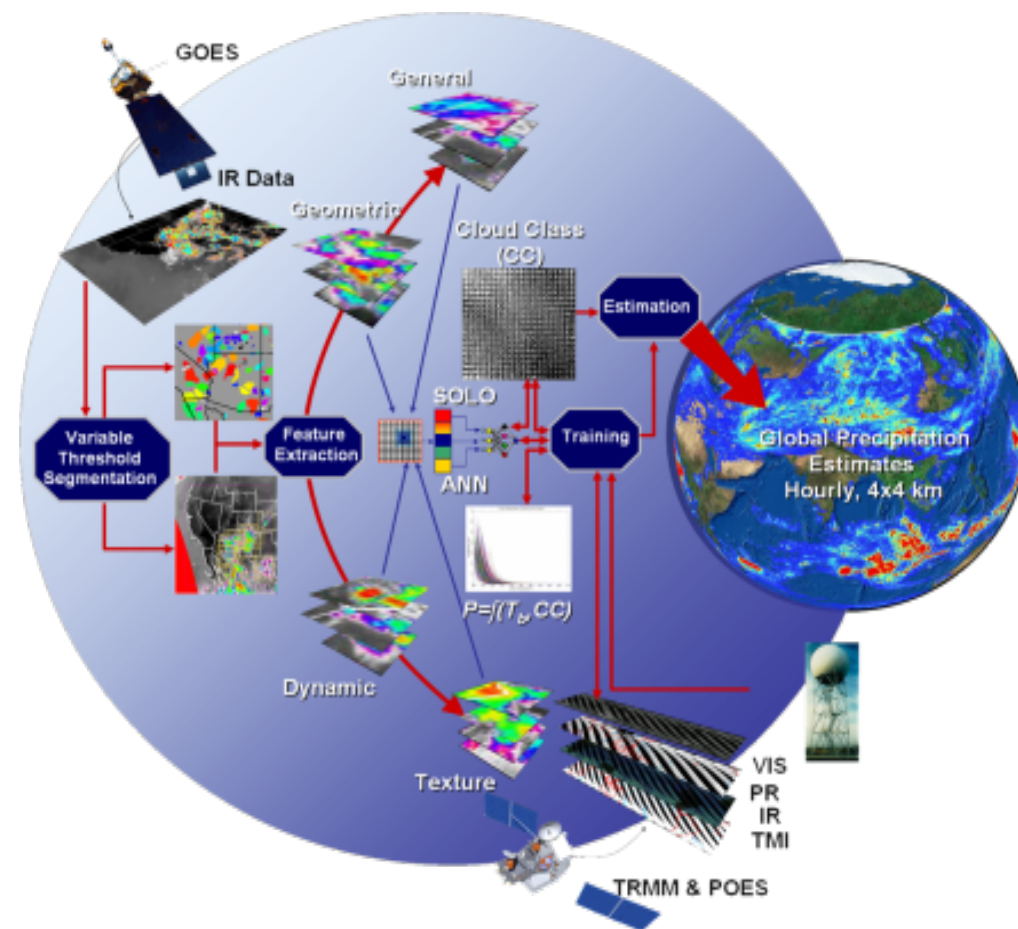
An Integrated System for Global Real-time Precipitation Observation



Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks (PERSIANN)



