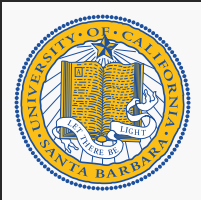


Drought Tools, Monitoring, Interpretation, and Diagnostics

Andy Hoell, Chris Funk, and the FEWS NET Team
contact: hoell@geog.ucsb.edu



Overview

- New Precipitation Dataset: CHIRPS
- Drought Monitoring Using Famine Early Warning Systems Network Web Resources
- Drought Diagnostics Using a Framework of Observations and Models

CHIRPS Precipitation Dataset

Where Can I Download CHIRPS?

chg.geog.ucsb.edu/data/chirps

Who Can I Contact?

Pete Peterson
geogpete@gmail.com

What is CHIRPS?

- **CHIRPS** = **C**limate **H**azards Group **I**nfrared **P**recipitation with **S**tations
- Available for Land Only 1981-Present
 - $0.05^\circ \times 0.05^\circ$ for 50°S - 50°N , 180°E - 180°W
- Temporal Resolution: Day, Pentad, Month
- Release Date:
 - Day & Pentad: 2 days after a pentad ends
 - Month: By the middle of the following month

CHIRPS Recipe

1. Create a historical precipitation climatology called CHP_{clim}
2. Calculate a precipitation estimate using infrared data called IRP
 - $IRP = a * \% \text{ of CCD} + b$
3. Apply time variability of IRP to CHP_{clim} to create CHIRP
 - $CHIRP = (CHP_{clim}) * IRP$
4. Merge, Quality Control and blend stations (CHIRPS)

How Does CHIRPS Compare?

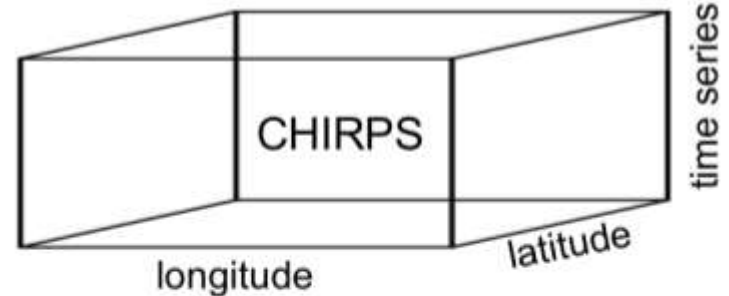
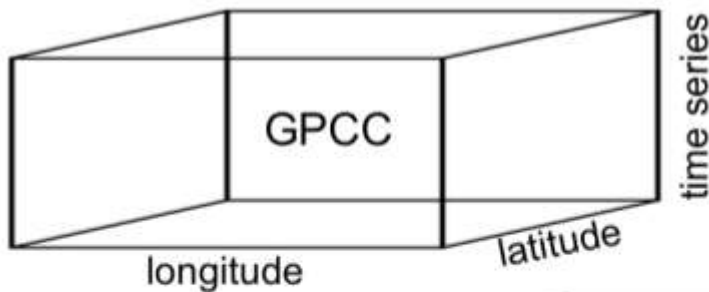
- for each data set, CFS, CPC-Unified, CHIRP(S), ECMWF, TRMM
- build cubes of Wet Season rainfall
- compare to GPCC

time series (1989 – 2010) of Wet Season rainfall

JFM [JFM₁₉₈₉, JFM₁₉₉₀, ..., JFM₂₀₁₀]

...

NDJ [NDJ₁₉₈₉, NDJ₁₉₉₀, ..., NDJ₂₀₁₀]



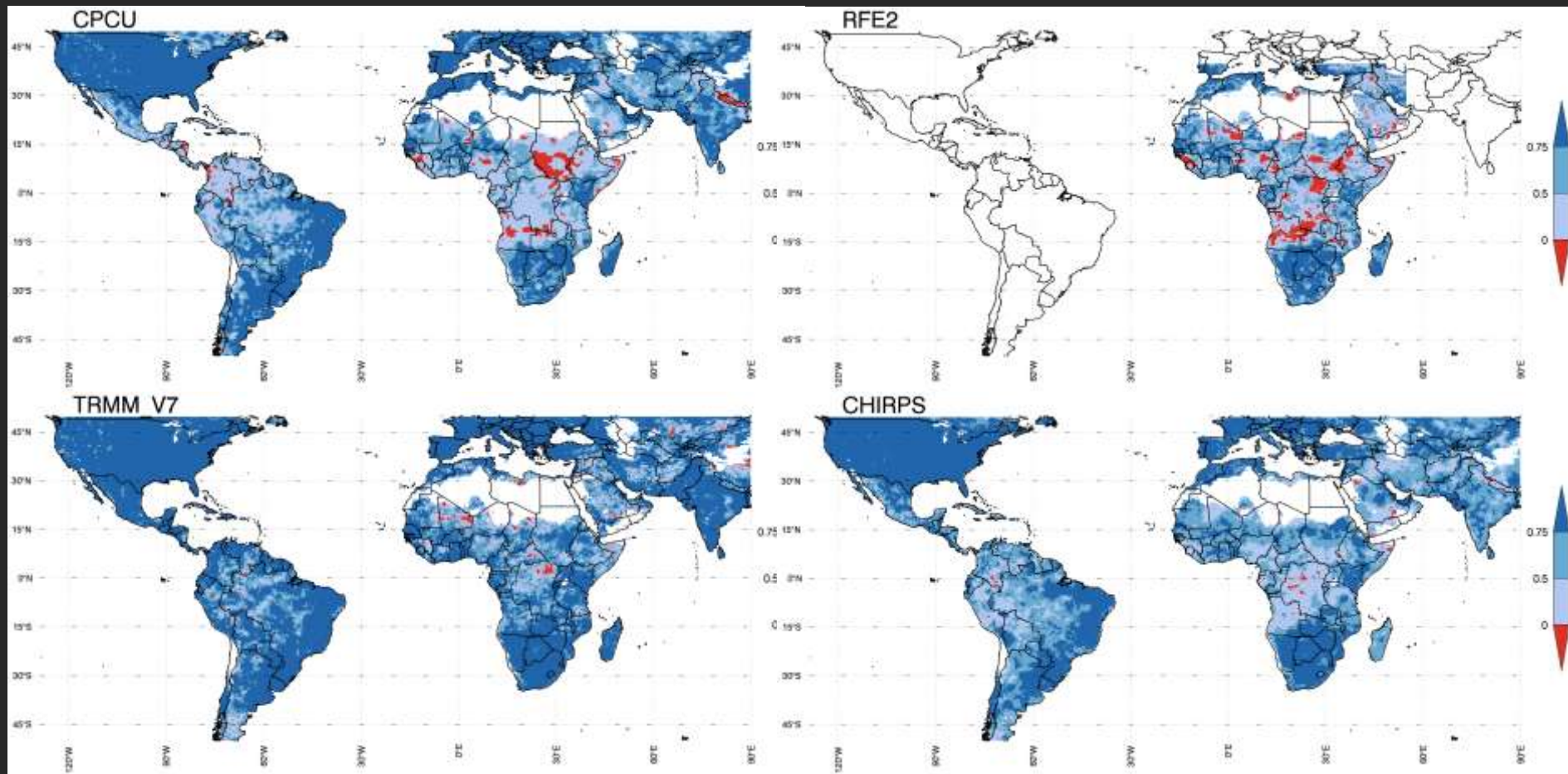
correlation

bias ratio

mean absolute error

CHIRPS Comparison



Wet Season Comparisons to GPCC



Famine Early Warning Systems Network Drought Monitoring

earlywarning.usgs.gov

← → ↻ earlywarning.usgs.gov 🔍 ☆ ⌘ f? ☰






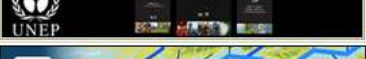



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Contact USGS
Search USGS

Early Warning and Environmental Monitoring Program



Early Warning and Environmental Monitoring Program (EWEM)

The Early Warning and Environmental Monitoring (EWEM) program encompasses a broad spectrum of scientific endeavors operating at national, regional, and international scales. EWEM project activities support investigations in the areas of climate change, natural resource management, environmental change detection, food security monitoring, water resource assessments, and hazard identification/mitigation.

