NASA Science Mission Directorate
Earth Science Division
Applied Sciences Program

PERSIANN-CDR: A long-term precipitation data for hydroclimate applications

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April 26-28, 2016

- **Challenge**
  - More frequent extreme events due to climate variability and change
  - Long term precipitation data is need for hydroclimate studies
  - High spatial and temporal resolution of data is required for study extreme events

- **Opportunity**
  - Precipitation climate data record: PERSIANN-CDR
  - 33+ years of daily precipitation estimation

Partners

- Global Precipitation Climate Project (GPCP)
- National Centers for Environmental Information, NOAA
- Global Network on Water and Development Information for Arid Lands (G-WADI), UNESCO-IHP
- Global Precipitation Measurement (GPM) Mission , NASA

User Community

- Asia, Africa, South America, G-WADI, UNESCO-IHP
- California Department of Water Resources

Partner communities you / your project could engage in the future

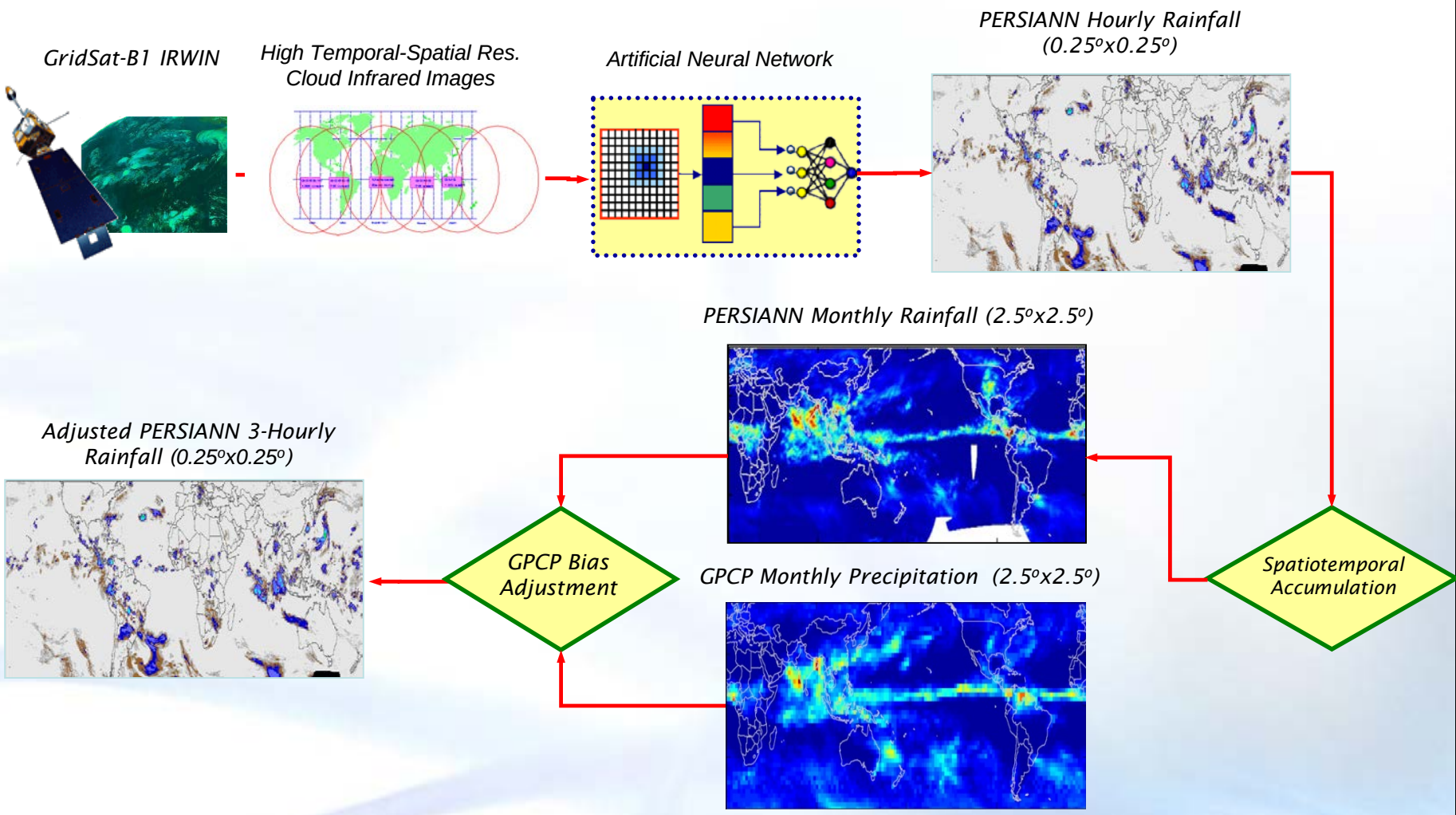
- SERVIR, DEVELOP
- USAID
- National and international water agencies
- Research communities to evaluate climate model precipitation estimation

Key datasets, models, scientific, technical tools

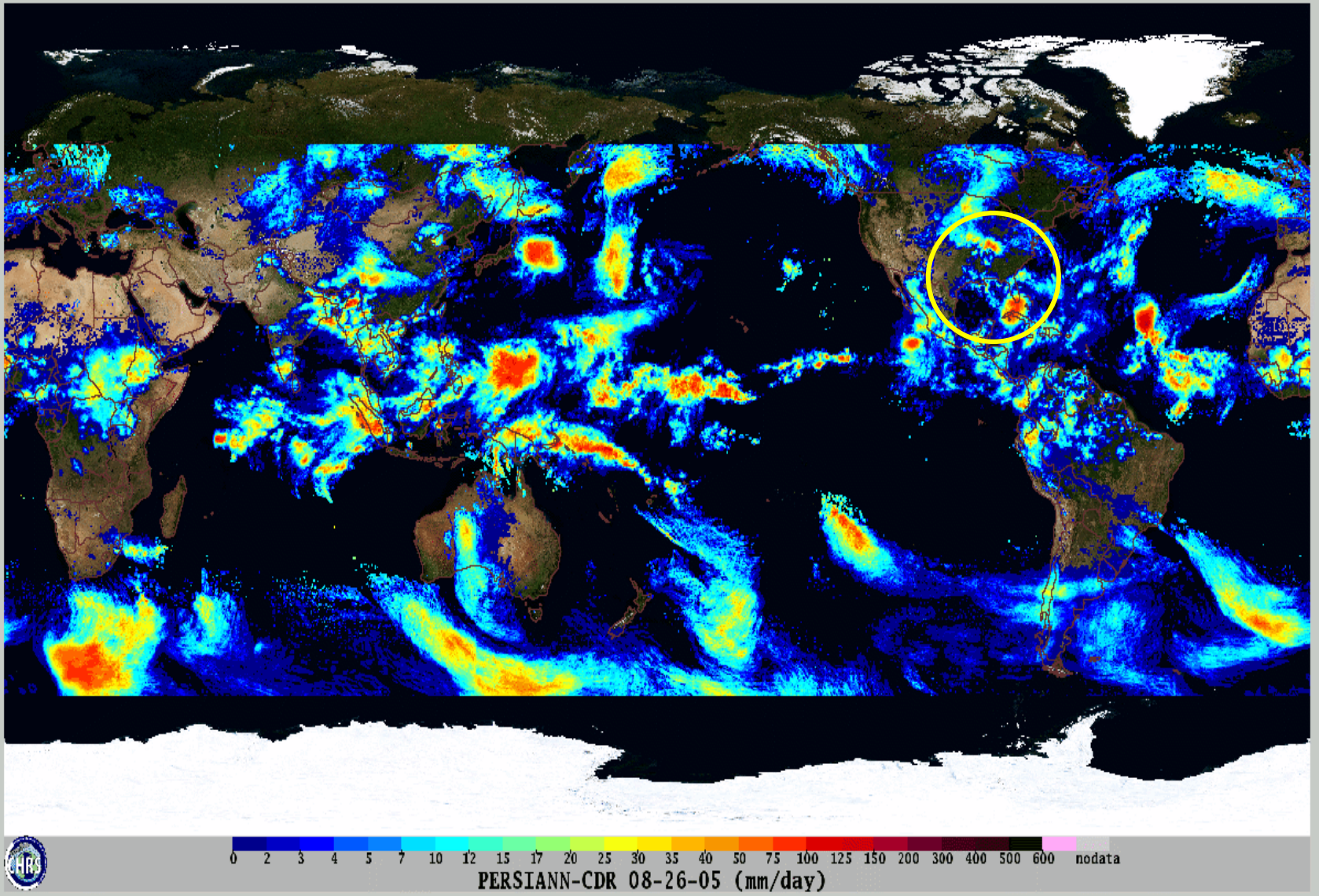
- PERSIANN (Precipitation Estimation from Remotely Sensed Information using Artificial Neural Networks) algorithm is used to produce more than 33+year of daily precipitation data (1983 to near current time).
- Global monthly GPCP precipitation data is used to adjust daily PERSIANN rainfall. The adjusted PERSIANN is consistent to the GPCP rainfall at monthly scale.