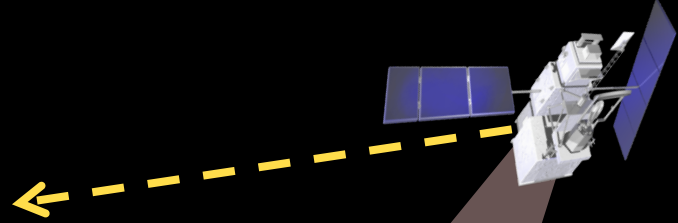
PERSIANN-CCS





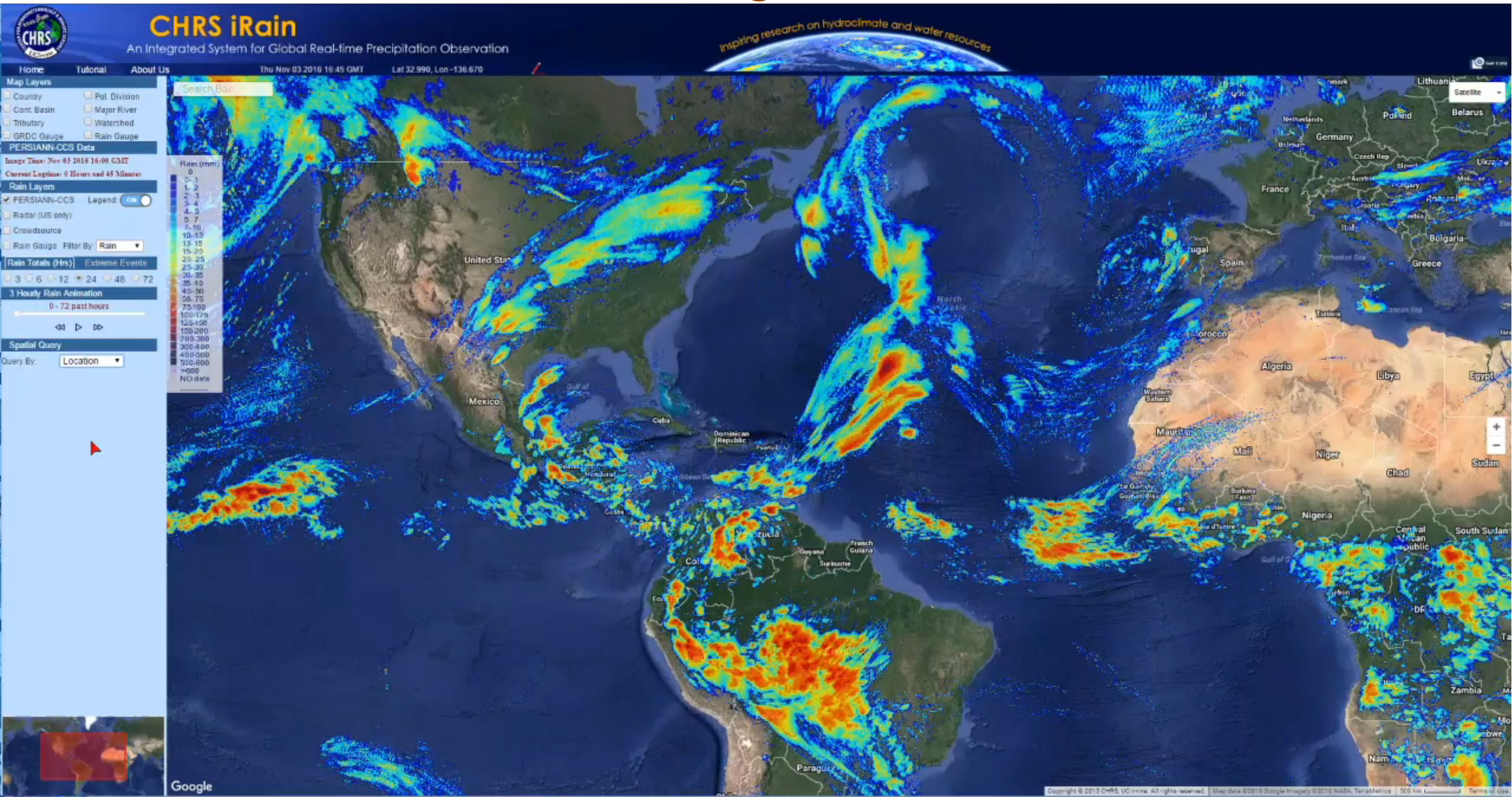
PERSIANN System
Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks

CHRS
CENTER FOR HYDROMETEOROLOGY & REMOTE SENSING
U.C. Irvine



Rain!