Projects	Websites
Afghanistan	
Famine Early Warning Systems Network (FEWS NET)	
US Evapotranspiration Modeling Water Balance Model - Energy Balance Model	
NASA Livestock Early Warning System (NASA LEWS)	
Phenology / Drought Monitoring	
United Nations Environment Programme (UNEP)	
HydroSHEDS	

Accessibility FOIA Privacy Policies and Notices

[U.S. Department of the Interior](#) | [U.S. Geological Survey](#)
URL: <http://earlywarning.usgs.gov>



earlywarning.usgs.gov/fews

← → ↻ earlywarning.usgs.gov/fews/ 🔍 ☆ 🌐 f? ☰

USGS science for a changing world | **USAID** FROM THE AMERICAN PEOPLE | **FEWS NET** FAMINE EARLY WARNING SYSTEMS NETWORK

▶ HOME ▶ DATA PORTALS ▶ DATA DOWNLOAD ▶ SOFTWARE ▶ PUBLICATIONS ▶ SEARCH ▶ ABOUT

Famine Early Warning Systems Network

The U.S. Agency for International Development (USAID) Famine Early Warning Systems Network (FEWS NET) is an information system designed to identify problems in the food supply system that potentially lead to famine or other food-insecure conditions in sub-Saharan Africa, Afghanistan, Central America, and Haiti. Click [here](#) for more.

Move your mouse inside the map area to select a FEWS NET data portal.

USGS FEWS NET Data Portal

The USGS FEWS NET Data Portal provides access to geo-spatial data, satellite image products, and derived data products in support of FEWS NET monitoring needs throughout the world. This portal is provided by the USGS FEWS NET Project, part of the Early Warning and Environmental Monitoring Program at the USGS Earth Resources Observation and Science (EROS) Center.


News and Announcements

- ▶ [Africa water points viewer released.](#)
- ▶ [Monthly CHIRPS rainfall data now available.](#)
- ▶ [Visit our pubs page for country-level climate trend analyses.](#)
- ▶ [FEWS NET - 25 years of food security monitoring \(video\).](#)

Software Portfolio


Interactive Map Viewer ➡

Interactive map viewers allow users to visualize administrative and crop zone time series of normalized difference vegetation index, dekadal (10-day) rainfall, and seasonal cumulative rainfall, including options for data



Early Warning Explorer (EWX) ➡

EWX is an interactive web-based mapping tool that allows visualization of rainfall estimates, land surface temperature, and normalized difference vegetation index data, anomalies, z-scores and time series at varied time



Data Downloads

The screenshot shows the website earlywarning.usgs.gov/fews/. The page features logos for USGS (science for a changing world), USAID (FROM THE AMERICAN PEOPLE), and FEWS NET (FAMINE EARLY WARNING SYSTEMS NETWORK). The navigation menu includes HOME, DATA PORTALS, DATA DOWNLOAD, SOFTWARE, PUBLICATIONS, SEARCH, and ABOUT. The DATA DOWNLOAD menu is expanded, listing eMODIS NDVI, ETa Anomaly, RFE, PET, CHIRPS, and All Downloads. A world map is visible in the background of the menu. The main content area includes a section for the Famine Early Warning Systems Network, a USGS FEWS NET Data Portal section, a News and Announcements section with links to Africa water points viewer, CHIRPS rainfall data, country-level climate trend analyses, and a 25-year food security monitoring video. The Software Portfolio section highlights the Interactive Map Viewer and the Early Warning Explorer (EWX).

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Africa: Available Products

← → ↻ earlywarning.usgs.gov/fews/africa/index.php 🔍 ☆ ⚙️ f? ☰

FEWS NET Africa Data Portal

The FEWS NET Africa Data Portal provides access to spatial data, satellite imagery, and other data and graphic products in support of the FEWS NET project.

The expandable table below provides a quick summary of the products available, frequency of observation (i.e. daily, dekadal, etc.), and product format. Separate data tables are available for continental, regional, and national scales where applicable.



[Open all](#) [Close all](#)

