

Drought Monitoring at NOAA's National Climatic Data Center

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Asheville, North Carolina, U.S.A.*

NOAA in the Carolinas – Water Resources and Resiliency
March 15, 2012, Charleston, SC



NOAA'S National Climatic Data Center



Overview

- Drought Monitoring Activities at NOAA / NCDC
- U.S. Drought Monitor
- North American Drought Monitor & North American Climate Service Partnership
- Global Drought Monitor Portal & Global Drought Information System
- U.S.-Canadian Drought Indices & Definitions Study



NOAA'S National Climatic Data Center



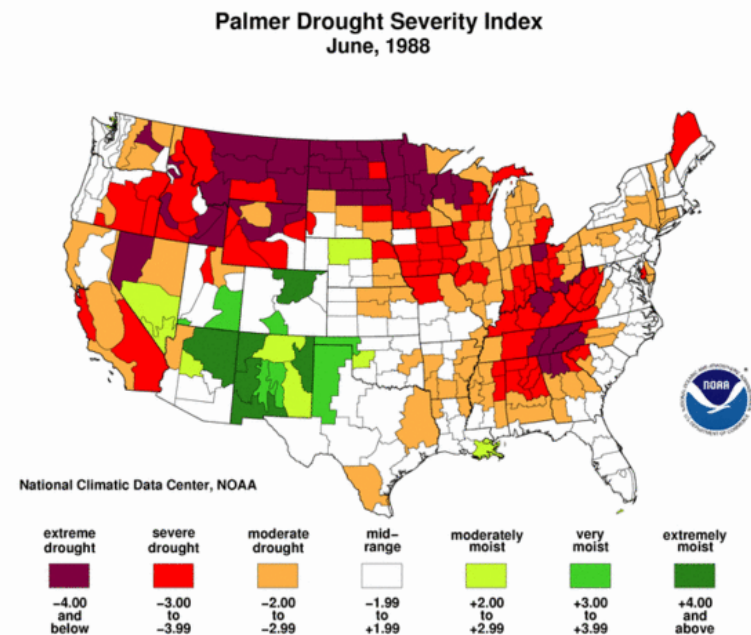
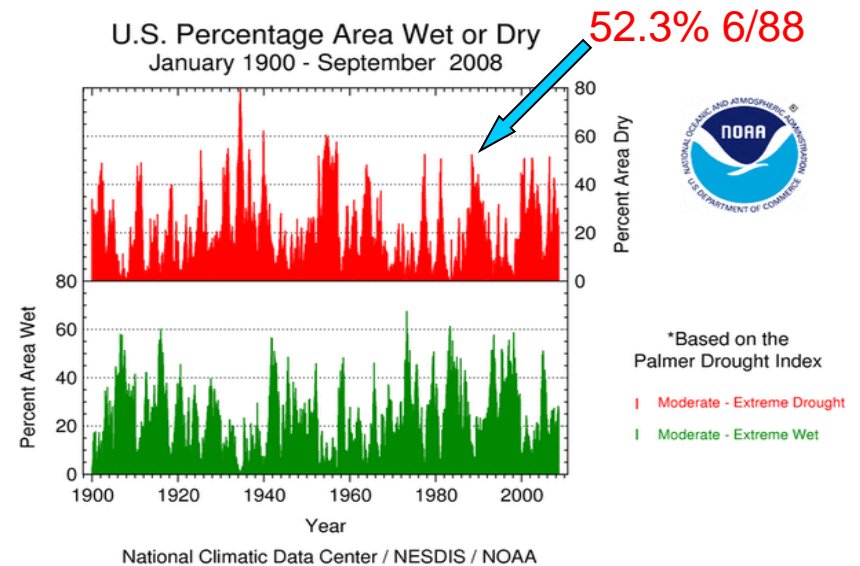
Introduction – NCDC Drought Monitoring

✓ The 1988 national drought

- NCDC established an active operational drought monitoring activity
- Focus on current conditions and historical perspective
- Monthly *Climate Variations Bulletin*

✓ 1999: Climate Monitoring Branch established

- Monitoring activity expanded with introduction of monthly & special web reports and monthly press releases



NOAA

NCDC's State of the Climate Reports

State of the Climate

Monthly State of the Climate Report

RSS Feed **XML**

National Section

- National Overview
- Drought
- Wildfires
- Hurricanes & Tropical Storms
- National Snow & Ice
- Tornadoes
- Synoptic Discussion

Global Section

- Global Analysis
- Upper Air
- Global Snow & Ice
- Global Hazards

- ✓ **Monthly reports**
 - Narrative & graphics
 - Many drought & climate indices
- ✓ **Synoptic Discussion & Drought Report have U.S. focus**
- ✓ **Synoptic Discussion Online by ~ 5th business day**
- ✓ **Drought Report Online by mid-month (12th to 15th)**
- ✓ **<http://www.ncdc.noaa.gov/sotc/>**



NOAA'S National Climatic Data Center



NCDC's SotC Synoptic Discussion

- ✓ Relates climate statistics to synoptic weather (fronts, lows, highs)
 - Temperature & precipitation patterns
 - Snow & tornadoes
 - Drought & wildfires
 - Tropical systems

State of the Climate
Synoptic Discussion
February 2012
National Oceanic and Atmospheric Administration
National Climatic Data Center

Use the form below to access monthly reports.

[« January 2012
Synoptic Discussion Report](#)

Report:

Year: Month:

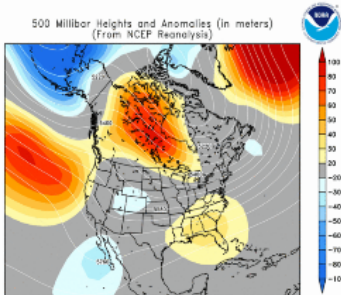
Get Report

Synoptic Discussion

Like much of this winter, the [weather pattern](#) over North America in February 2012 consisted of an active jet stream along the U.S.-Canadian border. Strong low pressure troughs frequently dug into the western U.S., brushing northern Mexico before moving to the Great Lakes or Atlantic coast and dragging cold fronts across the southeastern United States. Winter storms with some of these low pressure systems spread blankets of snow across parts of the country, with snow coverage reaching [nearly 48 percent](#) on February 14th. The snow would stay around for a few days under cold air behind the lows, but the snow cover [melted quickly](#) as warm southerly air blew into the snow area ahead of the next system. Northern states typically had [below-normal](#) snow amounts, with the monthly snow cover for the U.S. and North America ranking below normal for a third month in a row. [Severe weather](#) accompanied some of these systems from the Great Plains to the Midwest and Southeast, with [dozens of tornadoes](#) triggered near the [end of the month](#).

The frequent development of cold upper-level systems over the West, and the lack of frequent and persistent cold outbreaks in the East, resulted in widespread above-normal temperatures across much of the country east of the Rockies. Twelve states from the Upper

500 Millibar Heights and Anomalies (in meters)
(From NCEP Reanalysis)



February 2012

Upper-level circulation pattern and anomalies averaged for February 2012.