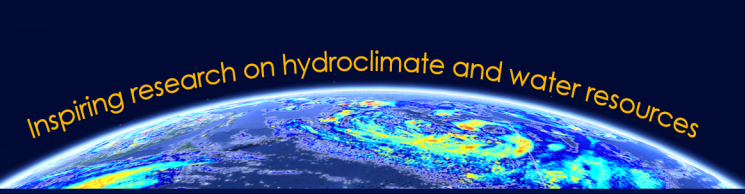






CHRS iRain


An Integrated System for Global Real-time Precipitation Observation



iRain available on App Store

iRain UCI [View More by This Developer](#)

By University of California, Irvine
Open iTunes to buy and download apps.



[View in iTunes](#)


This app is designed for both iPhone and iPad


Free
Category: Weather
Updated: Oct 29, 2016
Version: 2.0.2
Size: 36.3 MB
Language: English
Seller: University of California, Irvine
© CHRS UC Irvine
Rated 4+

Compatibility: Requires iOS 9.0 or later. Compatible with iPhone, iPad, and iPod touch.

Customer Ratings
We have not received enough ratings to display an average for the current version of this application.

More by University of California, Irvine

 UCIOTA
[View in iTunes](#)

 GeriTeam
[View in iTunes](#)

Description
Welcome to iRain version 2.02!
The app is licensed to the Center for Hydrometeorology & Remote Sensing (CHRS) at the University of California
[iRain UCI Support](#) ...More

What's New in Version 2.0.2

- Loading centroids has been made more reliable.
- Added the version number at the bottom of the "About" page.
- Improved the animation of the search bar.

...More

Screenshots iPhone | iPad

Report weather at your location!