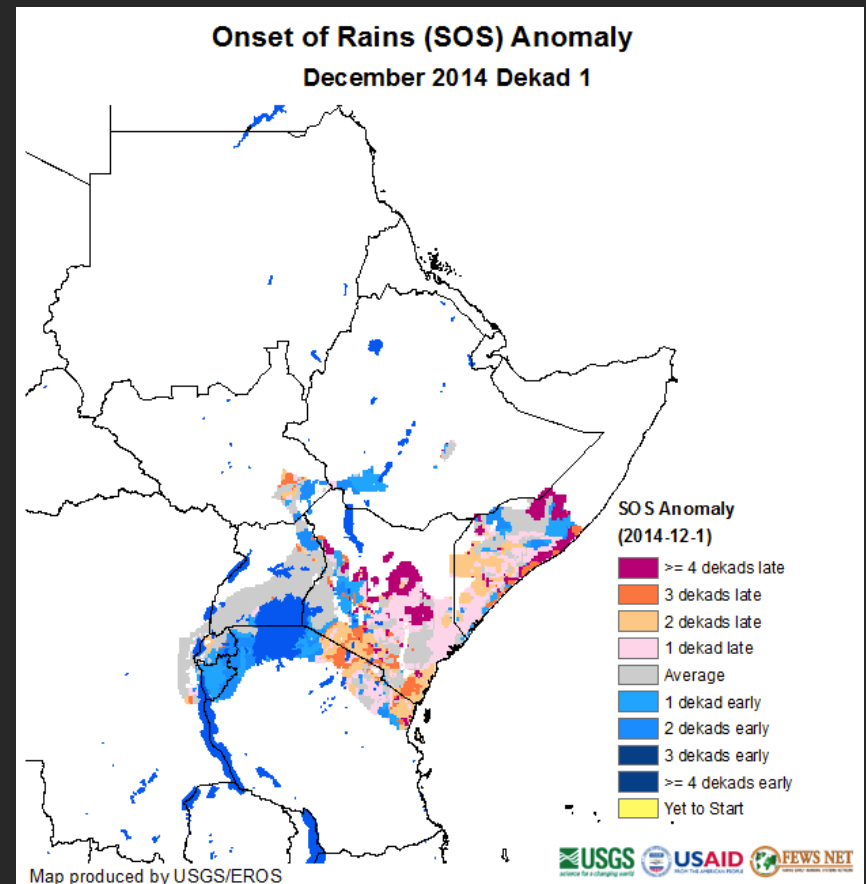
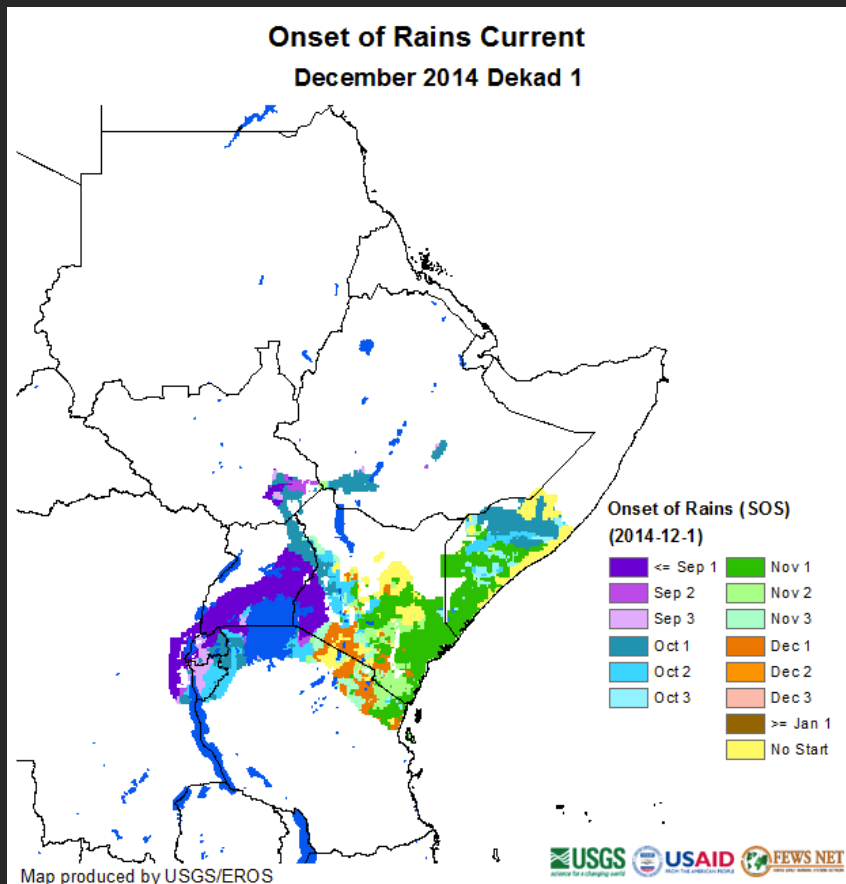
Product	Time Period	Data Available	PDF	PNG	Map Viewer	Preview
eMODIS NDVI(Normalized Difference Vegetation Index)	Pentadal	X	X	X		▼
RFE (Rainfall Estimate)	Dekadal	X		X	X	▼
Vectorial Capacity Model -- Malaria (8-day)	Dekadal		X	X		▼
RFE Anomaly -- Malaria	Dekadal	X	X	X		▼
SPI (Standardized Precipitation Index)	Dekadal			X		▼
Moisture Index	Dekadal			X		▼
Moisture Index/Soil Water Index Anomaly	Dekadal			X		▼
BERM (Basin Excess Rainfall Map)	Dekadal			X		▼
Inter-Tropical Front (ITF) Position	Dekadal			X		▼
Croplands Water Requirement Satisfaction Index (WRSI)	Dekadal			X		▼
Rangelands Water Requirement Satisfaction Index (WRSI)	Dekadal			X		▼
Seasonal NDVI & Rainfall Charts - Interactive Viewer	Dekadal				X	▼
Seasonal Evapotranspiration (ETa) Anomaly	Dekadal		X	X		▼
Monthly Evapotranspiration (ETa) Anomaly	Monthly		X	X		▼
Past 6 days RFE & GFS 6-day Precipitation Forecast	Daily	X		X		▼
Daily 10-Day RFE Anomaly -- Malaria	Daily	X		X		▼
Daily 10-Day Moisture Index	Daily			X		▼

Consider the Performance of the
2014 October-December
“short rains” over Eastern Africa
during the First Dekad of December

Seasonal Progression

Start of Season

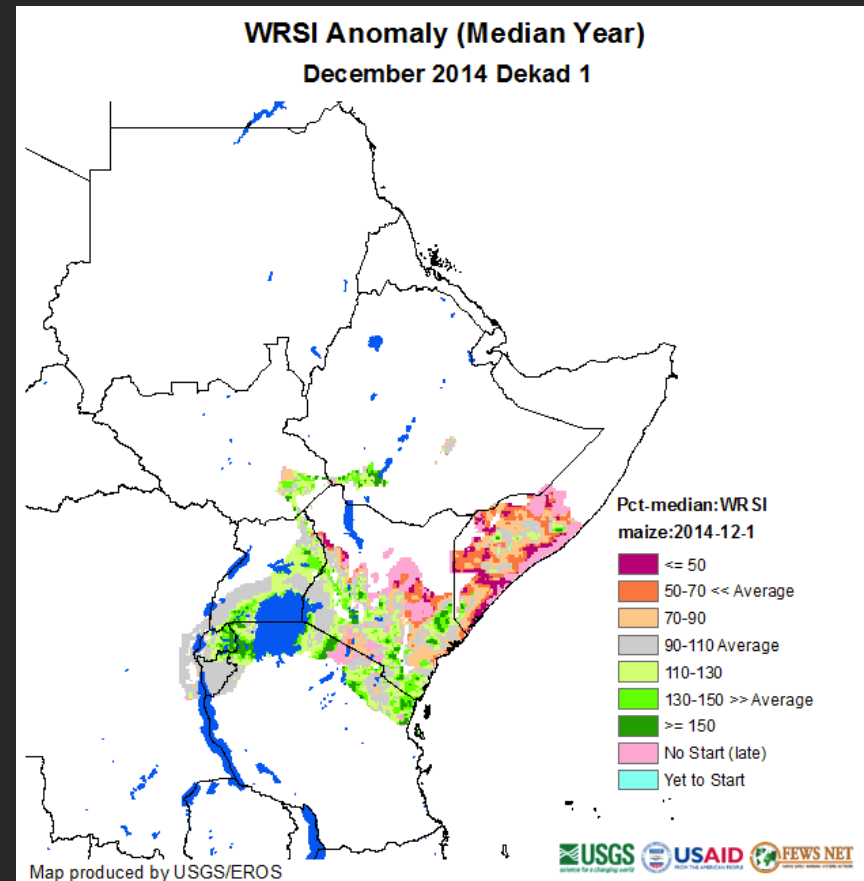
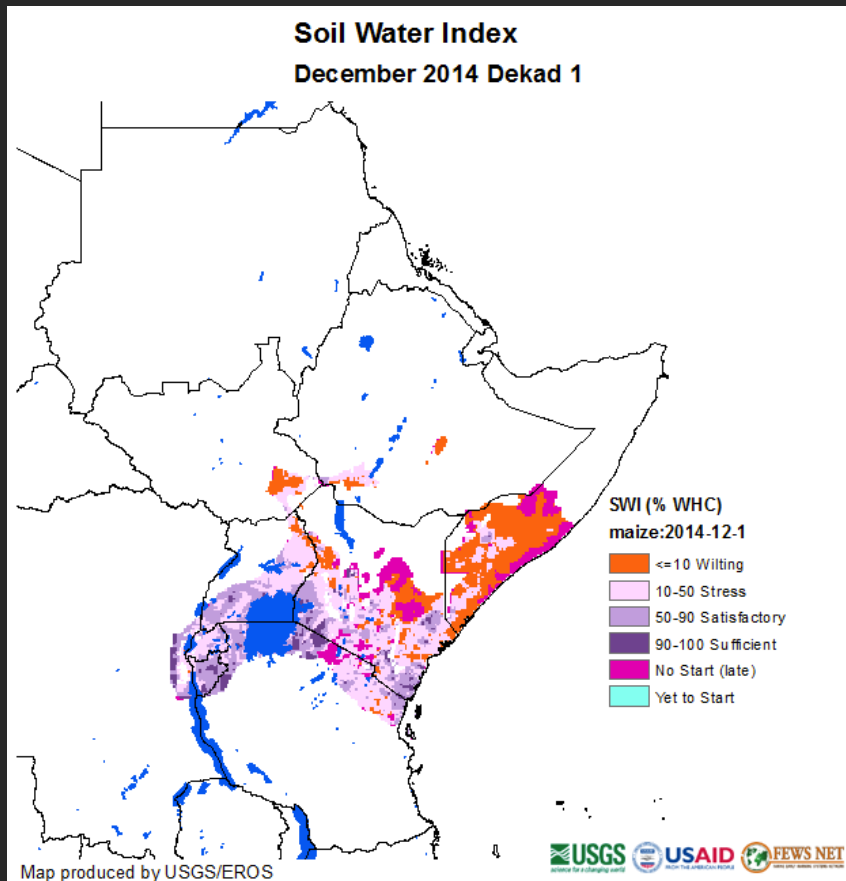
Start of Season Anomaly