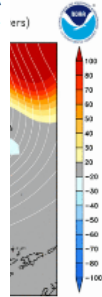


NCDC's SotC Synoptic Discussion

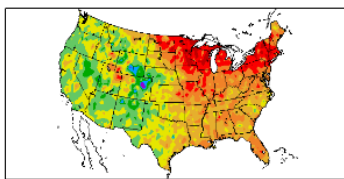
Cold fronts and low pressure systems moving in the storm track flow are influenced by the broadscale atmospheric circulation. Four such large-scale atmospheric circulation drivers were potentially influential during February:

- Ocean temperatures and atmospheric circulation anomalies indicated that the equatorial Pacific continued in a La Niña state, but the La Niña was weakening. La Niña this time of year (December-February) is associated with temperature and precipitation anomalies across the U.S. — temperatures are typically warmer than normal from the Southern Plains to Mid-Atlantic Coast and colder than normal in the Northern Plains and parts of the West, while drier-than-normal conditions dominate the southern tier and East Coast States with wet conditions limited to the Pacific Northwest and Tennessee Valley.
- The Pacific/North American (PNA) pattern was positive for most of the month, then turned negative at the end of the month. A positive PNA this time of year (January on the teleconnection maps) typically is associated with cooler-than-normal temperatures from the Southern Plains to Northeast and warmer-than-normal temperatures in the Northwest, with drier-than-normal conditions in the Northwest to Central Rockies and across much of the country from the Mississippi River to the East Coast.
- The Arctic Oscillation (AO) pattern was negative during the first part of February but turned positive during the last two-thirds of the month. A positive AO this time of year (December-February) is typically associated with warmer-than-normal temperatures east of the Rockies, dryness in the eastern Gulf Coast states and Northeast, and wetter-than-normal conditions in the coastal Northwest and Tennessee Valley. A negative AO this time of year is typically associated with the opposite conditions — colder-than-normal weather east of the Rockies (except the Southern Plains) and drier-than-normal weather in parts of the Southwest and from the Southern Plains to Ohio Valley. The AO relationship to monthly average weather can be difficult to assess during a month when the AO flips from one sign to the other. The December-February averaged upper-level circulation anomalies for a positive AO consist of a below normal pattern over the Arctic, including much of Alaska, and above normal pattern across the eastern half of the contiguous U.S.
- The North Atlantic Oscillation (NAO) pattern was neutral to positive throughout the month. A positive NAO during this time of year (January on the teleconnection maps) is typically associated with drier-than-normal conditions in the West while temperatures trend warmer than normal from the Plains to East Coast.

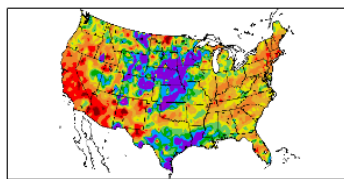
ation



Departure from Normal Temperature (°F)
2/1/2012 – 2/29/2012



Percent of Normal Precipitation (%)
2/1/2012 – 2/29/2012



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The February 2012 and winter averaged upper-level circulation anomalies are consistent with a positive AO pattern across the Lower 48 States. Over Canada and the Arctic, the winter averaged upper-level circulation pattern is consistent with a positive AO pattern but

the lack of
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- ✓ Relates climate statistics to synoptic weather (fronts, lows, highs)
 - Temperature & precipitation patterns
 - Snow & tornadoes
 - Drought & wildfires
 - Tropical systems
- ✓ Relates synoptic weather to atmospheric drivers
 - ENSO, PNA, NAO, AO, etc.

OAA'S National Climatic Data Center



NCDC's SotC Drought Report

State of the Climate
Drought
January 2012

National Oceanic and Atmospheric Administration
National Climatic Data Center

Use the form below to access monthly reports.

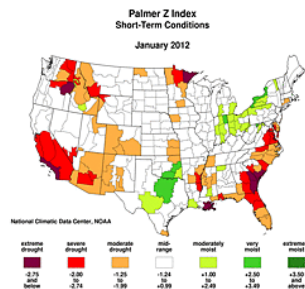
« Annual 2011
Drought Report

Report:
Year: Month:

Issued 15 February 2012

Contents Of This Report:

- National Drought Overview
- Detailed Drought Discussion
 - Overview
 - Synoptic Discussion
 - Palmer Drought Index
 - Standardized Precipitation Index
 - Agricultural & Hydrological Indices and Impacts
 - Regional Discussion
 - Regional Climate Center Reports
 - Pacific Island Drought
- State/Regional/National Moisture Status
- Drought Indicators
- Contacts & Questions



National Drought Overview

- Based on the Palmer Drought Index, [severe to extreme drought](#) affected about 15 percent of the contiguous United States as of the end of January 2012, [an increase of about 2 percent](#) from last month. About 14 percent of the contiguous U.S. fell in the [severely to extremely wet](#) categories.
- About [31 percent](#) of the contiguous U.S. fell in the [moderate to extreme drought](#) categories (based on the Palmer Drought Index) at the end of January.
- On a broad scale, the 1980s and 1990s were characterized by unusual wetness
- A file containing the national monthly percent area severely dry and wet from 1900 to present is available for the [severe to extreme](#) and [moderate to extreme](#) categories.
- Historical temperature, precipitation, and Palmer drought data from 1895 to present for climate divisions, states, and regions in the contiguous U.S. are available at the [Climate Division: Temperature-Precipitation-Drought Data](#) page. These filenames begin with "drd964x" and end with "txt".

- ✓ Spatial coverage ...
 - 50 States, Puerto Rico ...

NOAA'S National Climatic Data Center



NCDC's SotC Drought Report

State of the Climate
Drought
January 2012

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Use the form below to access monthly reports.

« Annual 2011
Drought Report

Report:

Year: Month:

On other [Pacific Islands](#), January was drier than normal for about two-thirds of the stations and near to above normal for the rest. Total rainfall for the last 12 months (February 2011-January 2012) was near to above normal for all stations except Pago Pago.

Pacific Island Percent of Normal* Precipitation

Station Name	Feb 2011	Mar 2011	Apr 2011	May 2011	Jun 2011	Jul 2011	Aug 2011	Sep 2011	Oct 2011	Nov 2011	Dec 2011	Jan 2012	Feb 2011-Jan 2012
Chuuk	116%	168%	100%	77%	218%	125%	144%	118%	97%	136%	125%	57%	123%
Guam IAP	205%	199%	220%	170%	96%	203%	102%	129%	135%	83%	103%	162%	136%
Kapingamarangi	2%	74%	73%	86%	130%	147%	162%	107%	57%	81%	124%	109%	98%
Koror	163%	201%	168%	171%	129%	152%	155%	266%	122%	62%	97%	36%	142%
Kosrae	85%	60%	92%	160%	114%	87%	122%	104%	154%	95%	174%	65%	109%
Kwajalein	447%	451%	71%	117%	121%	104%	144%	111%	125%	130%	84%	134%	135%
Majuro	190%	241%	33%	125%	97%	131%	108%	115%	115%	119%	91%	107%	117%
Pago Pago	112%	54%	43%	38%	132%	42%	72%	29%	137%	157%	75%	61%	80%
Pohnpei	128%	156%	44%	92%	128%	92%	138%	115%	77%	123%	110%	82%	104%
Saipan	108%	151%	184%	187%	174%	96%	93%	68%	140%	57%	110%	77%	108%
Yap	129%	230%	128%	176%	113%	138%	129%	156%	101%	112%	116%	33%	128%

* With this report, the normals transitioned from 1971-2000 means to 1981-2010 medians.

[SPI values](#) for seven time periods for Pacific Islands, computed by the [Honolulu NWS office](#).

Micronesia and Samoa data

Standardized Precipitation Index

Micronesia and Samoa data

Current -1 -2 -3 -4 -5 -6 -7 -8 -9 -10 -11

SELECTED PACIFIC ISLANDS STANDARDIZED PRECIPITATION INDEX (SPI) SUMMARY
NATIONAL WEATHER SERVICE HONOLULU HI
DATA THROUGH THE END OF JAN 2012

SPI VALUES BASED ON PROVISIONAL COOPERATIVE OBSERVER AND TELEMETERED

✓ Spatial coverage ...