- Inputs: NCEI GridSat-B1 CDR Data (IRWIN)
  GPCP monthly v2.2
- Output: GPCP adjusted PERSIANN precipitation
  Resolution: Daily, 0.25^{o}x0.25^{o} Lat-Lon scale
  Coverage: Near global coverage 60°S to 60°N

Approach


GridSat-B1 IRWIN
High Temporal-Spatial Res. Cloud Infrared Images
Artificial Neural Network
PERSIANN Hourly Rainfall (0.25°x0.25°)
PERSIANN Monthly Rainfall (2.5°x2.5°)
Spatiotemporal Accumulation
GPCP Monthly Precipitation (2.5°x2.5°)
GPCP Bias Adjustment
Adjusted PERSIANN 3-Hourly Rainfall (0.25°x0.25°)

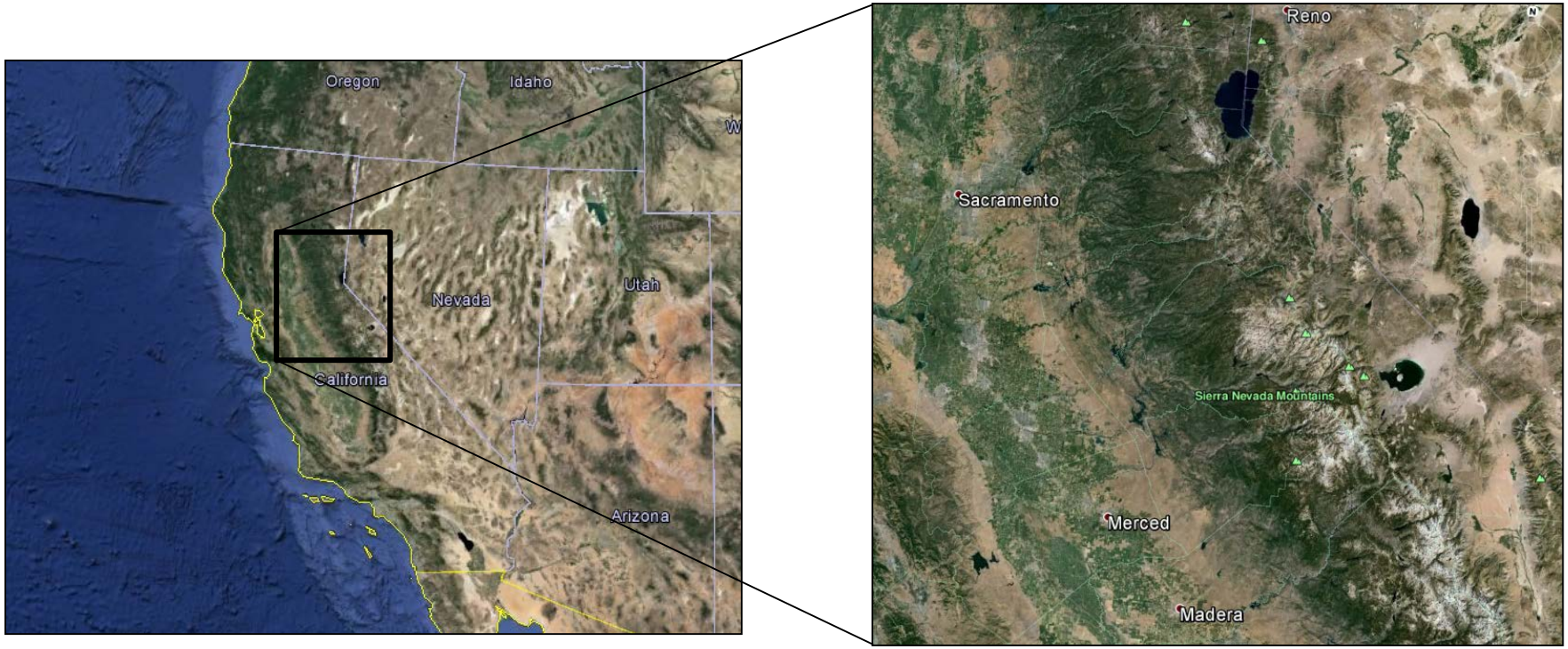
PERSIANN-CDR daily rainfall During Katrina 2005



Sierra-Nevada Mountain Region

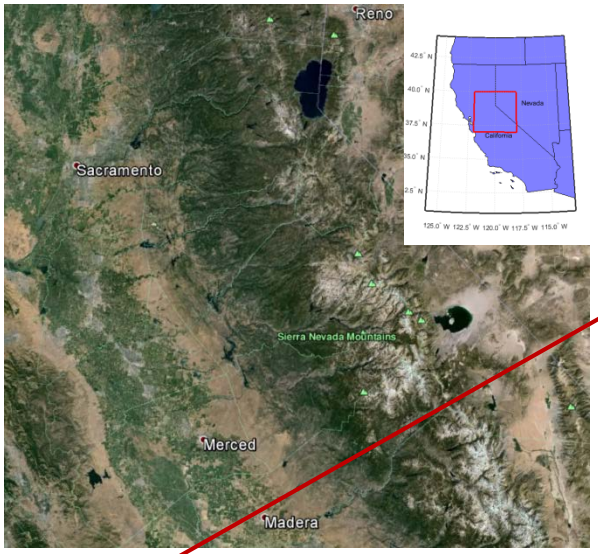
Area: 63,100 square kilometers (24,370 sq mi)

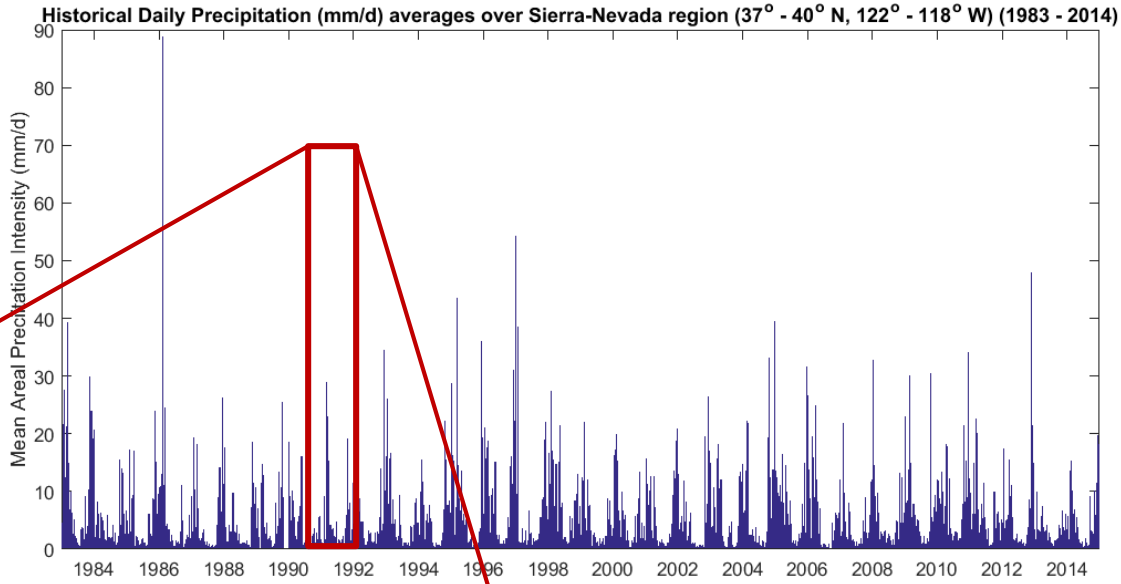
Length: 400 mile, Width: 64 mile.