Water Availability and Requirement

Soil Water Index

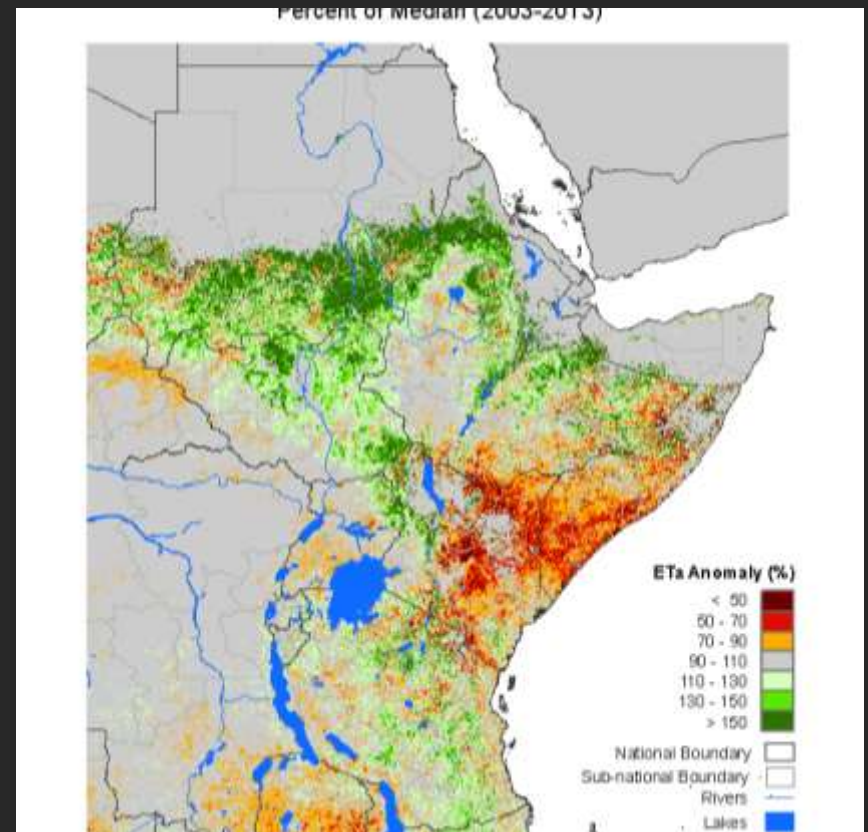
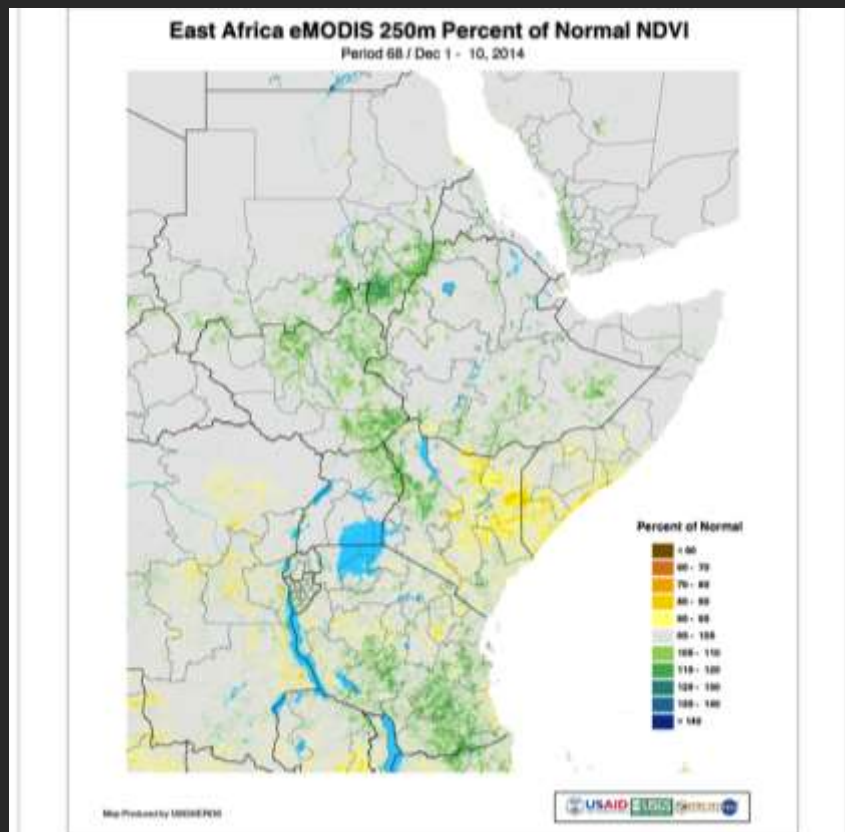
WRSI



Vegetation Health

NDVI

Evapotranspiration Anomaly



Central Asia: Available Products


← → ↻ earlywarning.usgs.gov/fews/sca/index.php

Central Asia Data Portal

The Central Asia Data Portal provides access to spatial data, satellite imagery, and other data and graphic products in support of the FEWS NET project.

The expandable table below provides a quick summary of the products available, frequency of observation (i.e. daily, dekadal, etc.), and product format. Separate data tables are available for continental, regional, and national scales where applicable.