- 50 States, Puerto Rico, and U.S. Pacific Islands

NOAA's National Climatic Data Center



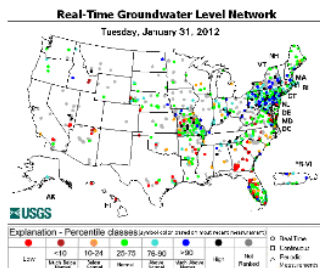
NCDC's SotC Drought Report

On other **Pacific Islands**, January was drier than normal for about two-thirds of the stations and n Drought conditions were reflected in numerous agricultural, hydrological, and other meteorological indicators, both observed and modeled:

(February 2011
Pago.

hydrological:

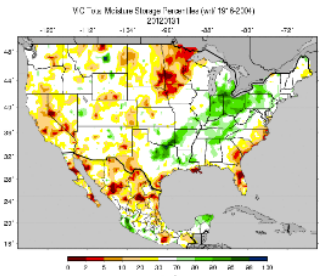
- USGS (U.S. Geological Service) **observed streamflow**;
- NOAA Climate Prediction Center (CPC) modeled runoff **anomalies and percentiles**;
- VIC (University of Washington Variable Infiltration Capacity macroscale hydrologic model) **1-, 2-, 3-, and 6-month runoff percentiles**;
- NLDAS (North American Land Data Assimilation System) modeled **streamflow anomalies and percentiles**;
- NLDAS model runoff **anomalies and percentiles**;
- USGS groundwater observations (**real-time network, climate response network, total active network**);



USGS groundwater map.

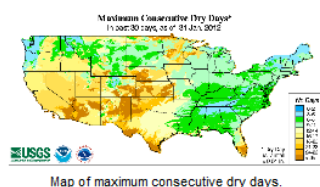
agricultural:

- CPC modeled soil moisture **anomalies and percentiles** for end of January, **soil moisture anomaly change**;
- CPC's Leaky Bucket model **soil moisture percentiles**;
- NLDAS modeled soil moisture percentiles for the **top soil layer and total soil layer**;
- VIC modeled **soil moisture percentiles, soil moisture percentile change**;
- **Vegetation Drought Response Index (VegDRI)**;
- the NESDIS satellite-based **Vegetation Health Index (VHI)**;



meteorological:

- total precipitation (plotted by the **USGS, NOAA National Weather Service [NWS], and NOAA High Plains Regional Climate Center [HPRCC]**);
- percent of normal precipitation and precipitation percentiles (**NWS, HPRCC station observations, Leaky Bucket model, CPC**);
- **USGS number of days with precipitation and maximum number of consecutive dry days**;
- temperature departures from normal (**HPRCC, CPC**) and percentiles (**CPC, Leaky Bucket**);
- number of **record warm daily low temperatures, record daily high temperatures, record daily low temperatures, and record cool daily high temperatures** set in January 2012 (from NCDC's **daily records analysis**).



✓ Spatial coverage ...

- 50 States, Puerto Rico, and U.S. Pacific Islands

✓ Drought indicators ...

- Historical objective national indicators (Palmer's, SPI, etc.)
- Modeled (soil moisture, runoff, etc.)
- Observed (streamflow, reservoirs, etc.)

Station Name
Chuuk
Guam IAP
Kapingamarangi
Koror
Kosrae
Kwajalein
Majuro
Pago Pago
Pohnpei
Saipan
Yap

* With this

SPI values fo

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NATIONAL
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SPI VALUES



NOAA'S National Climatic Data Center



NCDC's SotC Drought Report

✓ Spatial coverage ...

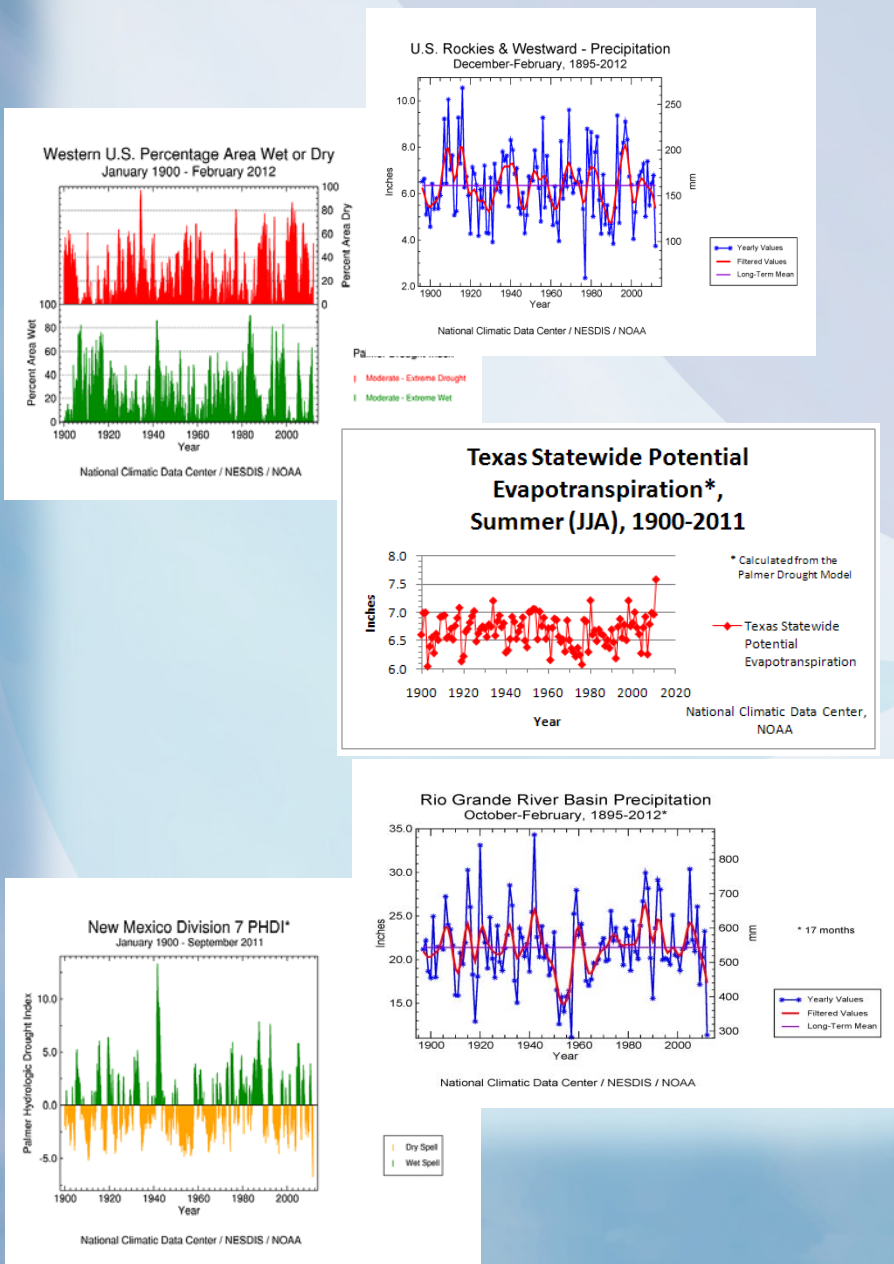
- 50 States, Puerto Rico, and U.S. Pacific Islands

✓ Drought indicators ...

- Historical objective national indicators (Palmer's, SPI, etc.)
- Modeled (soil moisture, runoff, etc.)
- Observed (streamflow, reservoirs, etc.)

✓ Historical perspective ...