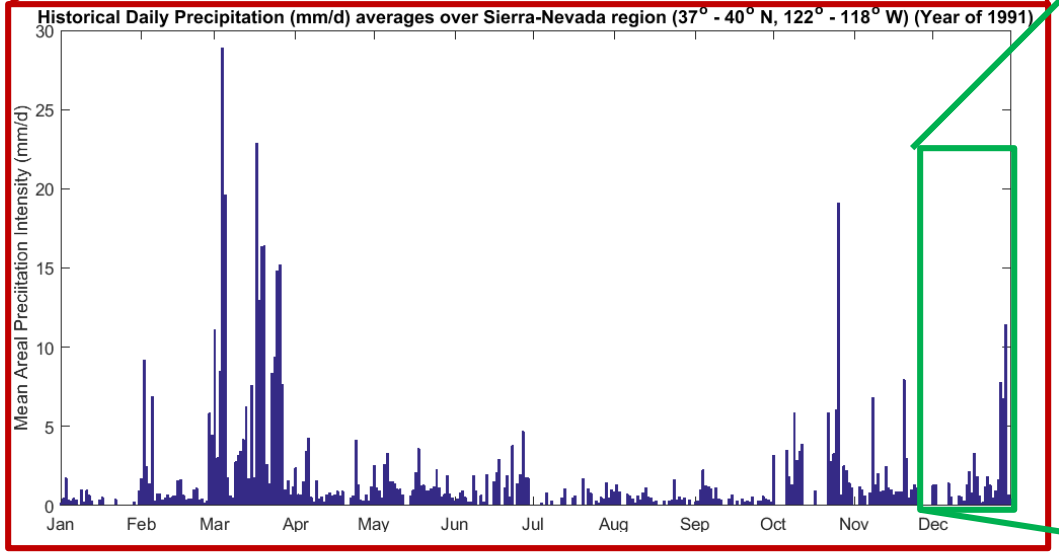


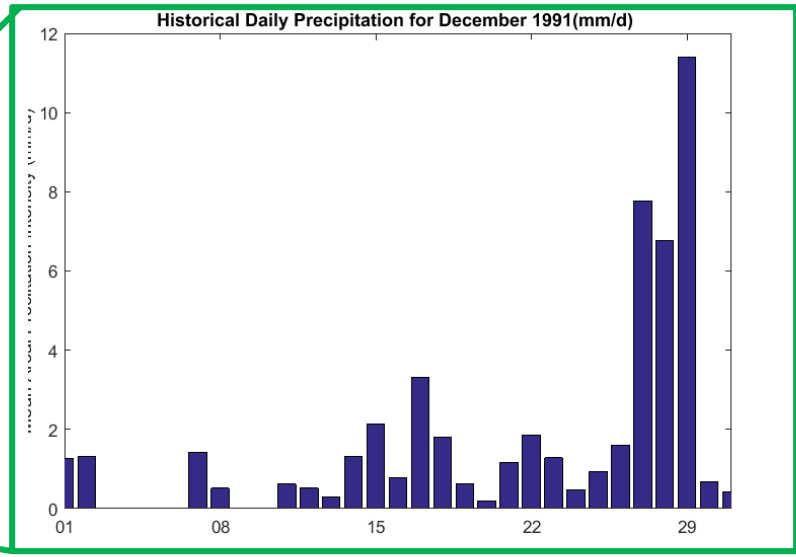
Source: Google Earth

Sierra-Nevada Mountain (California and Nevada)