Countries/Regions:
[Central Asia](#) [South Central Asia](#) [Afghanistan](#) [Pakistan](#) [Tajikistan](#) [Kazakhstan](#)



Central Asia

[Open all](#) [Close all](#)

Product	Time Period	Data Available	PDF	PNG	Map Viewer	Preview
eMODIS NDVI(Normalized Difference Vegetation Index)	Pentadal	X	X	X		▼
Dekadal RFE (Rainfall Estimate)	Dekadal		X	X		▼
Dekadal RFE & Anomaly	Dekadal		X	X		▼
Temperature Products	Dekadal		X	X		▼
Seasonal Evapotranspiration (ETa) Anomaly	Dekadal		X	X		▼
Monthly Evapotranspiration (ETa) Anomaly	Monthly	X	X	X		▼
Daily RFE & Forecast	Daily		X	X		▼
Daily 30-Day Rain and Dry Days	Daily		X	X		▼

[^ Top ^](#)

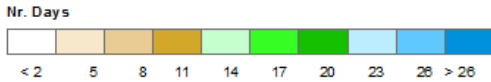
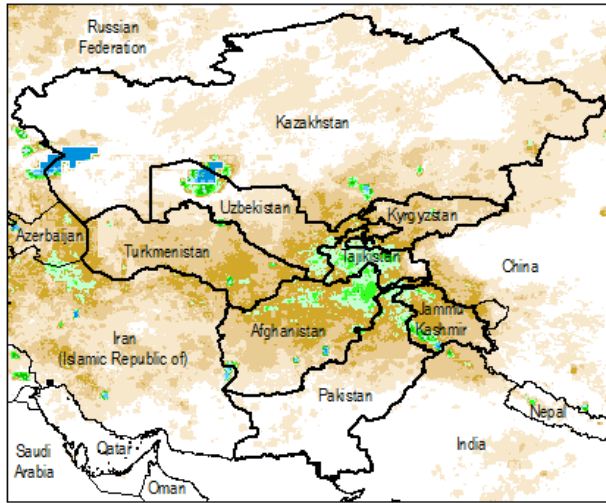
South Central Asia

[Open all](#) [Close all](#)

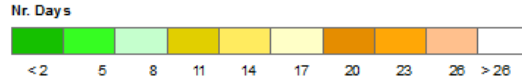
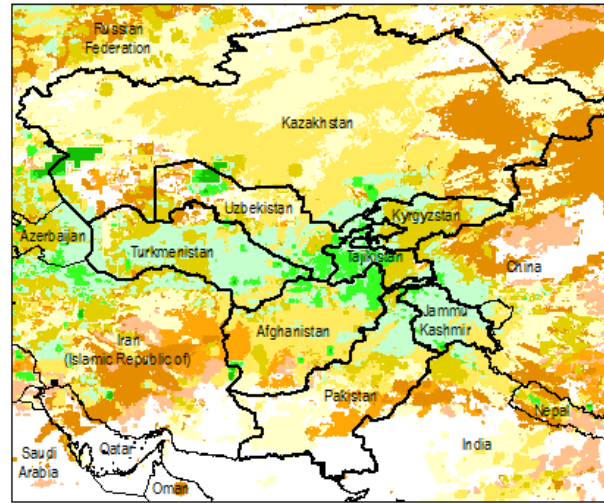
Product	Time Period	Data Available	PDF	PNG	Map Viewer	Preview
eMODIS NDVI(Normalized Difference Vegetation Index)	Pentadal	X	X	X		▼

Consider the Performance of the
2014 November-April Rainy Season
during the third dekad of February

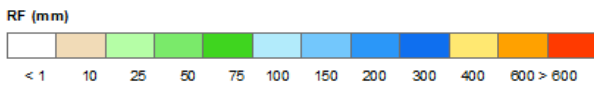
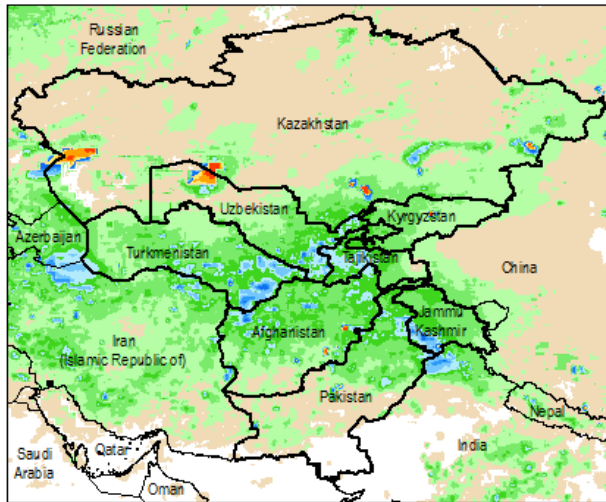
Number of Rain Days
in past 30 days, as of 23 Feb. 2015



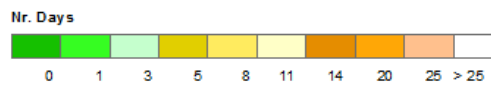
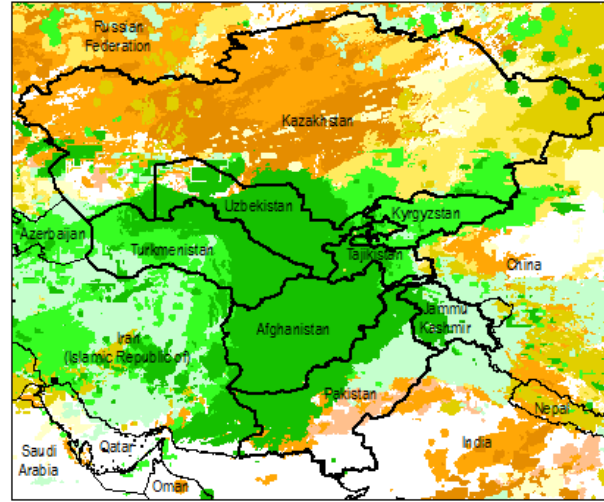
Maximum Consecutive Dry Days
in past 30 days, as of 23 Feb. 2015



Total Accumulated Rainfall
in past 30 days, as of 23 Feb. 2015



Number of Days Since Rain
in past 30 days, as of 23 Feb. 2015



Recent Rainfall

Afghanistan Snow Cover

Snow Cover Products

[Product Documentation](#)

● MODIS 8-day Snow Cover Extent

Current vs Average Period
[PNG](#) (pdf available)

Current vs Previous Year
[PNG](#) (pdf available)

Current vs Previous Period
[PNG](#) (pdf available)

● EROS Snow Water Equivalent

Daily Snow Water Equivalent

with provinces
[PNG](#) (pdf available)

with basins
[PNG](#) (pdf available)

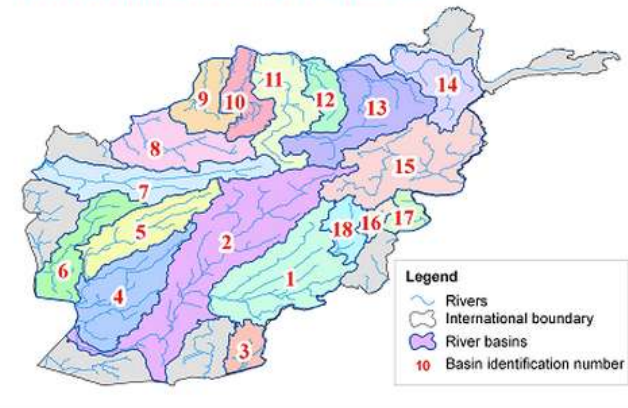
● NOHRSC Snow Water Equivalent

Daily Snow Water Equivalent

with provinces

Summarized by Basin

Click on the ID number to view the chart for that basin



Select a product type at left and click on a basin to display snow cover accumulation/depletion or snow water volume charts.