Zoom in to view rainfall measurement

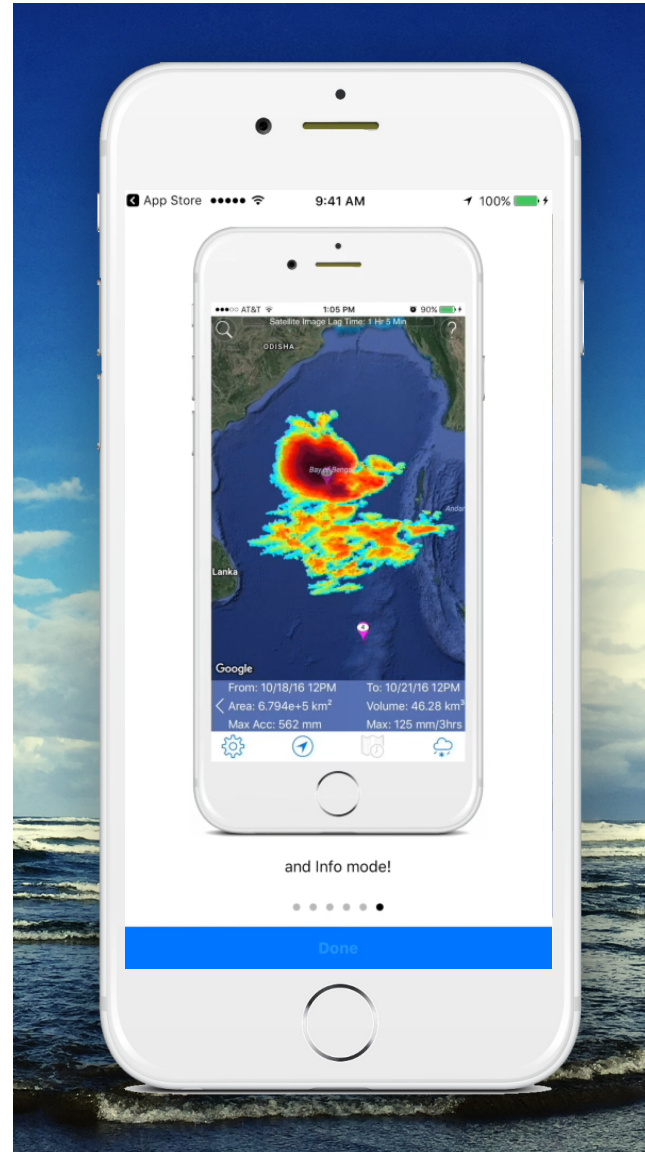


CHRS iRain

An Integrated System for Global Real-time Precipitation Observation

Inspiring research on hydroclimate and water resources

Show rain totals
from 3 hours to 3
days



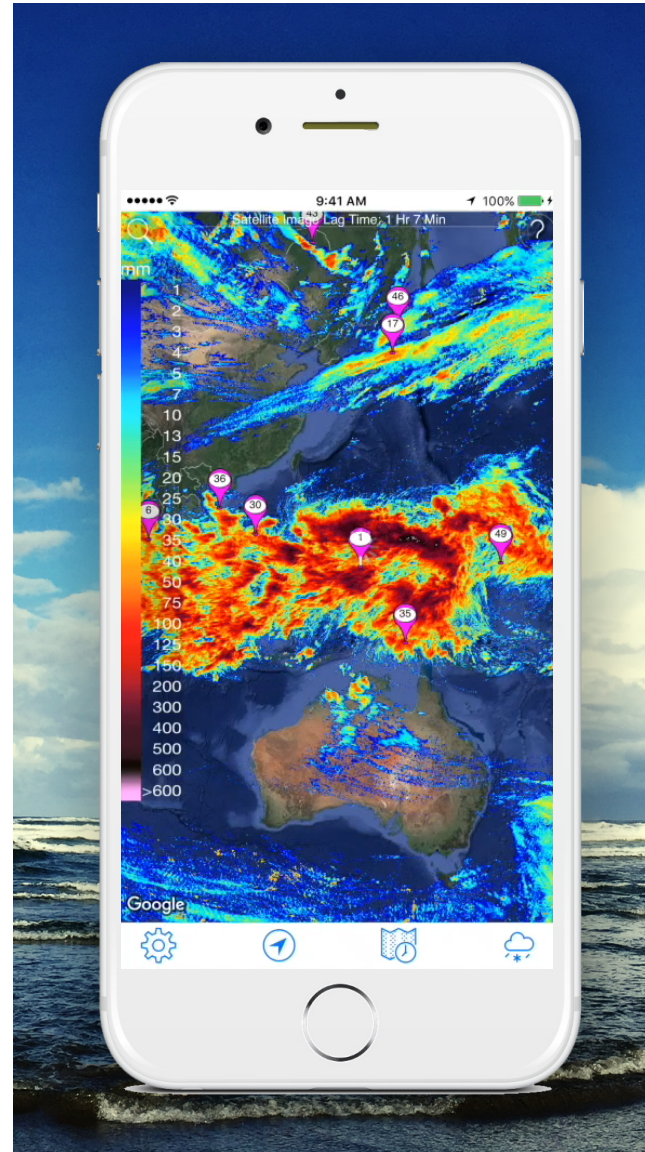


CHRS iRain

An Integrated System for Global Real-time Precipitation Observation

Inspiring research on hydroclimate and water resources

Extreme
rainfall event
animation



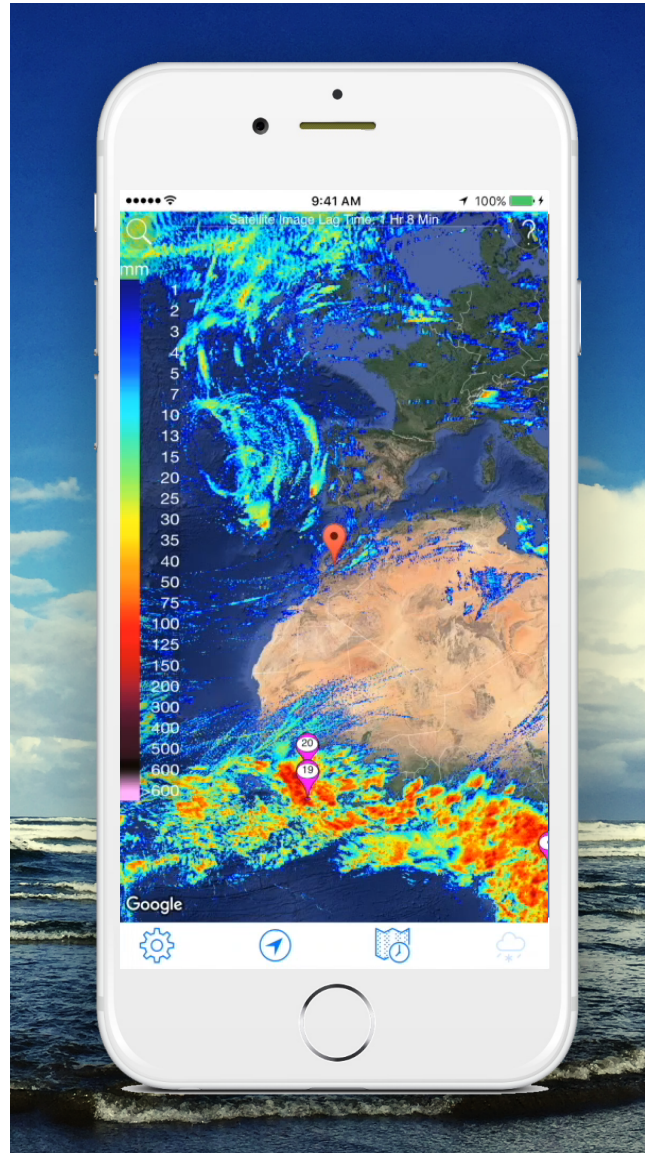


CHRS iRain

An Integrated System for Global Real-time Precipitation Observation

Inspiring research on hydroclimate and water resources

Report rainfall
at your
location





Data Portal

Home Info Tutorial Products About Us

Inspiring research on hydroclimate and water resources

Lat: -43.708, Lon: -110.602

PERSIANN PERSIANN-CCS PERSIANN-CDR

The current operational PERSIANN (Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks) system developed by the Center for Hydrometeorology and Remote Sensing (CHRS) at the University of California, Irvine (UCI) uses neural network function classification/approximation procedures to compute an estimate of rainfall rate at each 0.25° x 0.25° pixel of the infrared brightness temperature image provided by geostationary satellites. An adaptive training feature facilitates updating of the network parameters whenever independent estimates of rainfall are available. The PERSIANN system was based on geostationary infrared imagery and later extended to include the use of both infrared and daytime visible imagery. The PERSIANN algorithm used here is based on the geostationary longwave infrared imagery to generate global rainfall. Rainfall product covers 60°S to 60°N globally. [Further reading.](#)