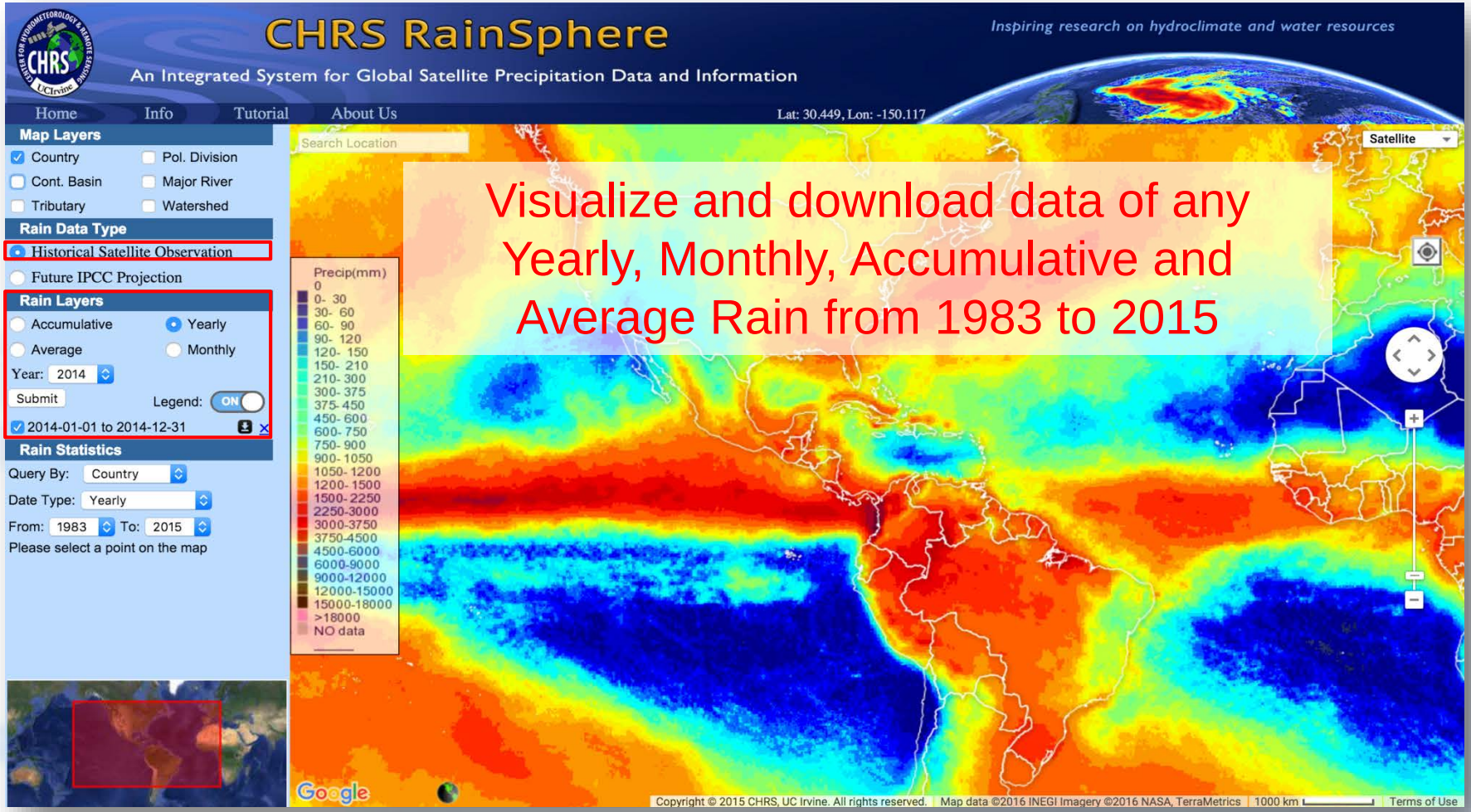




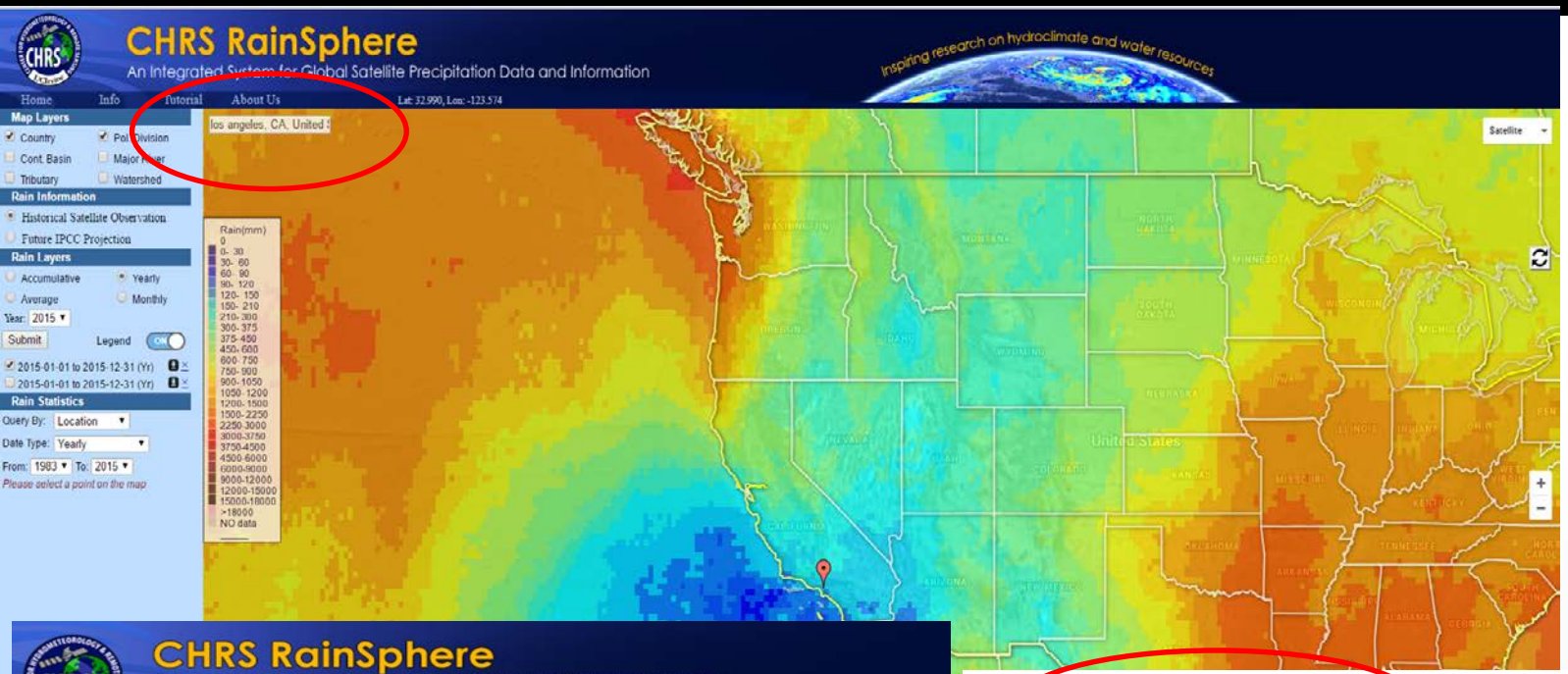


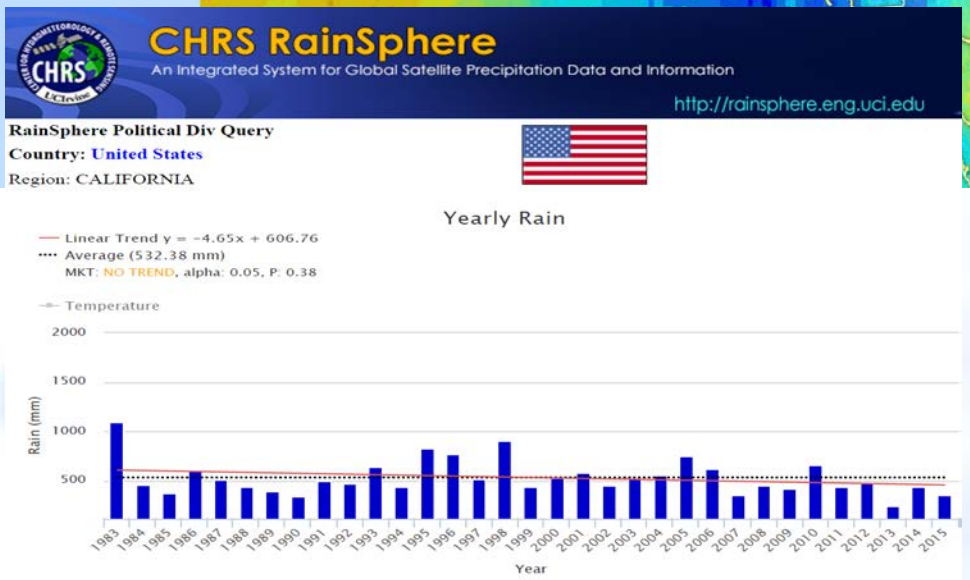
CHRS RainSphere

Historical Satellite Rain Observation (PERSIANN-CDR)

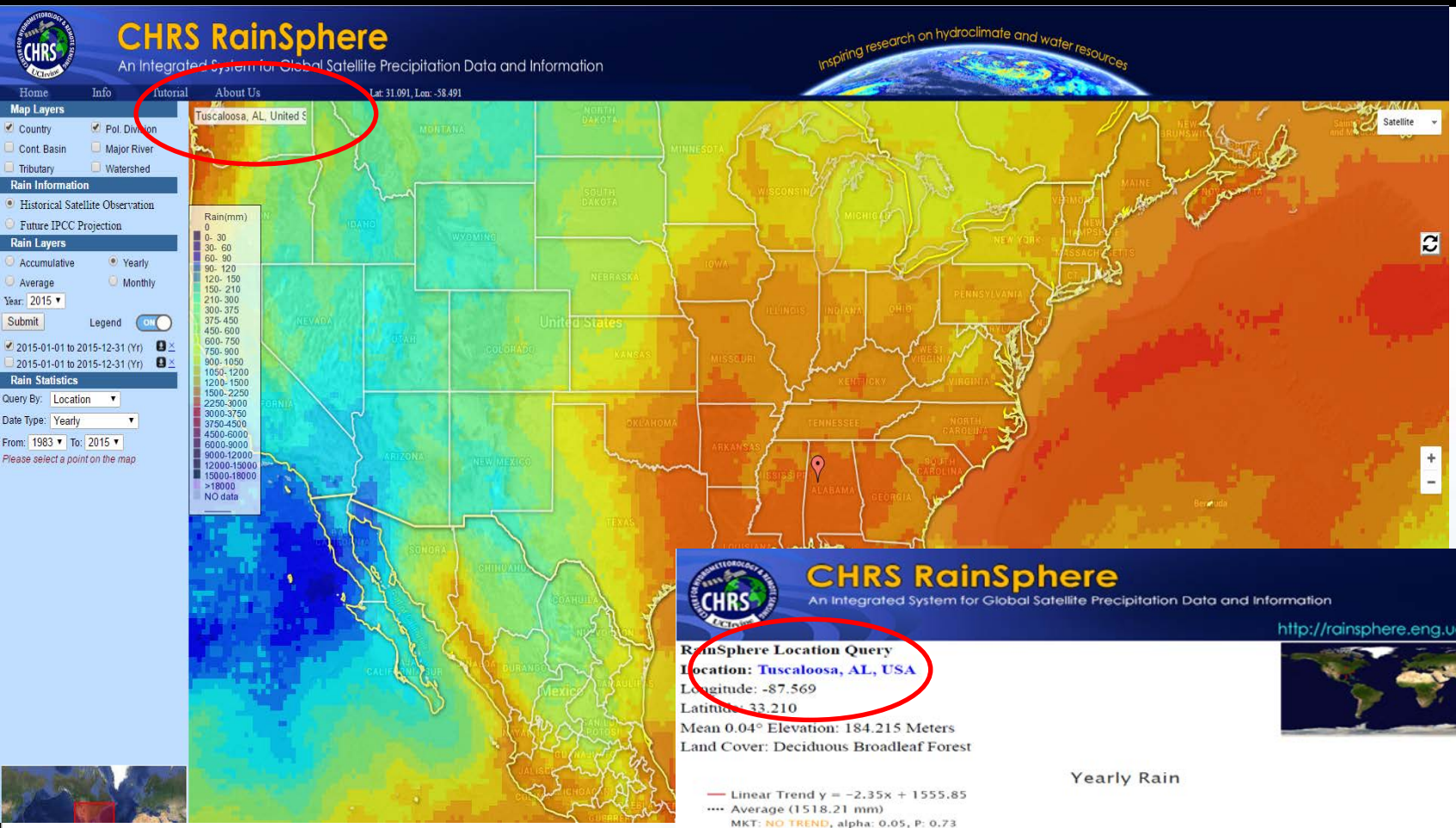


Visualize and download data of any Yearly, Monthly, Accumulative and Average Rain from 1983 to 2015


CHRS RainSphere
An Integrated System for Global Satellite Precipitation Data and Information
Inspiring research on hydroclimate and water resources
Home
Info
Tutorial
About Us
Lat: 32.990, Lon: -123.574
los angeles, CA, United
Map Layers
Country
Cont. Basin
Tributary
Watershed
Rain Information
Historical Satellite Observation
Future IPCC Projection
Rain Layers
Accumulative
Yearly
Average
Monthly
Year: 2015
Submit
Legend
2015-01-01 to 2015-12-31 (Yr)
2015-01-01 to 2015-12-31 (Yr)
Rain Statistics
Query By: Location
Date Type: Yearly
From: 1983 To: 2015
Please select a point on the map
Rain(mm)
0
0- 30
30- 60
60- 90
90- 120
120- 150
150- 210
210- 300
300- 375
375- 450
450- 600
600- 750
750- 900
900- 1050
1050- 1200
1200- 1500
1500- 2250
2250- 3000
3000- 3750
3750- 4500
4500- 6000
6000- 9000
9000- 12000
12000- 15000
15000- 18000
>18000
NO data
Satellite
United States