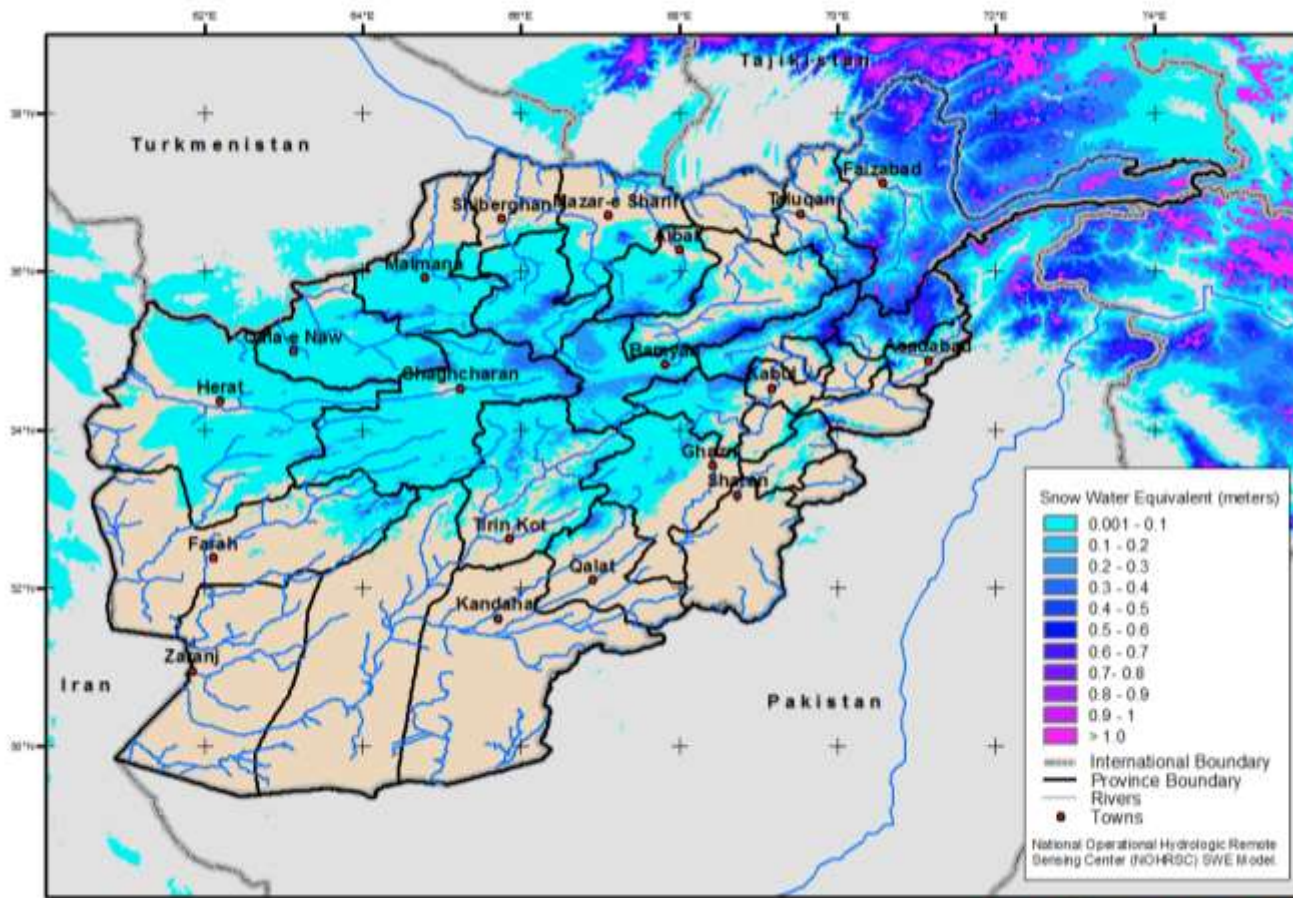
NOHRSC Snow Water Equivalent Anomaly

Daily Snow Water Equivalent Anomaly

with provinces

Snow Water Equivalent

February 24, 2015

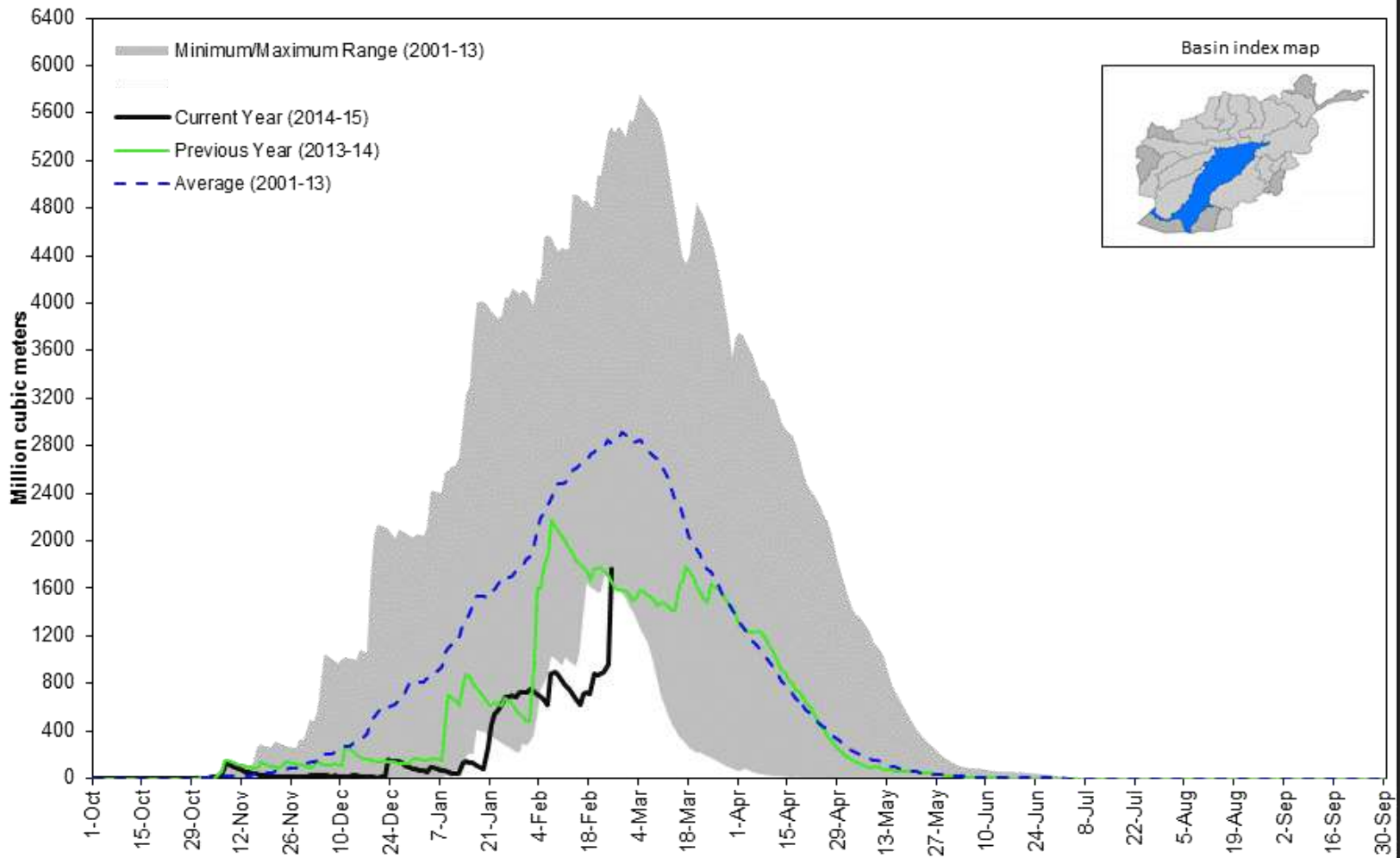


Map created by USGS/EROS



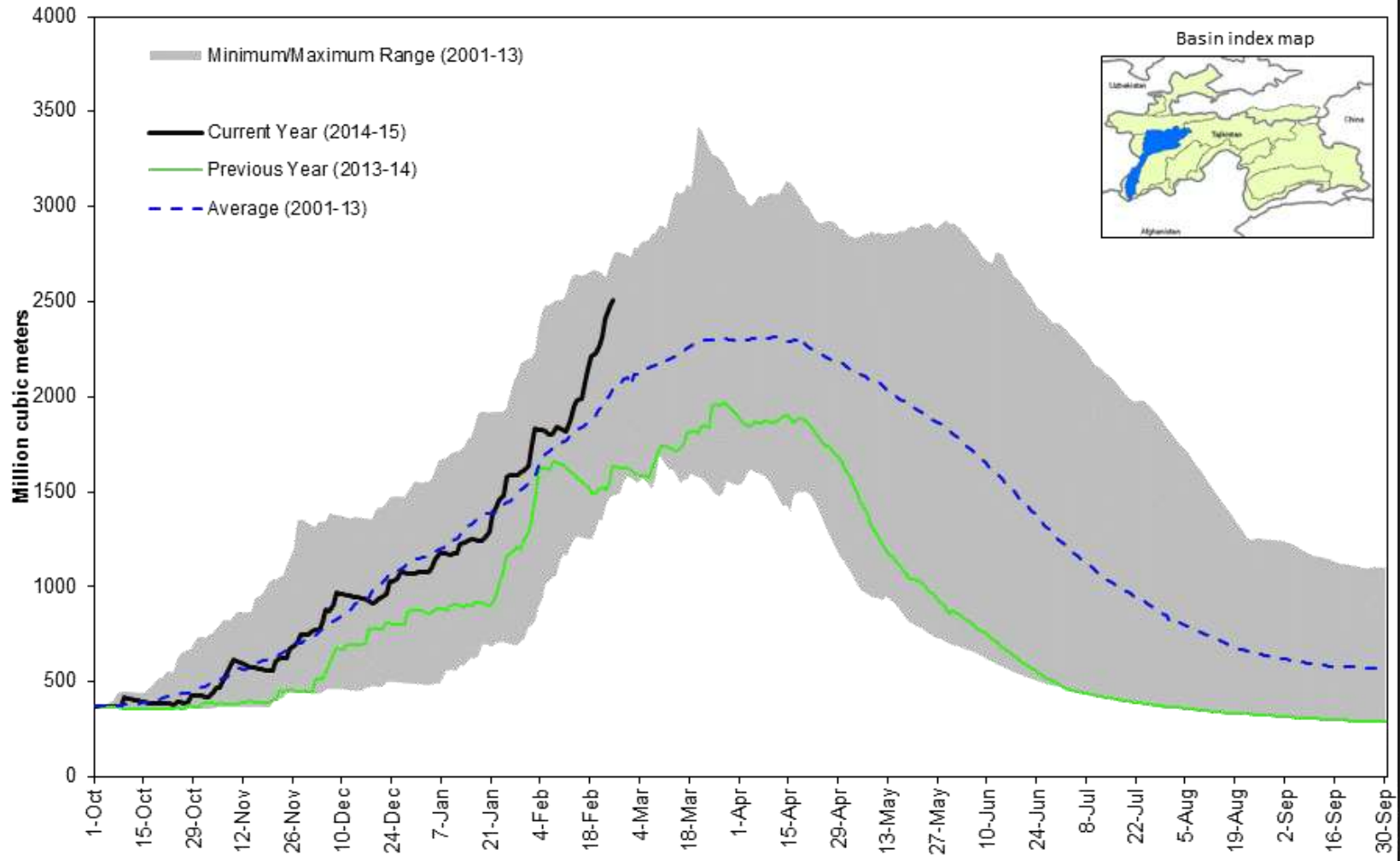
Afghanistan Snow Cover

