13B.4

NOAA's National Climatic Data Center – Resources Regarding Climate and Weather Extremes

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ABSTRACT

NOAA's National Climatic Data Center (NCDC) has developed a number of products and services over the past several years to provide data and information related to US and global climate and weather extremes. These products and services are intended to serve a variety of constituents: government, educational, research, private sector, news media, individual, etc. By working with various user groups to determine requirements, NCDC has made use of existing data in its digital archives to convert large holdings of data into more useful information. Examples include a service to provide long-term extremes of various parameters by location, county, or state; GIS Services to easily locate stations with available data; climate monitoring products to track extremes such as for snowfall; a monitoring system to display trends in 12 indicators of climate extremes across North America; monthly global hazards summaries with narrative and impact information; and numerous other products. In each case, the intent of the product or service is to address requirements both within and outside of NOAA, and to better inform the public about climate and weather extremes.

1. ONLINE SERVICES

1.1 Long-term Extremes by Month

NCDC's digital database of monthly data includes temperature, precipitation, snowfall, and various other parameters, for over 8000 active U.S. (and U.S. territory) station locations. A web application (Figure 1) allows users to query the data for numerous extremes such as:

- Lowest/highest minimum temperature by month
- Lowest/highest maximum temperature by month
- Least/greatest precipitation by month (Figure 2 – example)
- Least/greatest snowfall and snow depth by month
- Number of days with precipitation exceeding various thresholds, by month
- Number of days with temperature exceeding various thresholds, by month

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The application allows geospatial parsing by city/town (i.e., station location), county, climate division, and state. For example, a user can quickly determine the lowest temperatures recorded by month for a county of interest.

The URL of this service is:
http://cdo.ncdc.noaa.gov/CDO/cdoextremescountryselect.cmd?exdsid=31

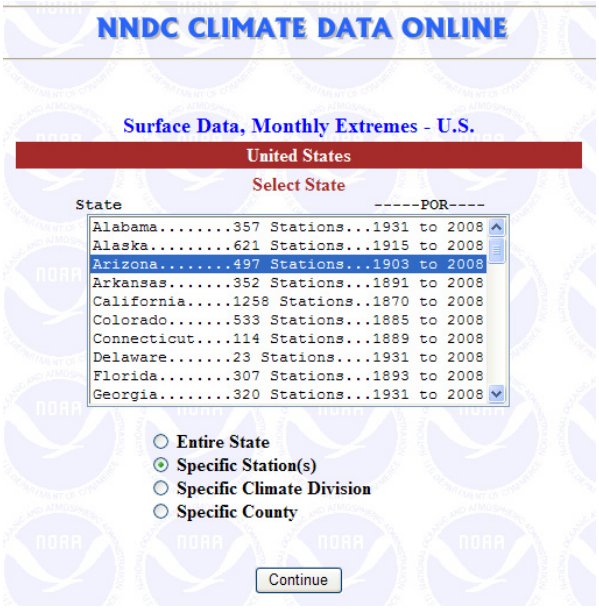

Figure 1. Monthly Extremes Interface.

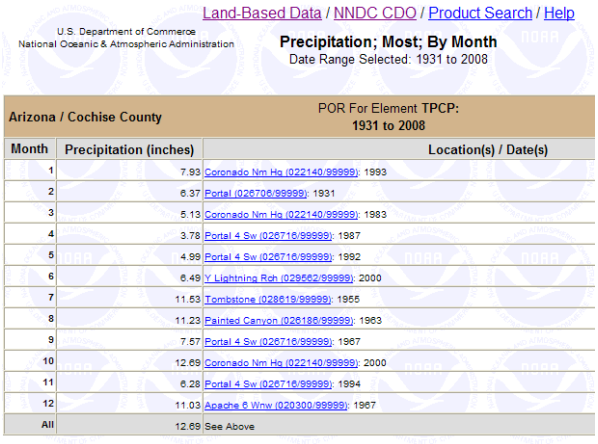

Figure 2. Sample Output – Monthly Maximum Precipitation for Cochise County, AZ.