CHRS RainSphere
An Integrated System for Global Satellite Precipitation Data and Information
http://rainsphere.eng.uci.edu
RainSphere Political Div Query
Country: United States
Region: CALIFORNIA
Yearly Rain
Linear Trend y = -4.65x + 606.76
Average (532.38 mm)
MKT: NO TREND, alpha: 0.05, P: 0.38
Temperature
Rain (mm)
Year

RainSphere Location Query
Location: 1st & Main, Los Angeles, CA 90012, USA
Longitude: -118.244
Latitude: 34.052
Mean 0.04° Elevation: 732.866 Meters
Land Cover: Urban and Built-up
Yearly Rain
Linear Trend y = -4x + 376.81
Average (312.76 mm)
MKT: NO TREND, alpha: 0.05, P: 0.35
Temperature
Rain (mm)
Year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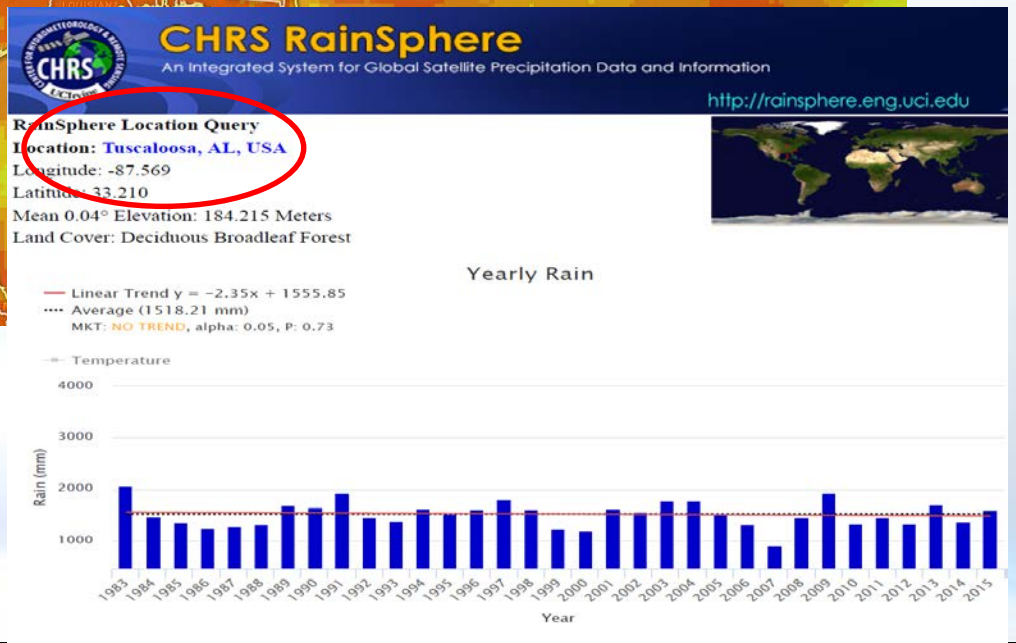
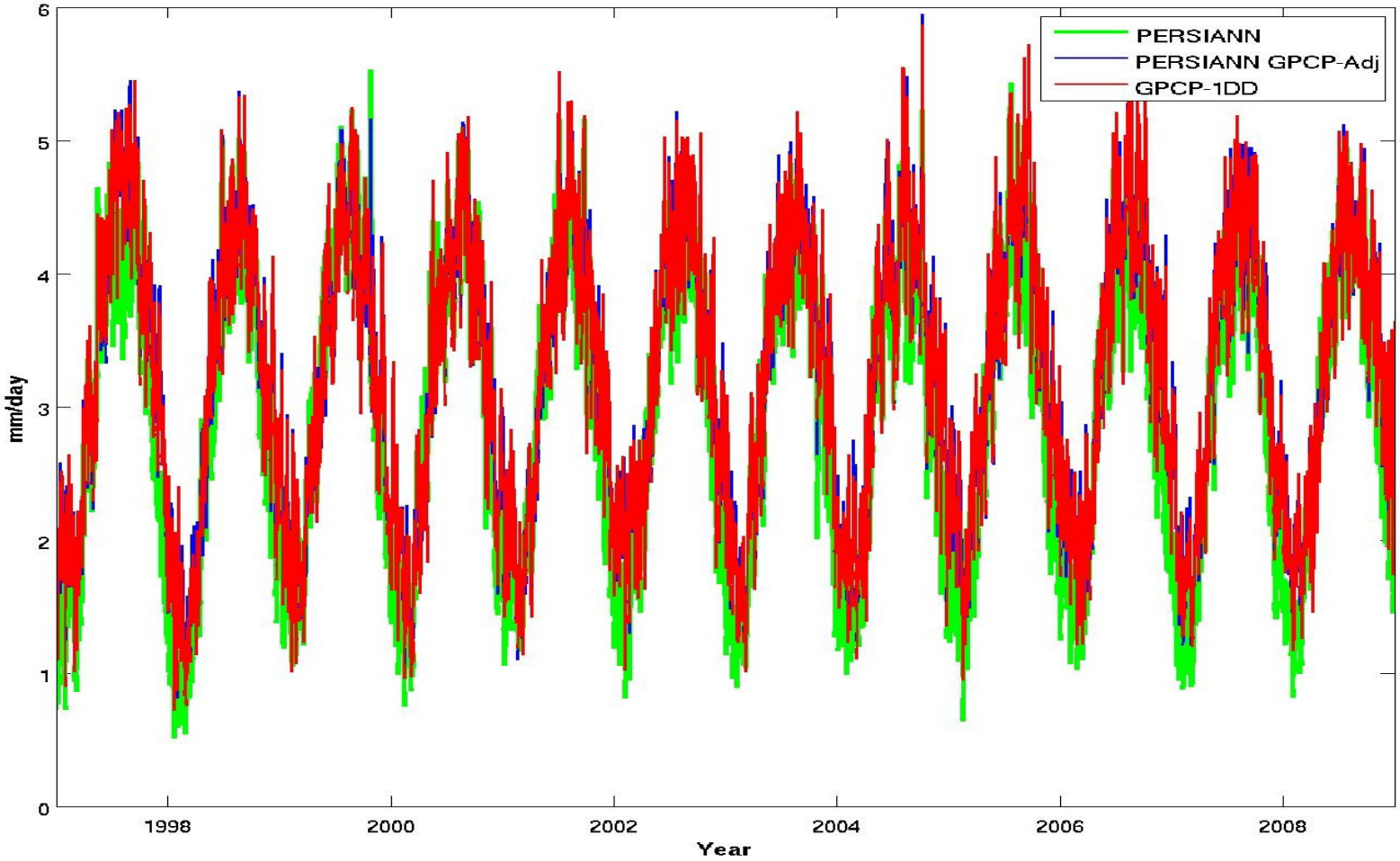
Rain Layers
Accumulative
Yearly
Average
Monthly
Year: 2015
Submit
Legend
ON
2015-01-01 to 2015-12-31 (Yr)
2015-01-01 to 2015-12-31 (Yr)
Rain Statistics
Query By: Location
Date Type: Yearly
From: 1983
To: 2015
Please select a point on the map
Rain(mm)
0
0- 30
30- 60
60- 90
90- 120
120- 150
150- 210
210- 300
300- 375
375- 450
450- 600
600- 750
750- 900
900- 1050
1050- 1200
1200- 1500
1500- 2250
2250- 3000
3000- 3750
3750- 4500
4500- 6000
6000- 9000
9000- 12000
12000- 15000
15000- 18000
>18000
NO data
Satellite
United States
Mexico


CHRS RainSphere
An Integrated System for Global Satellite Precipitation Data and Information
http://rainsphere.eng.uci.edu
RainSphere Location Query
Location: Tuscaloosa, AL, USA
Longitude: -87.569
Latitude: 33.210
Mean 0.04° Elevation: 184.215 Meters
Land Cover: Deciduous Broadleaf Forest
Yearly Rain
Linear Trend y = -2.35x + 1555.85
Average (1518.21 mm)
MKT: NO TREND, alpha: 0.05, P: 0.73
Temperature
Rain (mm)
Year