- 1895-present time series
- Percentile / Percent of normal / rank maps








NOAA'S National Climatic Data Center

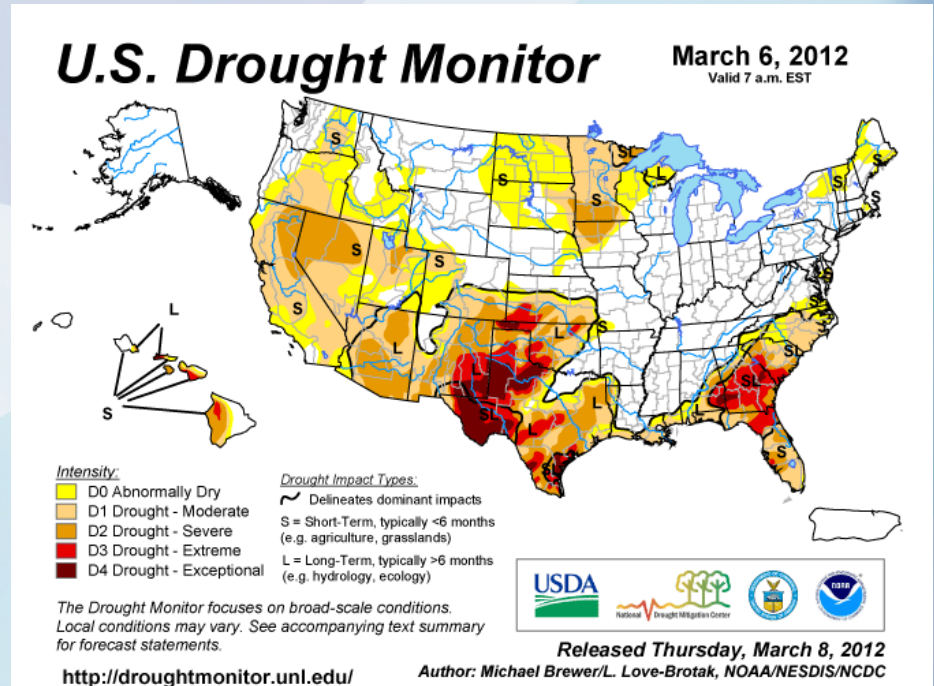


U.S. Drought Monitor (USDM)

- ✓ A *partnership* between the National Drought Mitigation Center, USDA/JAWF, and NOAA's CPC, NCDC, & WRCC – *Authors*
- ✓ USDM is an operational product issued weekly and provides a general up-to-date summary of current drought conditions across the Lower 48 States, Hawaii, Alaska, & Puerto Rico; first issued in 1999.
- ✓ 4 drought categories (D1-D4) plus abnormally dry (D0) category, based on percentile rank (Fujita-like scale)

Percentile Rank:

21-30		D0 Abnormally Dry
11-20		D1 Drought – Moderate
6-10		D2 Drought – Severe
3-5		D3 Drought – Extreme
0-2		D4 Drought – Exceptional



<http://droughtmonitor.unl.edu/monitor.html>

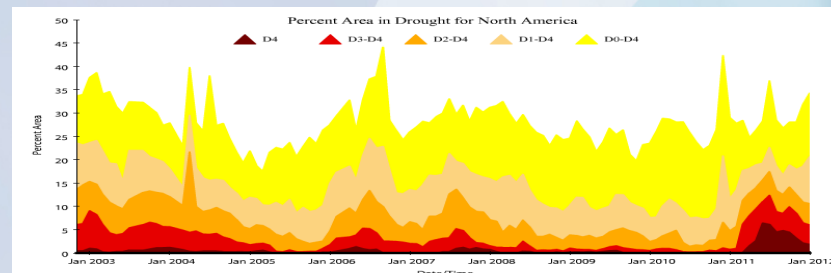


NOAA'S National Climatic Data Center



North American Drought Monitor (NADM)

- ✓ NADM takes the USDM concept to the international / continental scale
- ✓ NADM is an operational product issued monthly that provides a general summary of current drought conditions across North America; first issued publicly in 2003.
- ✓ Participants:
 - U.S. (most of the USDM authors):
 - NOAA (NCDC, CPC)
 - USDA / JAWF
 - NDMC
 - Canada:
 - Agriculture & Agri-food Canada
 - Meteorological Service of Canada
 - Mexico:
 - National Meteorological Service (SMN)



North American Drought Monitor

January 31, 2012

Released: Wednesday, February 15, 2012

<http://www.ncdc.noaa.gov/nadm.html>

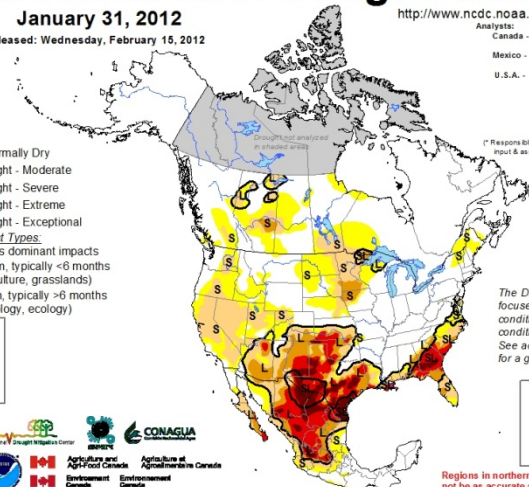
Analysts:
Canada - Trevor Hadwen
Richard Rieger
Mexico - Reynaldo Pascual
Adelina Altamirano
U.S.A. - Eric Luebbehusen
Richard Heiser
Liz Love-Brotak

(* Responsible for collecting analysis is not assembling the NA-DM map)

Intensity:
D0 Abnormally Dry
D1 Drought - Moderate
D2 Drought - Severe
D3 Drought - Extreme
D4 Drought - Exceptional

Drought Impact Types:

Delineates dominant impacts
S = Short-Term, typically <6 months
(e.g. agriculture, grasslands)
L = Long-Term, typically >6 months
(e.g. hydrology, ecology)



The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text for a general summary.

Regions in northern Canada may not be as accurate as other regions due to limited information.



<http://www.ncdc.noaa.gov/oa/climate/monitoring/drought/nadm/index.html>

NOAA'S National Climatic Data Center



North America Climate Service Partnership

- ✓ Partnership: Canada, U.S., & Mexico
 - NOAA, MSC, SMN
- ✓ Trilateral cooperation & capacity development by sharing information & tools
- ✓ Two priorities:
 - Water resources
 - Engaging the end user
- ✓ NADM is one of several existing regional initiatives being folded into the NACSP activity



Intent: Facilitate the exchange of information, technology and management practices related to the development of climate information and the delivery of integrated climate services for North America.



The NIDIS Drought Portal (www.drought.gov)

The screenshot shows the NIDIS U.S. Drought Portal homepage. At the top, it features the NIDIS logo and the text 'National Integrated Drought Information System' and 'U.S. Drought Portal' with the URL 'www.drought.gov'. Navigation tabs include HOME, WHAT IS NIDIS?, CURRENT DROUGHT, FORECASTING, IMPACTS, PLANNING, EDUCATION, RESEARCH, RECOVERY, and REPORTS. A search bar is located on the right. The main content area is divided into several sections:

- Area Drought Information:** Includes dropdown menus for 'Select State...' and 'Select Region...' with 'Go' buttons.
- Maps & Tools:** Lists links for 'Map & Data Viewer - new!', 'Geodata Portal', 'Drought Monitor Graphics', and 'CRN Soil Data'.
- Events & Announcements:** Lists recent events such as 'Risk Management Meeting 11/2011', 'ACF Climate Outlook Forum and Pilot Review Meeting 2011', and 'Engaging Preparedness Communities Webinar, Dec 13th 1-2 PM EST'.
- Regional Drought Webinars:** Lists webinars for the ACFR Drought Assessment, ACF Briefing Presentations, and South Central Drought Briefing.
- Drought In The News:** Lists news items like 'City Adjusts Water Use for New Restrictions', 'Texas drought twists migrations of many birds', and 'Report: Drought costs state \$5.2B in 2011'.
- Featured Products:** Includes 'Where are Drought Conditions Now?', 'How is the Drought Affecting Me?', and 'Will the Drought Continue?'. It features a 'U.S. Drought Monitor' map for March 6, 2012, showing drought intensity across the United States.
- NIDIS Feature:** Includes a link to the 'INTERMOUNTAIN WEST CLIMATE SUMMARY'.
- Drought Information Statements:** Includes a map of the Western United States with links to view current NWS Drought Information Statements.
- Drought Monitor Time Series:** Includes a graph showing the '%Area for U.S., including AK, HI & PR' for drought classifications D3-D4, D2-D4, and D1-D4 from 2009 to 2010.
- Regional Drought Early Warning Systems (DEWS):** Includes a map of the United States highlighting the Upper Colorado River Basin, Four Corners Region, and Apalachicola-Chattahoochee-Flint River Basin.