1.2 GIS Services

NOAA has a number of collaborative efforts ongoing in the GIS arena. NCDC has been working closely with the National Ocean Service's Coastal Services Center in Charleston, SC in various activities, such as the ESRI Geoportal Toolkit (http://www.esri.com/library/fliers/pdfs/gis-portal-toolkit.pdf). Other collaborations include NCDC with the National Weather Service's Climate Prediction Center and with various other partners. The NCDC GIS Portal (http://gis.ncdc.noaa.gov/) – see Figure 3, provides an overall front-end for users to see which NCDC products and services provide GIS-enabled capabilities.

A key goal in developing and deploying GIS technology is to provide users with simple map-based access to climate services. Users who are presented with data discovery options which flow into detailed product selection maps can search using standard tools or gazetteer (geographical dictionary search) functions. Each tabbed selection offers steps to help users progress through the system. A series of additional base map layers and data types provide companion information.

In addition to providing dynamic maps to access data, Web Map Services (WMS) provide maps or images and Web Feature Services (WFS) provide spatial features. These services may be used from Open Geospatial Consortium (OGC)-compliant applications to directly access data and metadata. KMZ files used directly within 3D GIS viewers (e.g., ArcExplorer, Google Earth) are also available for a number of datasets and products. Datasets and products are recorded in Federal Geographic Data Committee (FGDC)-compliant metadata which are harvested into catalog portals such as Geospatial One-Stop (http://gos2.geodata.gov/wps/portal/gos) and the Global Change Master Directory (http://gcmd.nasa.gov/).

Value-added layers and data types are also included which visually provide, for example -- agricultural regions, coastal hazards, population density, global ecoregions and wetlands, state and regional climate divisions, National Transportation Atlas data, topography data, and visual imagery (e.g., aerial photos). "Gazetteers" provide advanced search functions which allow users to rapidly isolate stations or areas of interest, such as by location name, zip code, river name, country, etc.

Through the GIS Services interface, various data selection methods are presented (Figure 4). Also, the ability to graph parameters of interest is included – see Figure 5 for an example.

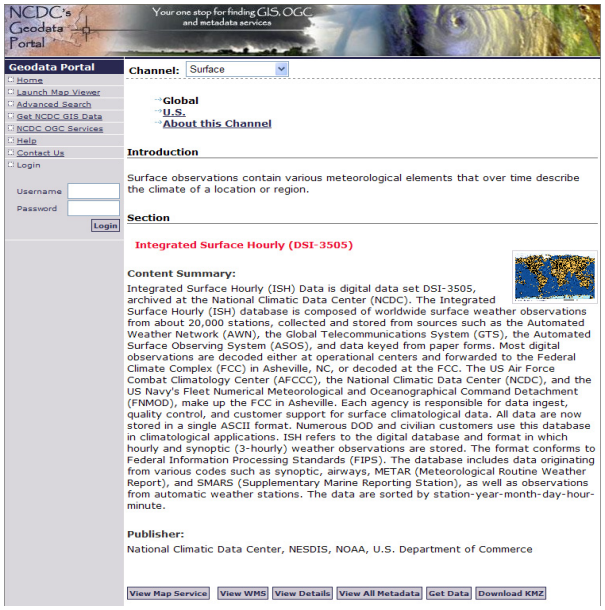

Figure 3. Geodata Portal.