GPCP 1-DD and PERSIANN Precipitation (0-30°N)

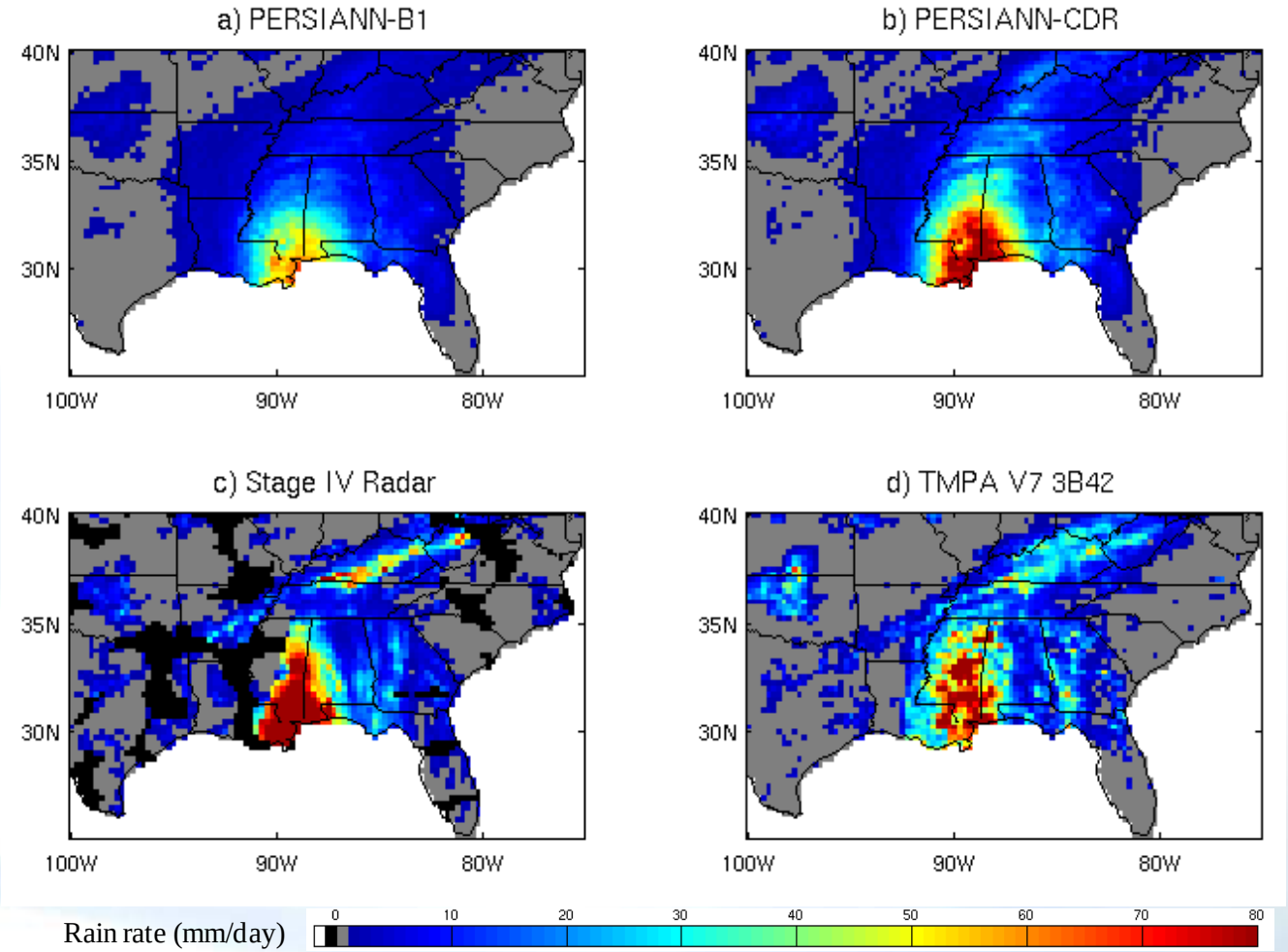
- Comparison of the PERSIANN and Bias-Adjusted PERSIANN with Daily GPCP product (1-DD)
- Data evaluation: Data Period: 1997—2009. Data Coverage: 0—30°N
- Bias-Adjusted PERSIANN estimates are consistent with the GPCP Daily (1-DD) estimates.



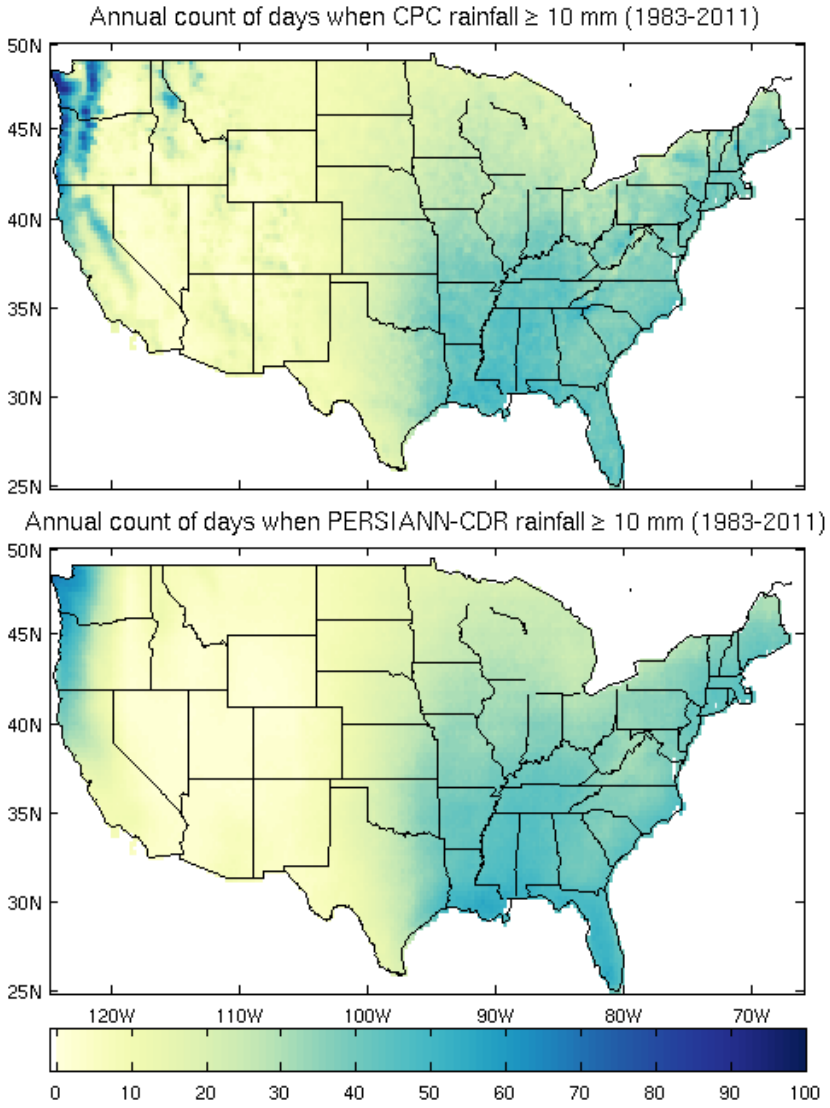
Daily Precipitation: Hurricane Katrina, 2005