- ✓ Service-oriented architecture
- ✓ GIS interface for spatial overlays
- ✓ Data & metadata services
- ✓ OGC-compliant web mapping services
- ✓ Regional pilots

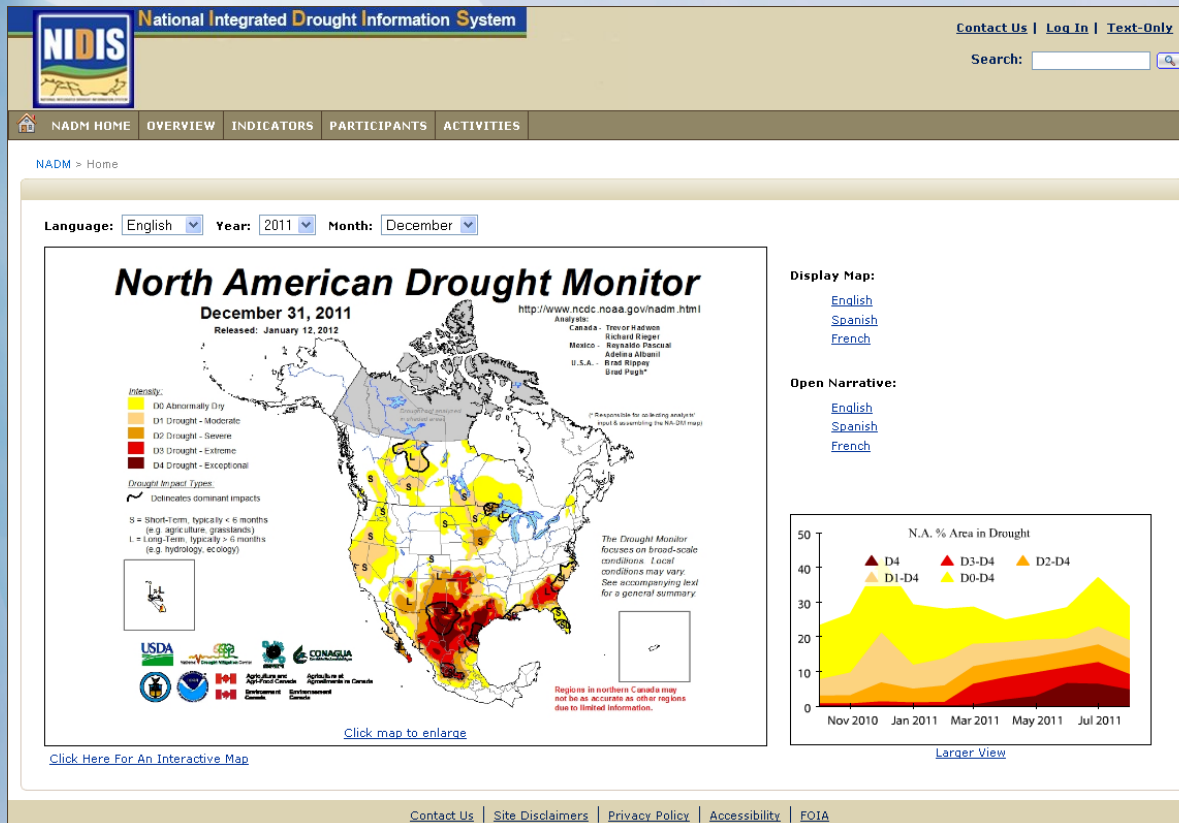


NOAA'S National Climatic Data Center



The NIDIS Drought Portal

(www.drought.gov)



- ✓ Service-oriented architecture
- ✓ GIS interface for spatial overlays
- ✓ Data & metadata services
- ✓ OGC-compliant web mapping services
- ✓ Regional pilots
- ✓ **Portal Home for USDM, NADM, & GDM**



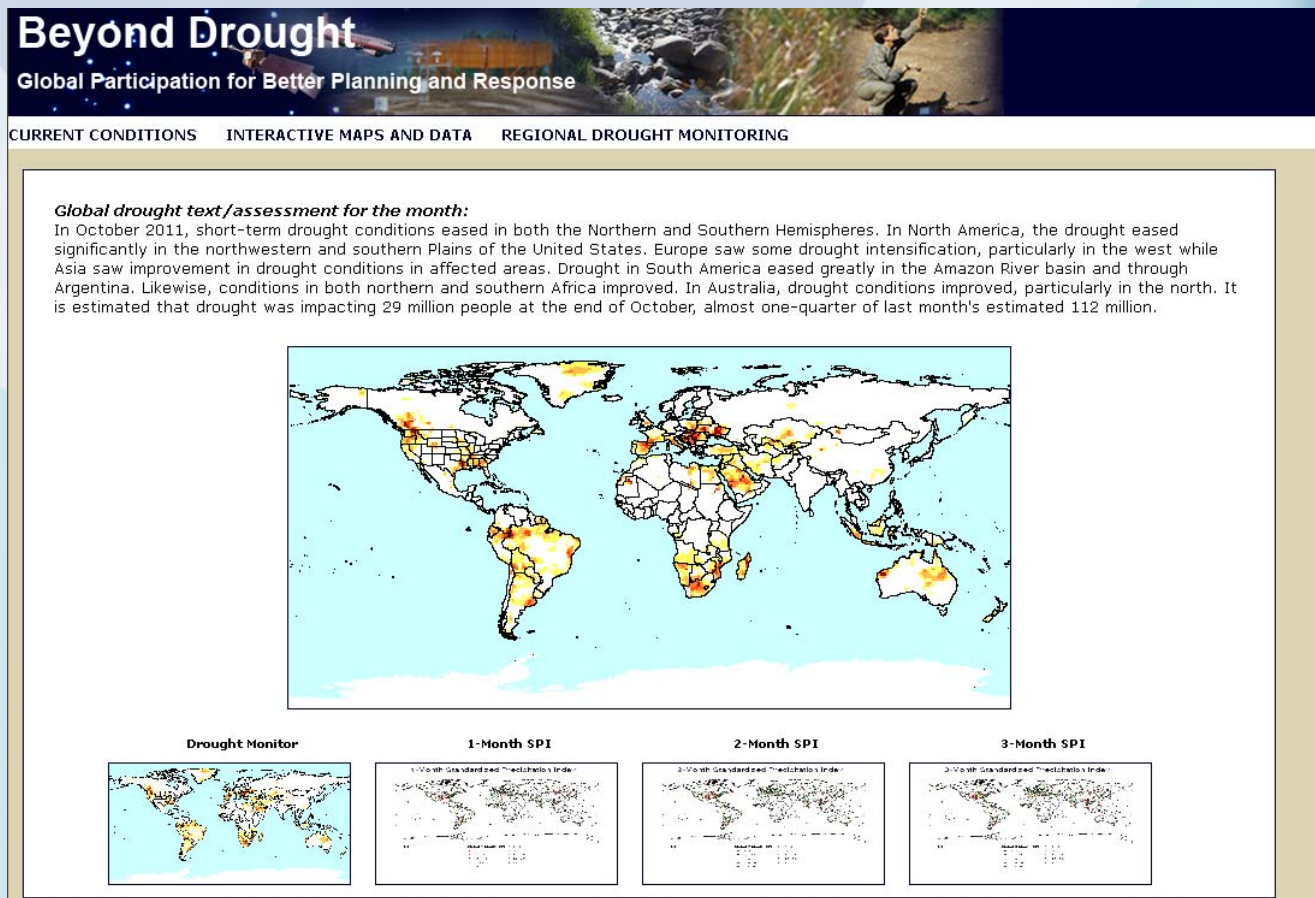
NOAA'S National Climatic Data Center



Global Drought Monitor (GDM)