Data Period: March 2000 - Present

Coverage: 60°S to 60°N

Resolutions: 0.25° x 0.25°

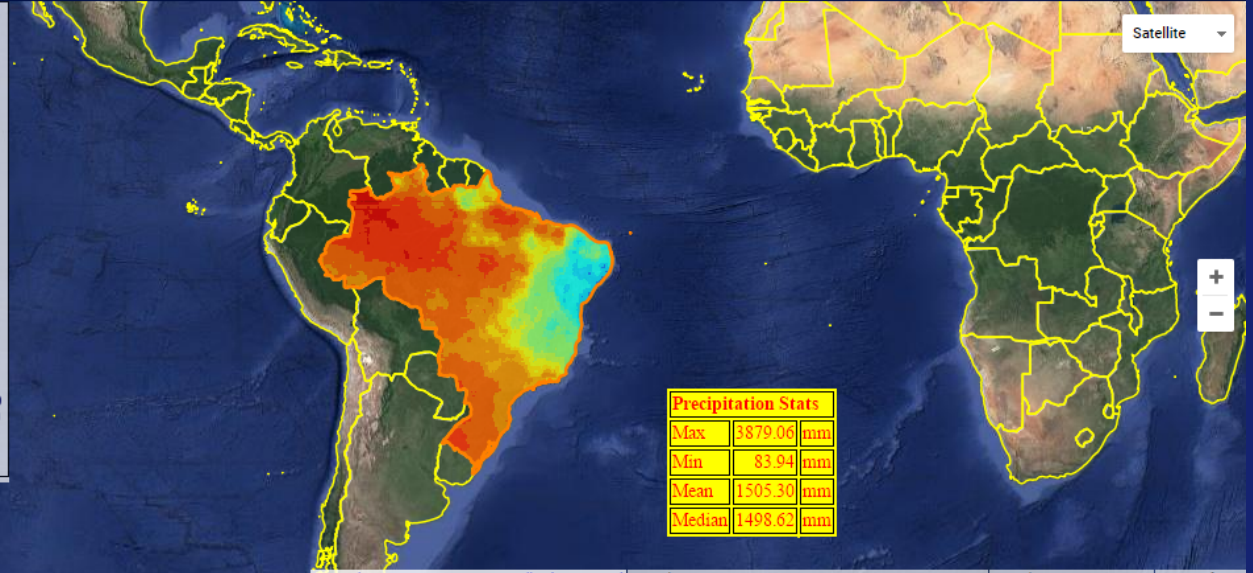
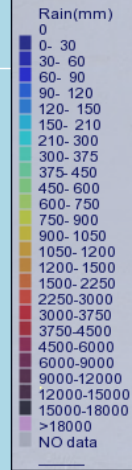
Timesteps: 1, 3, 6 hourly, daily

FTP Download (full): [1 hourly](#), [3 hourly](#), [6 hourly](#), [Daily](#), [Monthly](#), [Yearly](#)

Latest Update: Near real-time with 2 day delay

Selected References:

Sorooshian, S., P. Nguyen, S. Sellars, D. Braithwaite, A. AghaKouchak, and K. Hsu, 2014: Satellite-based remote sensing estimation of precipitation for early warning systems, Extreme Natural Hazards, Disaster Risks and Societal Implications, A. Ismail-Zadeh, J.U. Fucugauchi, A. Kijko, K. Takeuchi, H. Z. Li, and G. ...



Precipitation Stats	
Max	3879.06 mm
Min	83.94 mm
Mean	1505.30 mm
Median	1498.62 mm

Google

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Dataset: PERSIANN Time Step: Yearly Domain: Country

Visualization Download Comparison

DateTime: 2016 Visualize Clear Image Legend: ON

News FAQ

- [Hurricane Matthew](#)
- [Houston Flooding Rainfall](#)
- [Hurricane Patricia](#)
- [RainMapper](#)
- [Check out our RainSphere](#)
- [Super Typhoon Haiyan](#)
- [PERSIANN-CDR Dataset](#)

News & Recent Events

Hurricane Matthew Category -5 Major Hurricane

Hurricane Matthew started on September 28, 2016 from a tropical wave originated from Africa. It weakened as it moved towards southeastern parts of the US and ultimately dissipated on October 10, 2016 as it was absorbed by a cold front along the U.S. Eastern Seaboard. Matthew was classified as Category 5 Atlantic hurricane in the period (11 p.m. EDT on Sept. 30 - 5 a.m. EDT on Oct. 1) , the first of its type since 2007 with highest sustained winds of 160 mph. During the period September 27 to October 9, 2016 PERSIANN-CCS captured heavy rainfall associated with Matthew with a maximum intensity of 6140 mm/2hr and average intensity of 617 mm/2hr. (Source: NASA/JAXA/J-1 Data)