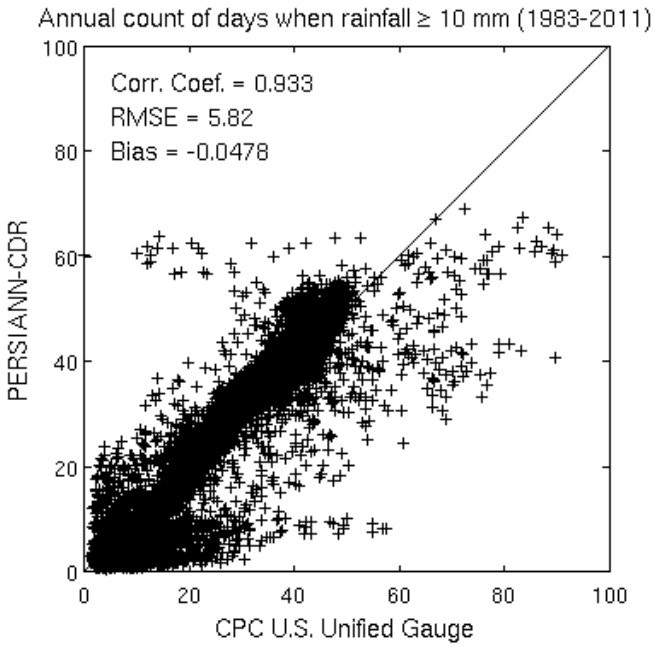
PERSIANN w/o GPCP adjustment

PERSIANN w/o GPCP adjustment



R10mm: Annual Count of days when rainfall >= 10 mm

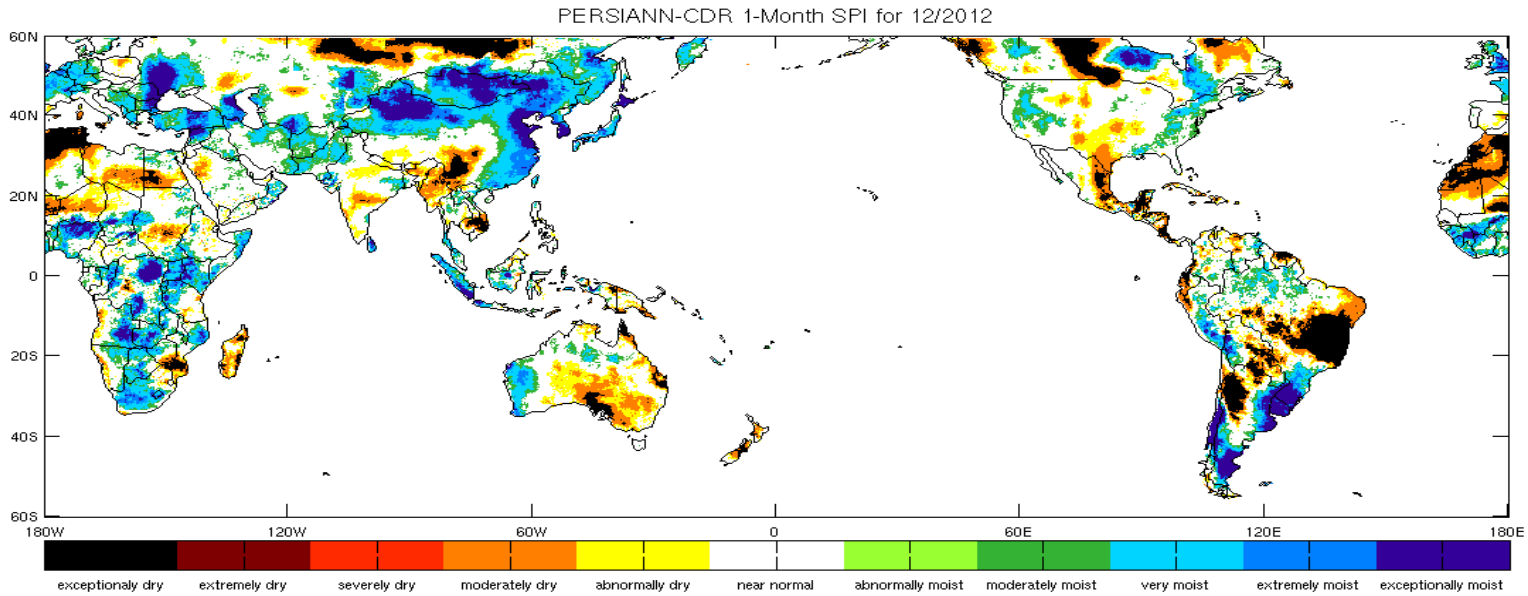




Global Drought Monitoring

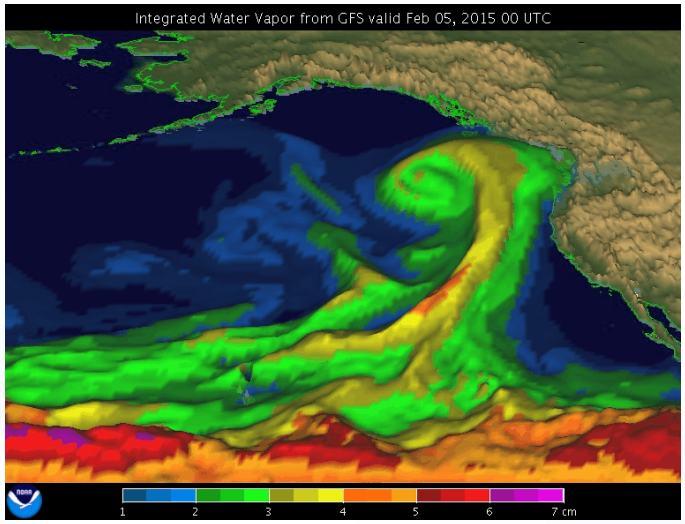
Standard Precipitation Index (SPI) estimated:

- **PERSIANN-CDR 0.25-deg**

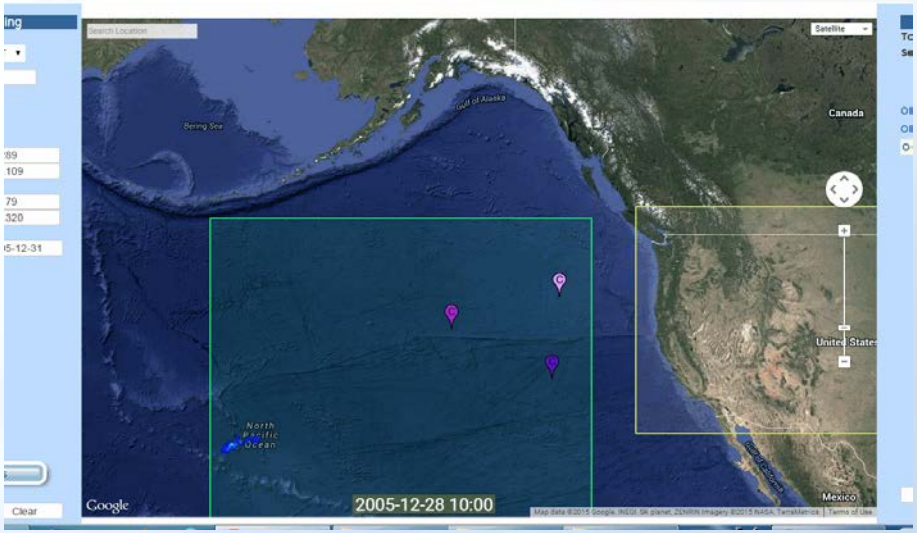


Data Set to Study Atmospheric River

- Atmospheric River
  - Contribute to 30 ~50% California's annual precipitation

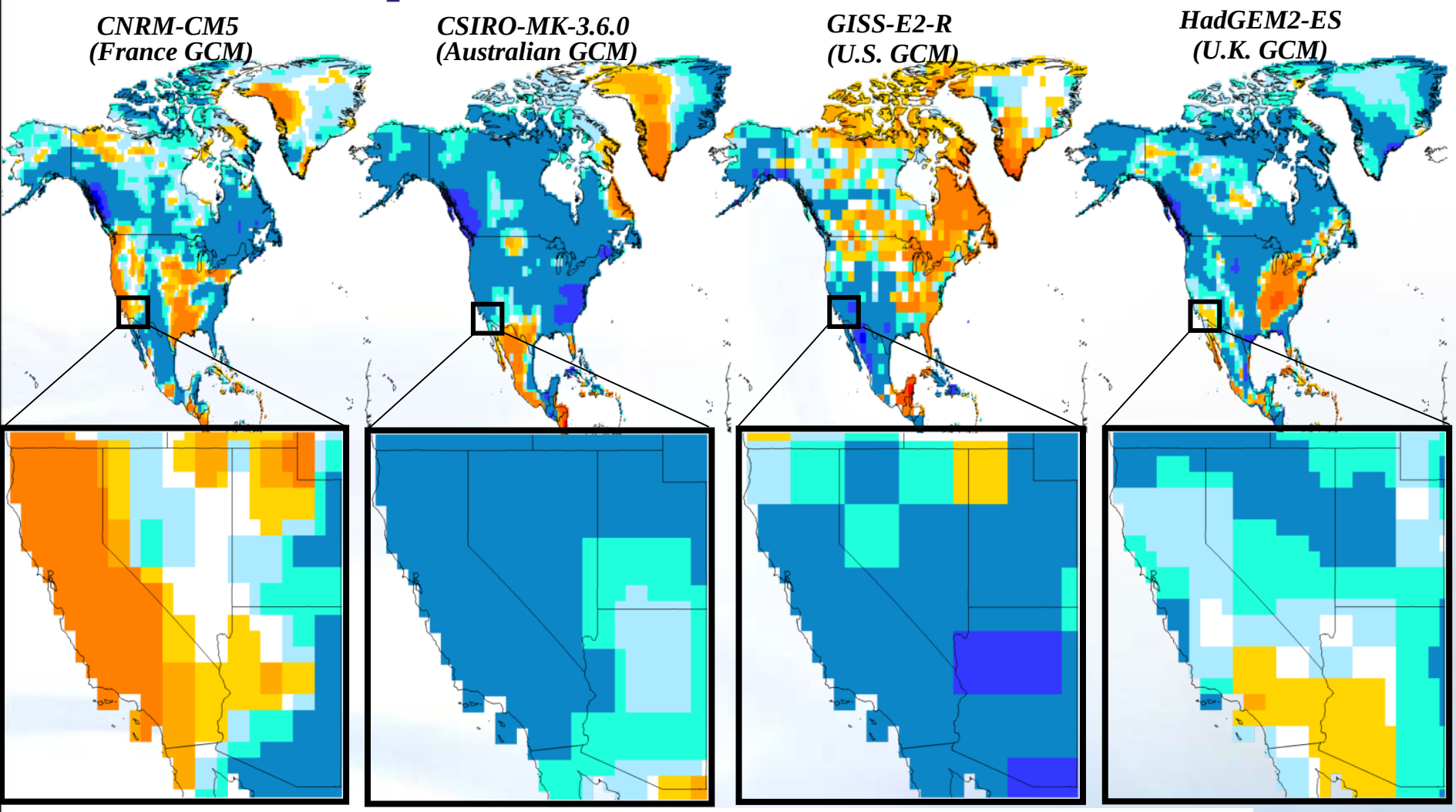


- PERSIANN-CDR CONNECT data:
  - Track evolving system through space and time
  - Identify rainfall systems (i.e., AR)
  - Obtain object's attributes & statistic
  - Advanced search based on storm features



Climate Model Projection of Precipitation Change

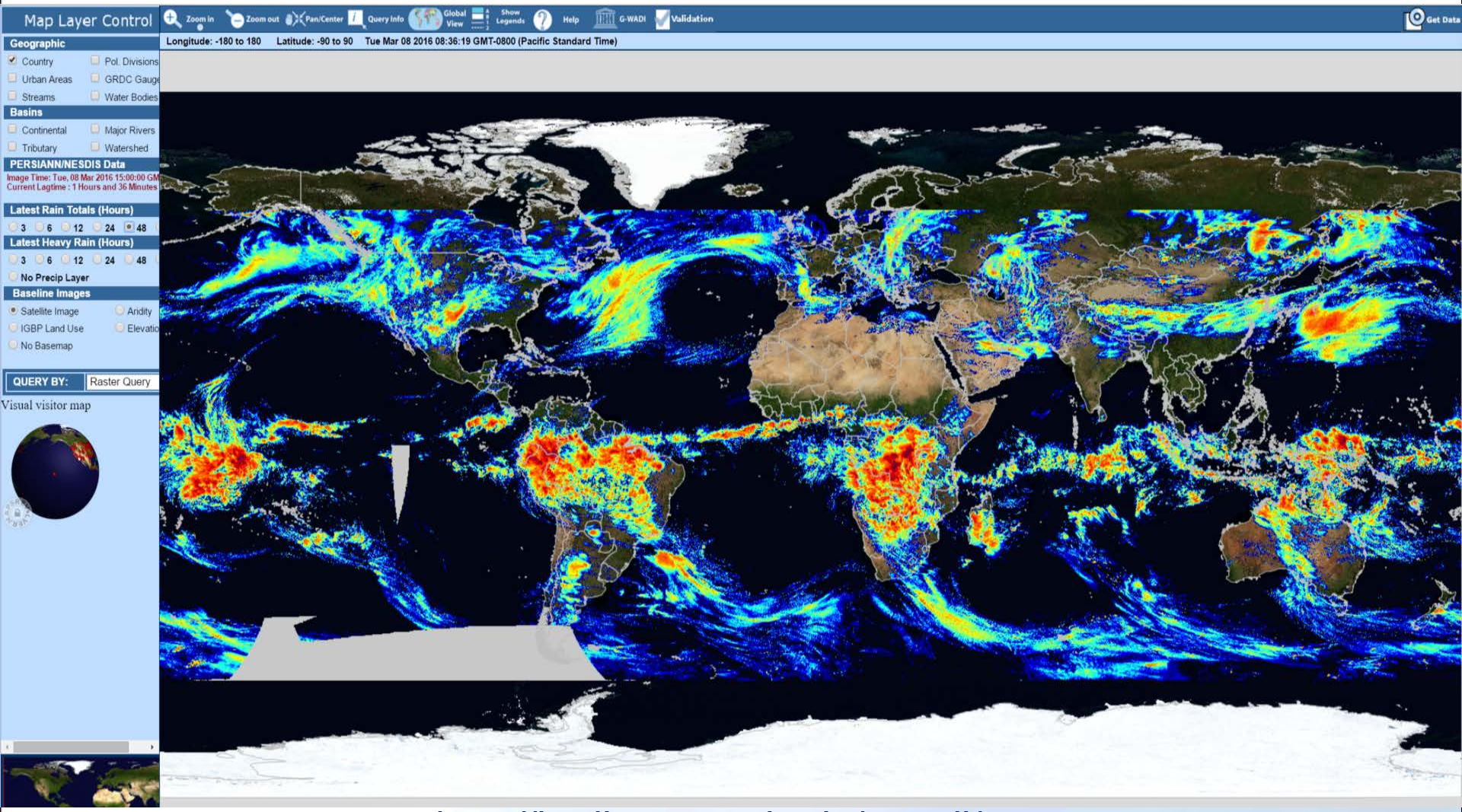
RCP2.6 Time period: 2006-2099



Precipitation change (mm per day per decade)

-.5 -.4 -.3 -.2 -.1 -.05 -.01 -.005 -.001 .001 .005 .01 .05 .1 .2 .3 .4 .5

CHRS Near Real-time Precipitation Estimation



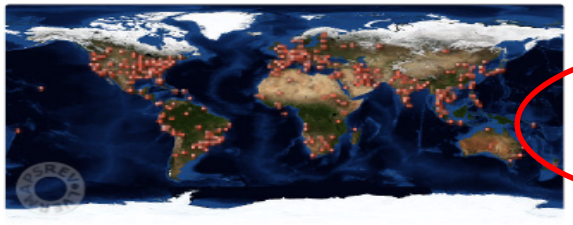
http://hydis.eng.uci.edu/gwadi/

Users for near real-time CHRS Precipitation Estimation

3 recent cities from 3 countries

2D Map | 3D Globe | Locations | 24 Hours | Settings

14,863 visits since Jan 15, 2016



Countries

Visits from 101 countries registered.

up

No.	Country	Last Visit		Percent & Number of Visits	
1	United States	Tue Apr 26, 2016	05:35:01	27.40%	4,073
2	Israel	Thu Apr 21, 2016	01:25:56	16.57%	2,463
3	Peru	Tue Apr 26, 2016	05:31:42	13.13%	1,952
4	Iran, Islamic Republic of	Tue Apr 26, 2016	04:13:05	10.23%	1,521
5	Vietnam	Tue Apr 26, 2016	02:03:55	10.17%	1,512
6	Thailand	Tue Apr 26, 2016	02:38:17	8.80%	1,308
7	China	Mon Apr 25, 2016	05:08:35	1.22%	182
8	Australia	Thu Apr 14, 2016	03:35:02	1.14%	170
9	Namibia	Tue Apr 26, 2016	00:34:16	0.95%	141
10	Saudi Arabia	Mon Apr 25, 2016	00:39:37	0.77%	115
11	Indonesia	Sat Apr 23, 2016	09:15:06	0.76%	113
12	Switzerland	Tue Apr 26, 2016	05:16:44	0.71%	105

5 Recent Pageviews:

05:35:01
United States
Birmingham, Alabama

05:34:57
United States
Birmingham, Alabama

05:34:53
United States
Birmingham, Alabama

05:33:09
France
Caluire-et-Cuire, Rhône-Alpes

05:31:42 | IPv6
Peru
Lima, Municipalidad Metropolitana de Lima

- Provide consistent, long-term data set with 33 years of precipitation data
- High resolution database for hydroclimate studies: Daily rainfall estimation at 0.25-degree lat-long scale
- Work with community for providing long-term precipitation data for hydroclimate studies