- ✓ GDM takes the USDM & NIDIS concepts to the global level
- ✓ Web-services-based environment for:

- Integration of regional or continental Drought Monitors
- Computation & display of spatially consistent drought indicators on a global scale – in situ (station) SPI, satellite-based indices, modeled soil moisture
- Drill-down capability to regional, national, & local drought products



http://www.drought.gov/portal/server.pt/community/global_drought

NOAA'S National Climatic Data Center



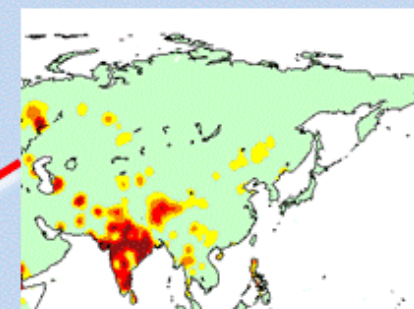
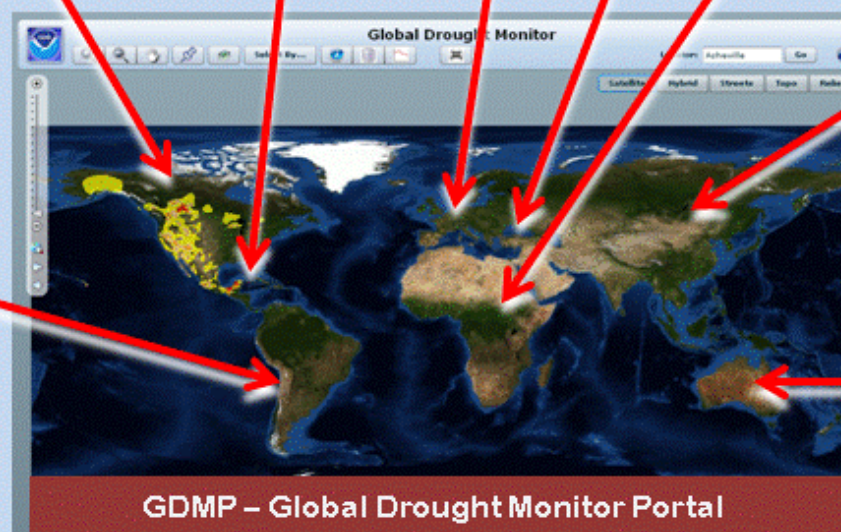
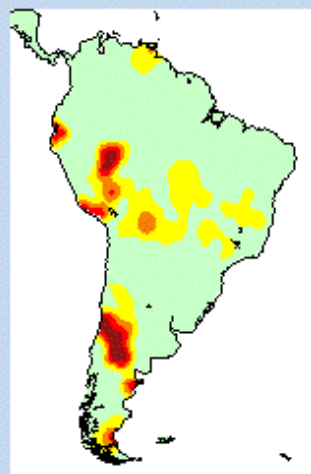
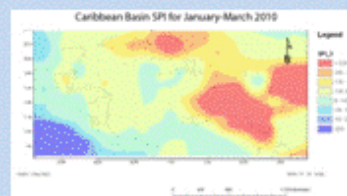
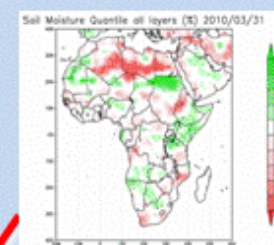
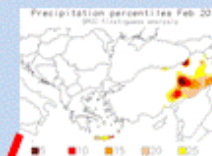
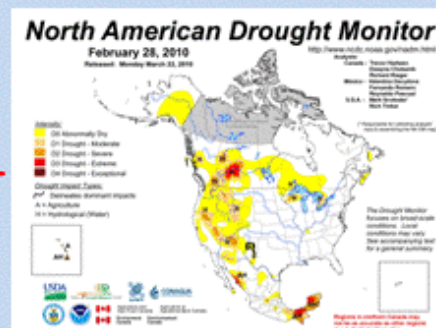
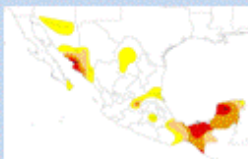
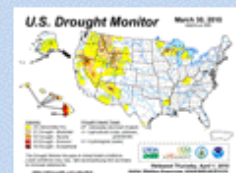
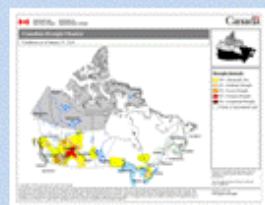
Regional / Continental Drought Monitor Models

- Each continental Drought Monitor constructed and functions according to the unique conditions of that continent.
- Global Drought Monitor.
- Global Drought Information System (GDIS).

	NADM Model	EDO Model	ADM Model
Drought Experts	In-house expertise for monitoring, forecasting, impacts, research, planning, education	In-house expertise for continental monitoring, forecasting, impacts, research, planning, education. Combined with regional, national, & local expertise	External expertise for monitoring and forecasting, coupled with in-house expertise for impacts, research, planning, education
National Climate Observing Network	Extensive data networks & near-real time daily observations from all 3 countries; supplemented by continental satellite observations & model data	Extensive data networks providing near-real time daily observations (> 30 countries); supplemented by satellite observations & modeled data	Extensive data networks and near-real time daily observations for some nations, (more satellite observations than in situ observations for most regions)
National Drought Assessments	National Drought Monitors in each country already routinely produced timely (monthly or more frequently) & merged into continental Drought Monitor	Continental assessment done at JRC, complemented by regional, national and local (e.g., river basin) assessments, where available. The latter are accessible through EDO.	No currently existing National Drought Monitor assessments (National Drought Monitor assessments do not go into the continental assessment)
International Data Exchange	Station data exchanged for creation of regional or continental standardized indicators	Station data from GTS and other sources, Forecasting data from ECMWF. Common drought indices for multi-scale assessment, mutual exchange of knowledge. Local indicators accessible through EDO.	Station data from GTS and CLIMAT transmissions are used for real-time data; historical data are from GHCN and similar compilations
International Collaboration	National experts collaborate to create regional or continental Drought Monitor	Continental monitoring coordinated by EDO (EC-Joint Research Centre). National expert network to support development.	Nations on the continent request experts from outside to create regional or continental Drought Monitor that are run in-house
IT Infrastructure	ArcGIS, web, email	Web, interoperable OWS map servers, ArcGIS, ORACLE DB	web, GIS, <u>GoogleMaps</u> , email



A GDIS Conceptual Framework – An Integration of Continental / Regional Drought Monitors