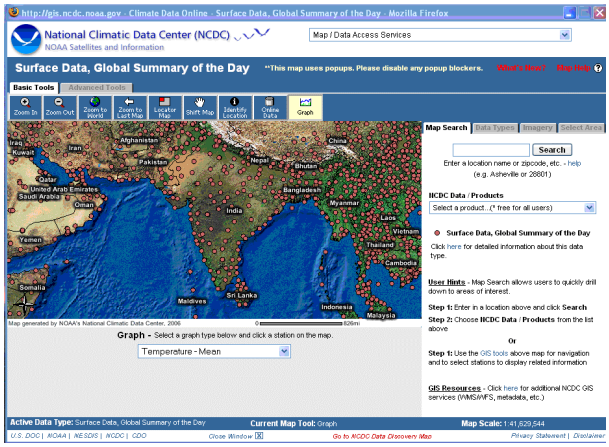

Figure 4. GIS Map Interface--Sample.

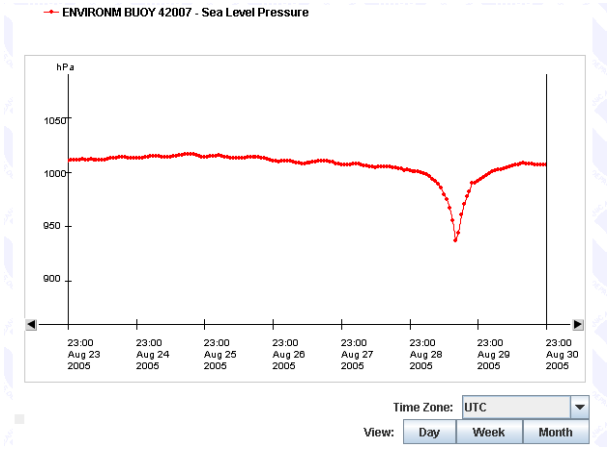

Figure 5. Pressure During Hurricane Katrina.

1.3 Global Hazards and Extreme Events

Each month NCDC highlights various extreme events globally, via a "global hazards' web page – http://www.ncdc.noaa.gov/oa/climate/research/hazards/index.php (see Figure 6).
This service provides summaries and related data for numerous U.S. and global extreme weather/climate events, such as heavy rainfall and flooding, drought, tropical cyclones, tornadoes, etc. The web page for the month is updated as additional information becomes available.

Various other information and data are available via the "extreme weather and climate events" service – http://www.ncdc.noaa.gov/oa/climate/severeweather/extremes.html -- which provides links to topical information for particular types of events. This also includes a link to the annually updated report on billion-dollar climate/weather disasters (Figure 7).

Figure 6. Global Hazards for October 2008.

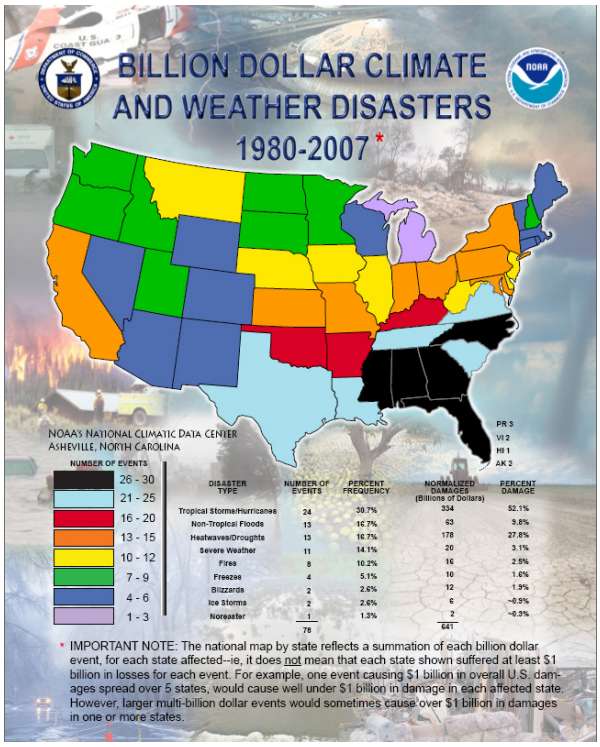

Figure 7. Billion-Dollar Climate/Weather Disasters.