NOHRSC Snow Water Volume as of February 24, 2015



Tajikistan Snow Cover

NOHRSC Snow Water Volume as of February 24, 2015

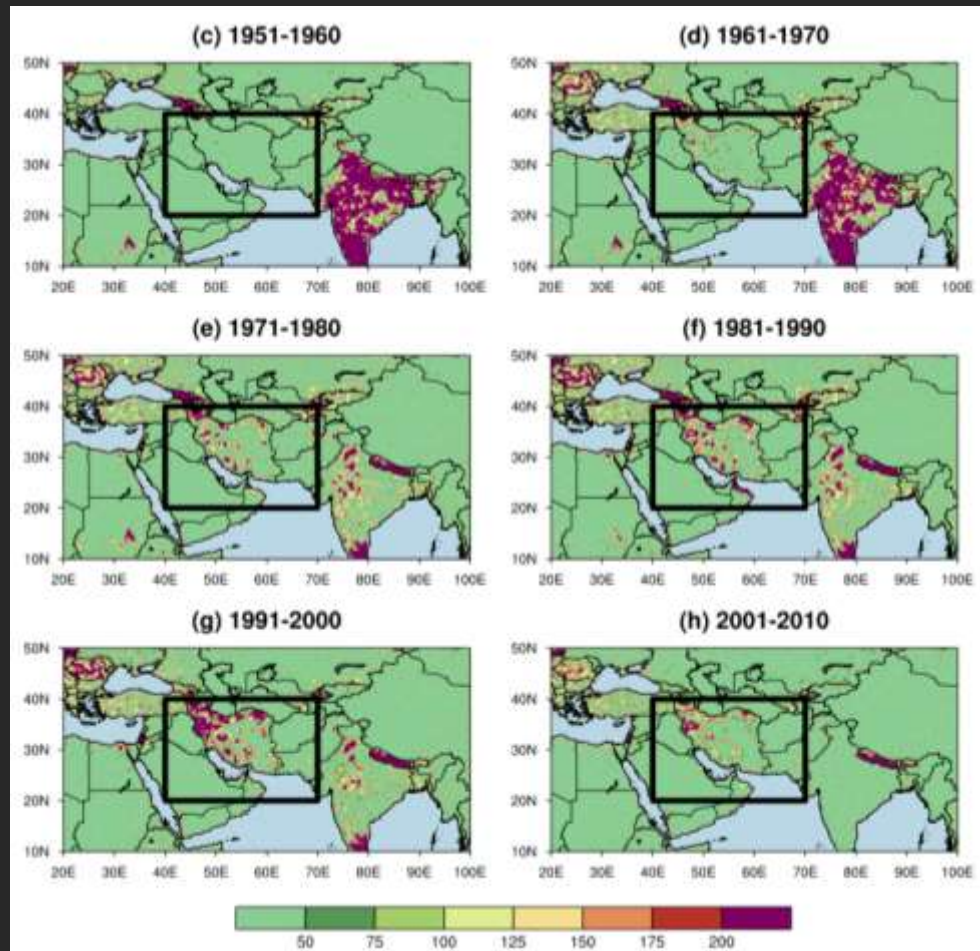


Drought Diagnostics: Observations and Models

Data Scarcity

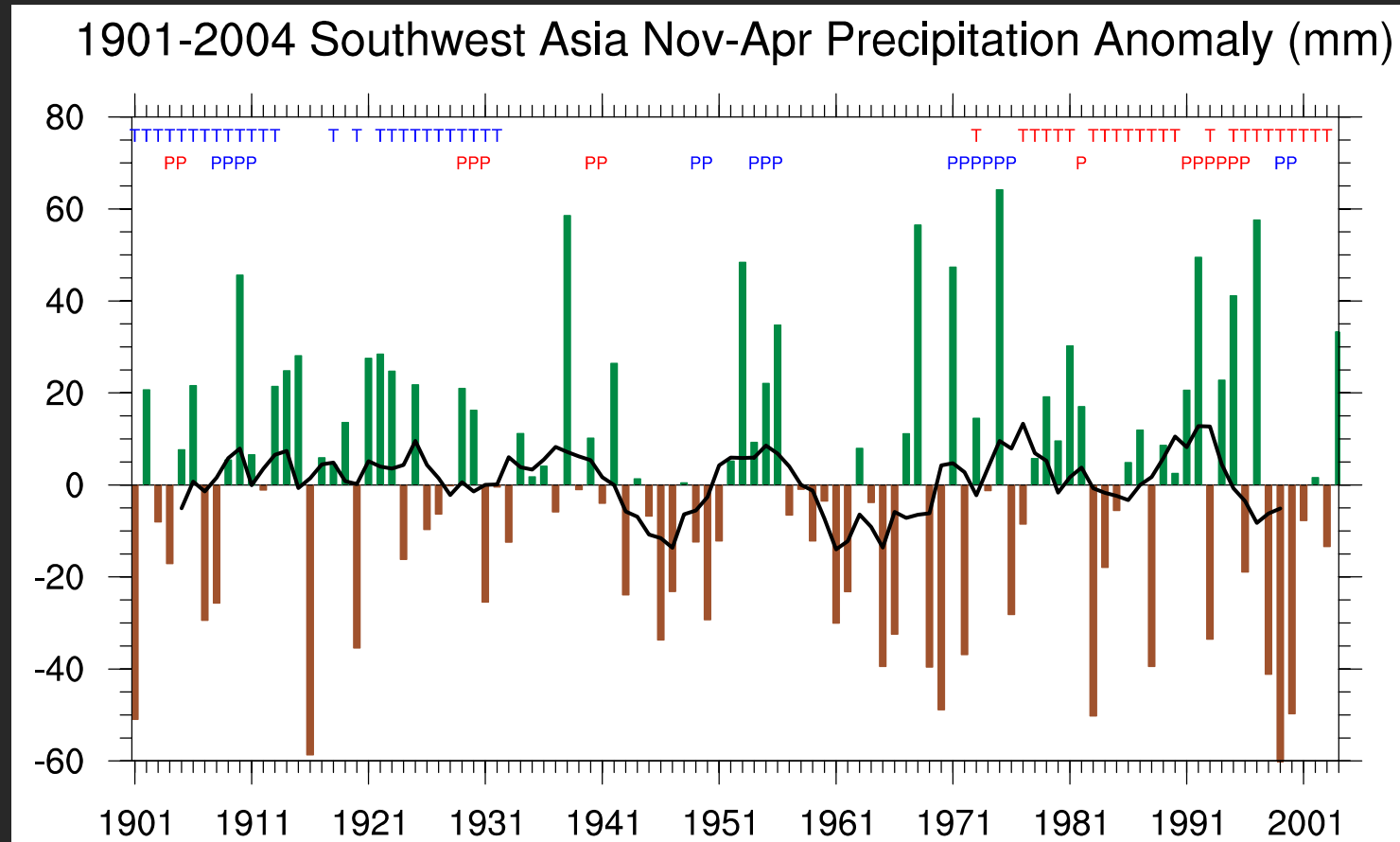
Robust Observed Diagnostics Are Difficult