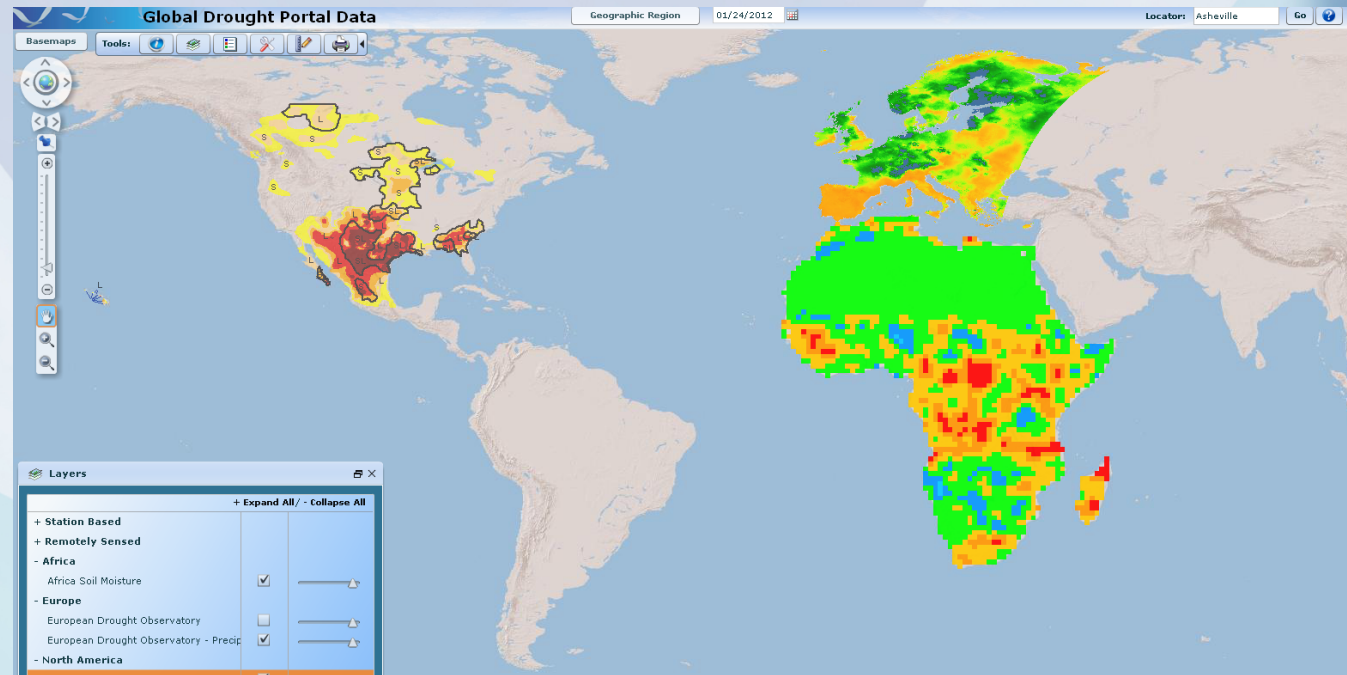


Global Drought Monitor (GDM)

http://www.drought.gov/portal/server.pt/community/global_drought

Current partners:

- NADM
- European Drought Observatory
- African Drought Monitor

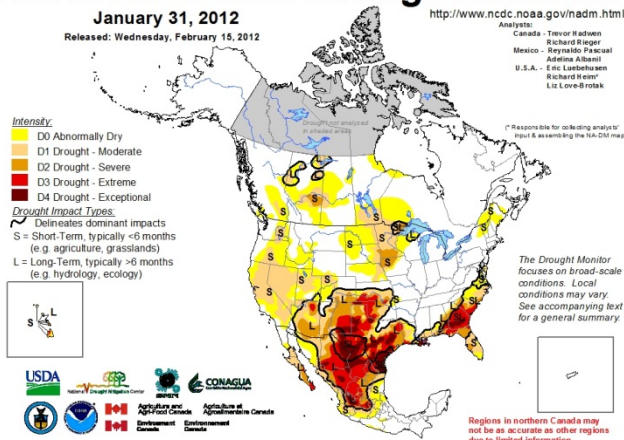


North American Drought Monitor

January 31, 2012

Released: Wednesday, February 15, 2012

<http://www.ncdc.noaa.gov/nadm.html>



European Commission Joint Research Centre

European Drought Observatory

Institute for Environment and Sustainability

DESERT Action | EDO > EDO Home

EDO Home

What is Drought

EDO Partner Network

Projects

Contact us

EU Policy

Drought Report

Current Situation

Drought in the Media

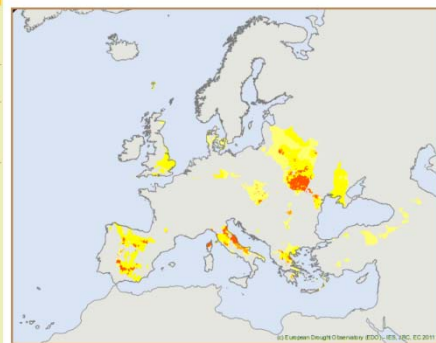
Date & Tools

Metadata

EDO MapViewer

Analysis Tools

Data Download



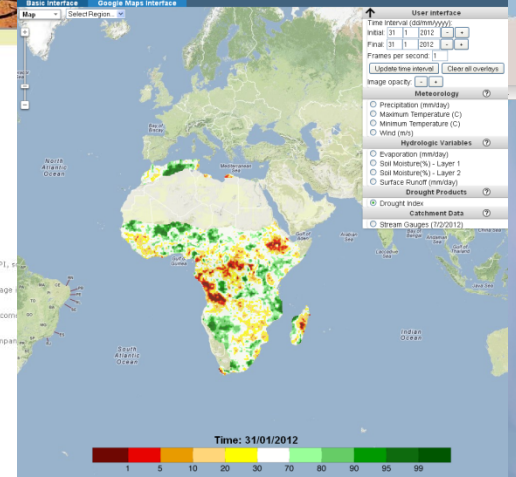
Droughts in the Media

Metadata / Documentation

Compare Indicators

MapViewer

African Drought Monitor



Global Drought Information System (GDIS)

GDIS – Information system for:

- ✓ global drought monitoring
- ✓ forecasting
- ✓ impacts
- ✓ history
- ✓ research
- ✓ education

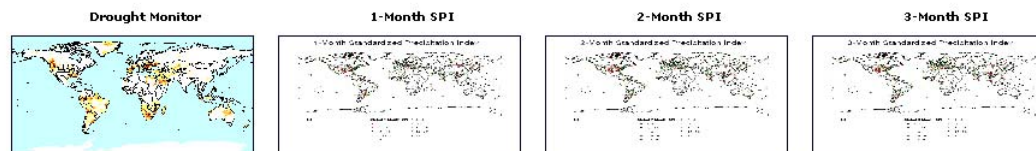
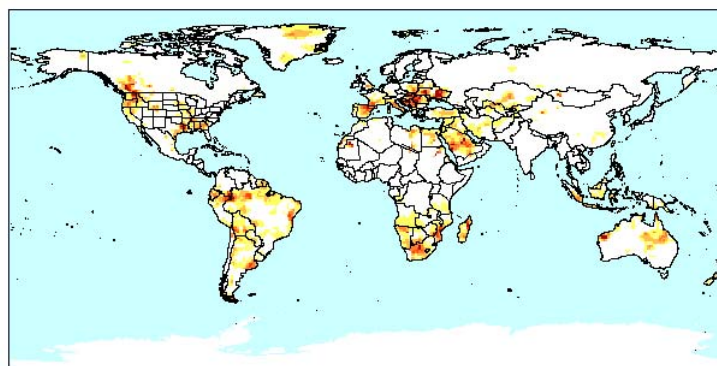
Beyond Drought

Global Participation for Better Planning and Response

CURRENT CONDITIONS INTERACTIVE MAPS AND DATA REGIONAL DROUGHT MONITORING

Global drought text/assessment for the month:

In October 2011, short-term drought conditions eased in both the Northern and Southern Hemispheres. In North America, the drought eased significantly in the northwestern and southern Plains of the United States. Europe saw some drought intensification, particularly in the west while Asia saw improvement in drought conditions in affected areas. Drought in South America eased greatly in the Amazon River basin and through Argentina. Likewise, conditions in both northern and southern Africa improved. In Australia, drought conditions improved, particularly in the north. It is estimated that drought was impacting 29 million people at the end of October, almost one-quarter of last month's estimated 112 million.