CHRS iRain

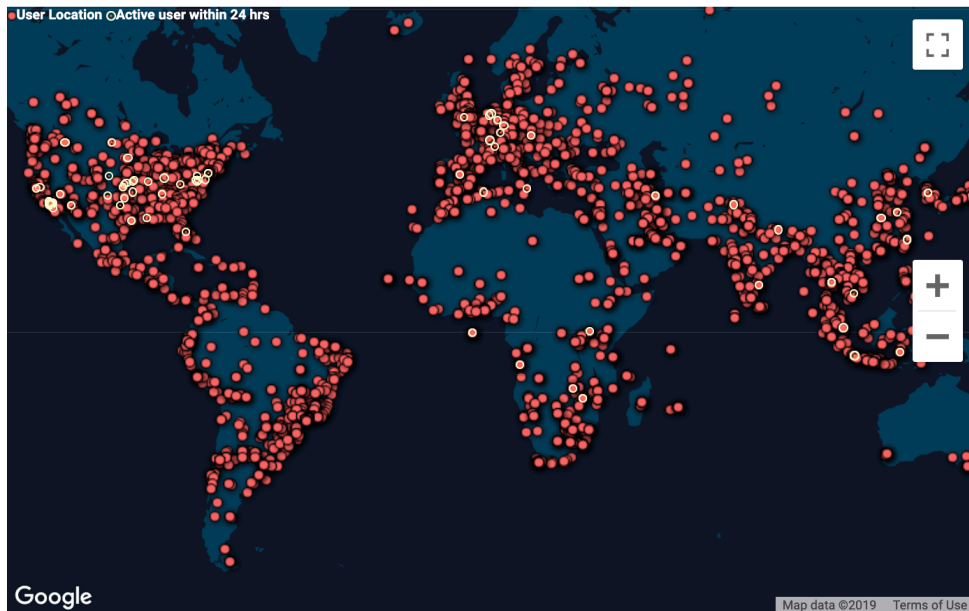
An Integrated System for Global Real-time Precipitation Observation

Inspiring research on hydroclimate and water resources

Who uses CHRS's Products?



CHRS User Statistics



Overall [CHRS Homepage](#) [iRain](#) [RainSphere](#) [Data Portal](#) [CONNECT](#)

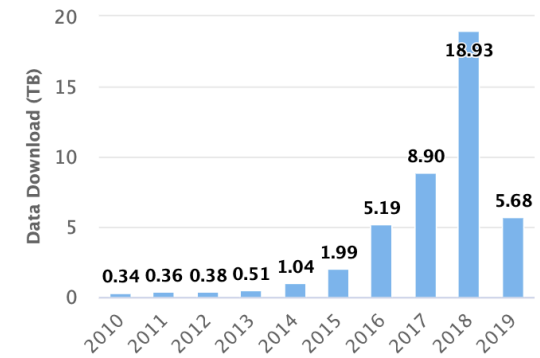
Total Visits: 865,008 since 31-Dec-2009

Countries: 205 countries registered

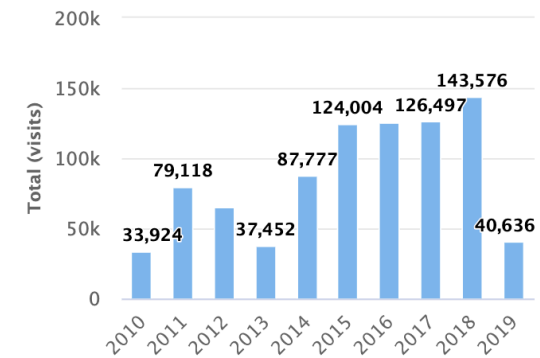
#	Country	Total Visits
1	United States	486,233
2	China	45,341
3	Israel	37,960
4	Thailand	32,211
5	Private IP	27,318
6	France	22,473
7	Iran, Islamic Republic Of	19,232
8	Japan	16,902
9	Germany	14,551

Year Month

Data Download



User Visit



Acknowledgements