Number of monthly observations in GPCC dataset in each 10 year period



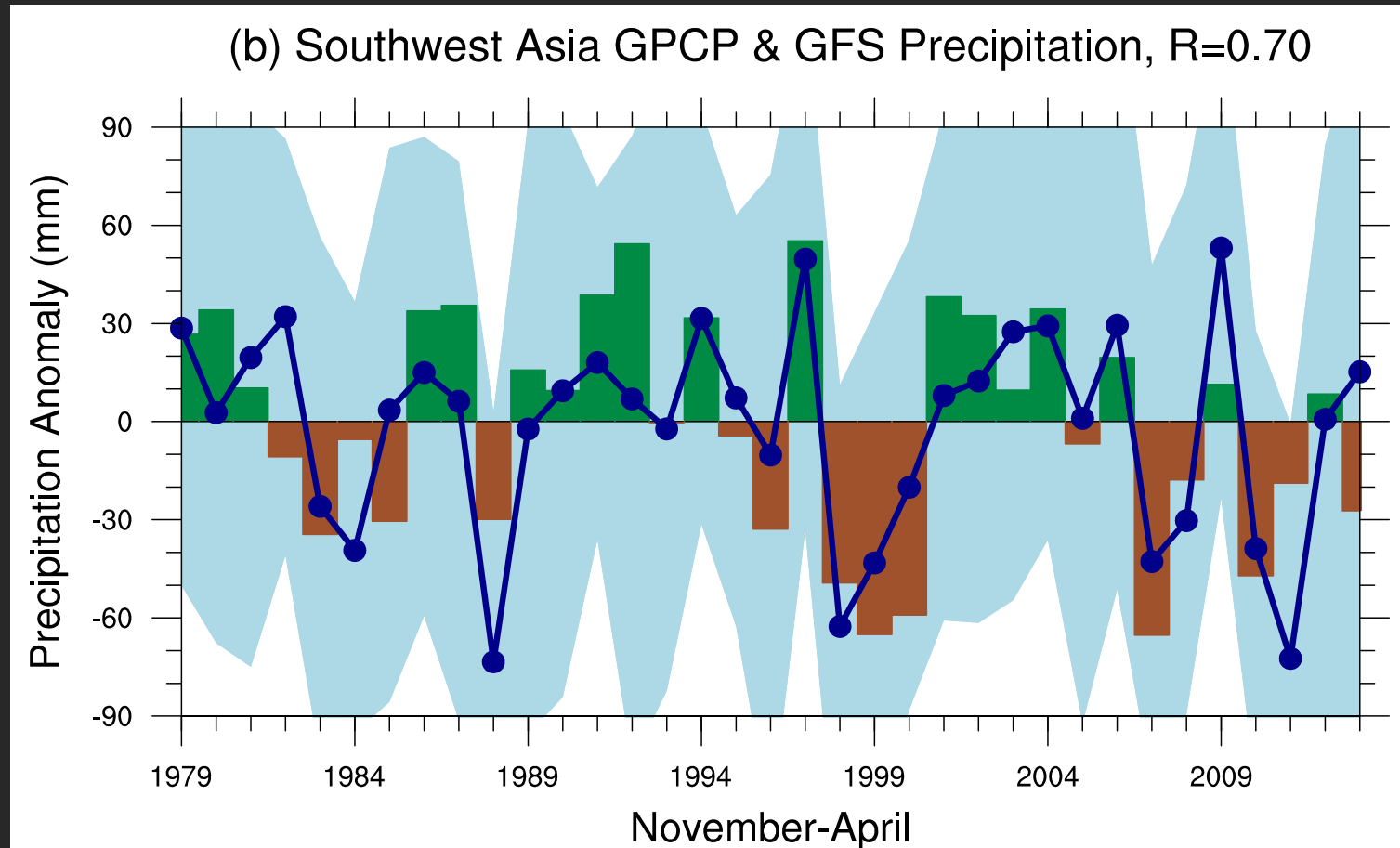
“Long Term” Southwest Asia Precipitation

Poor Sampling Results in Poor Record



Diagnosis With Data Difficulties

Use Simultaneous Observed and Modeling Approach



La Nina-related Drought

Test Response to an SST Pattern