GDM / GDIS could serve as a template or model for global cooperation for climate extremes monitoring within the WMO GFCS

http://www.drought.gov/portal/server.pt/community/global_drought

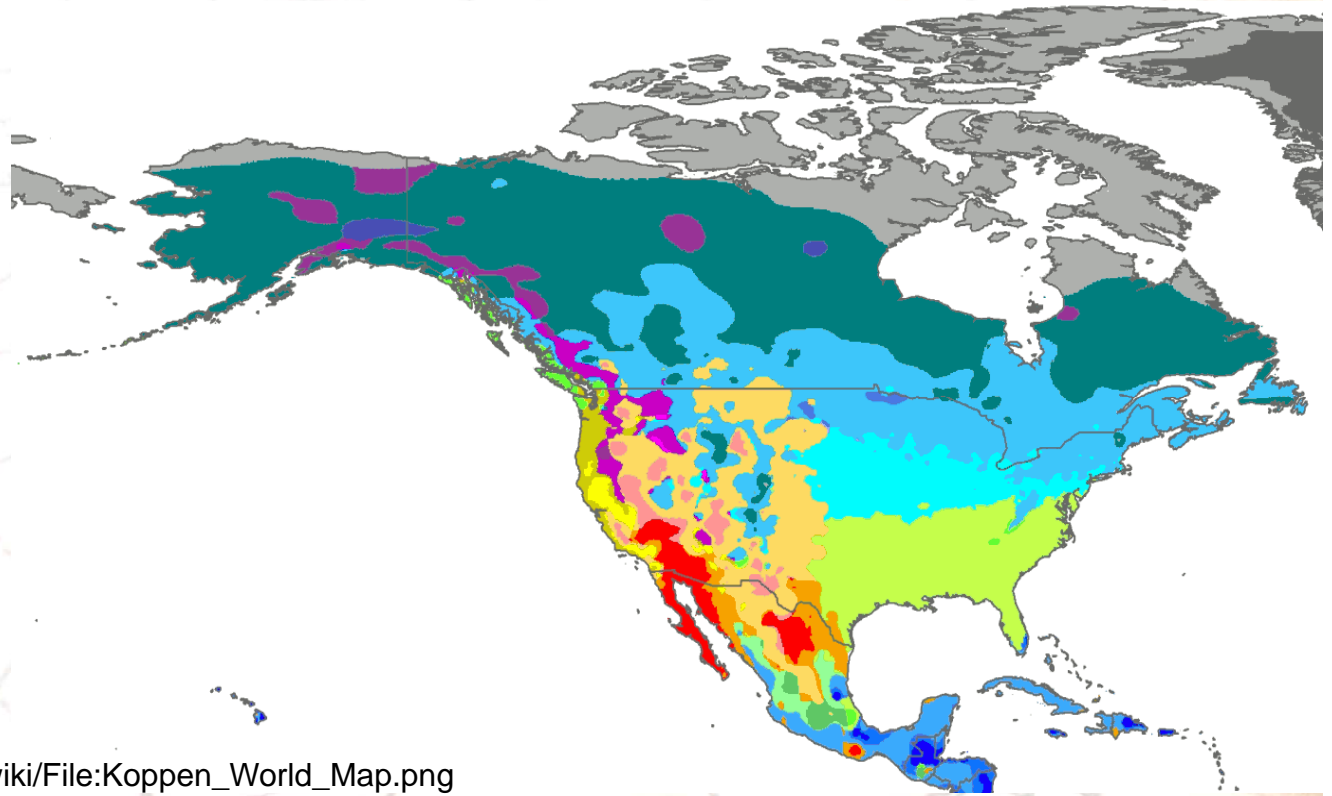


NOAA'S National Climatic Data Center



U.S.-Canadian Drought Indices & Definitions Study

- One of the primary challenges for monitoring drought across a large area with diverse climates is which drought indices to use, and even how to define drought.



Map Source: http://en.wikipedia.org/wiki/File:Koppen_World_Map.png



NOAA's National Clin

Af	BWh	Csa	Cwa	Cfa	Dsa	Dwa	Dfa	ET
Am	BWk	Csb	Cwb	Cfb	Dsb	Dwb	Dfb	EF
Aw	BSh		Cwc	Cfc	Dsc	Dwc	Dfc	
	BSk				Dsd	Dwd	Dfd	

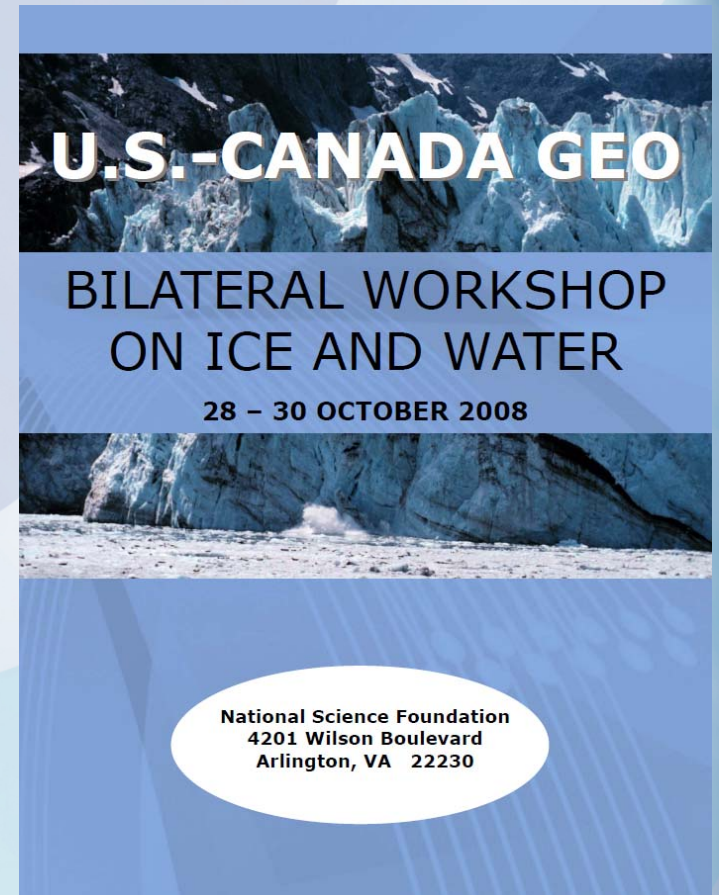
U.S.-Canadian Drought Indices & Definitions Study

✓ Workshop recommendations:

- International testbeds
- A shared data assimilation platform
- Bi-national data products
- Commitment to the Global Cryosphere Watch
- **Bilateral studies to support the assessment of monitoring systems for droughts and other extremes**

✓ Drought Indices and Definitions Study

- U.S. & Canada
- Mexico soon for entire continental coverage



Study's Objective

- To **improve the definition of drought** for the diverse climate regions of North America including arid, semiarid, subhumid, humid, subarctic, arctic, and tropical climate zones.
- Assess existing drought indices to **determine the appropriateness** of the indices for the various climate regions in North America.
- Provide information on feasibility of expanding regional indicators to a **continental scale**.
- Continent-wide study for the comparative analysis across regions with close **links to the testbed activities**.



Goals and Deliverables

- Produce an **inventory of indices and indicators** used to monitor drought in the two countries to determine which indices and data sets are appropriate for monitoring drought in each of the climate regions of North America, including consideration of seasonality, timescales, climate criteria, and related impacts.
- Conduct a literature review of drought studies to produce a **bibliography of references** addressing the definition of drought relevant to the diverse climates of North America.
- Provide assessment and recommendation for the development of regional drought indices that can be produced on a continental scale.



Goals and Deliverables

- **The inventory and bibliography will provide the basis for a peer-reviewed drought monitoring toolkit available to the water resources community. The toolkit will contain:**
 - a description of drought in the diverse climates of North America – from drought in wet climates to drought in dry climates, drought in hot climates to drought in cold climates – which addresses the varied perception issues associated with drought;
 - a rational process (generalized methodology) for choosing which drought indicators to use in each sector and climatic type, thus aiding water managers and decision-makers in preparing a drought monitoring response.

Thank-You!

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NOAA'S National Climatic Data Center