1.4 Climate Monitoring Products

Daily temperature and precipitation extremes for several thousand U.S. stations can be obtained via the U.S. Records web page interface (http://www.ncdc.noaa.gov/oa/climate/research/records/). Parameters include:

- Coldest minimum temperature
- Warmest minimum temperature
- Coldest maximum temperature
- Warmest maximum temperature
- Highest precipitation
- Highest snowfall

Daily, monthly, and all-time records for specific days can be extracted, and the data are updated on a near-real time basis for those stations having current data.

Summaries of selected U.S. city and state extremes, in map and tabular form, are also available via that web site, by month. Parameters include temperature / dew point, precipitation, snowfall, wind, and pressure.

Maps and time series of trends in 12 indicators of climate extremes across North America are available at the North America Climate Extremes Monitoring site (http://www.ncdc.noaa.gov/nacem/) (Figure 8). The maps display trends or anomaly fields for the specified parameter for all stations with data, while the time series show the historical variability and trend for the desired parameter on a station by station basis (see Figure 9 for examples). The parameters include:

- Number of frost days (Tmin < 0°C)
- Number of summer days (Tmax > 25°C)

- Number of icing days (Tmax < 0˚C)
- Number of tropical nights (Tmin > 20˚C)
- Growing season length
- Percentage of days when Tmax > 90th percentile
- Percentage of days when Tmax < 10th percentile
- Percentage of days when Tmin > 90th percentile
- Percentage of days when Tmin < 10th percentile
- Greatest 5-day total precipitation
- Simple precipitation intensity index
- Maximum length of dry spell (precip < 1 mm)

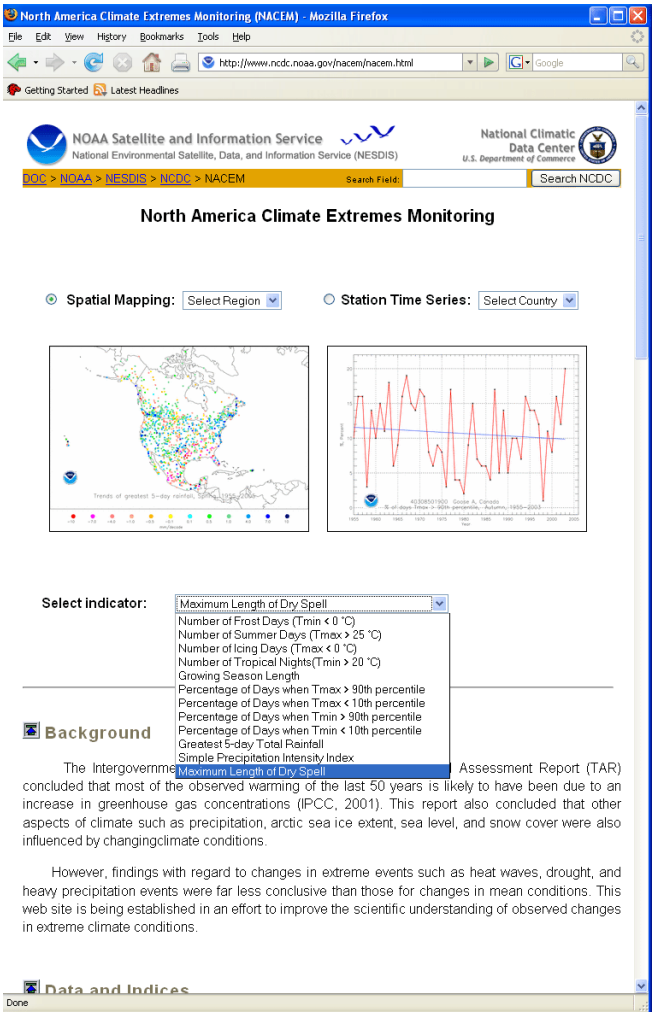

Figure 8. North America Climate Extremes Monitoring web site.

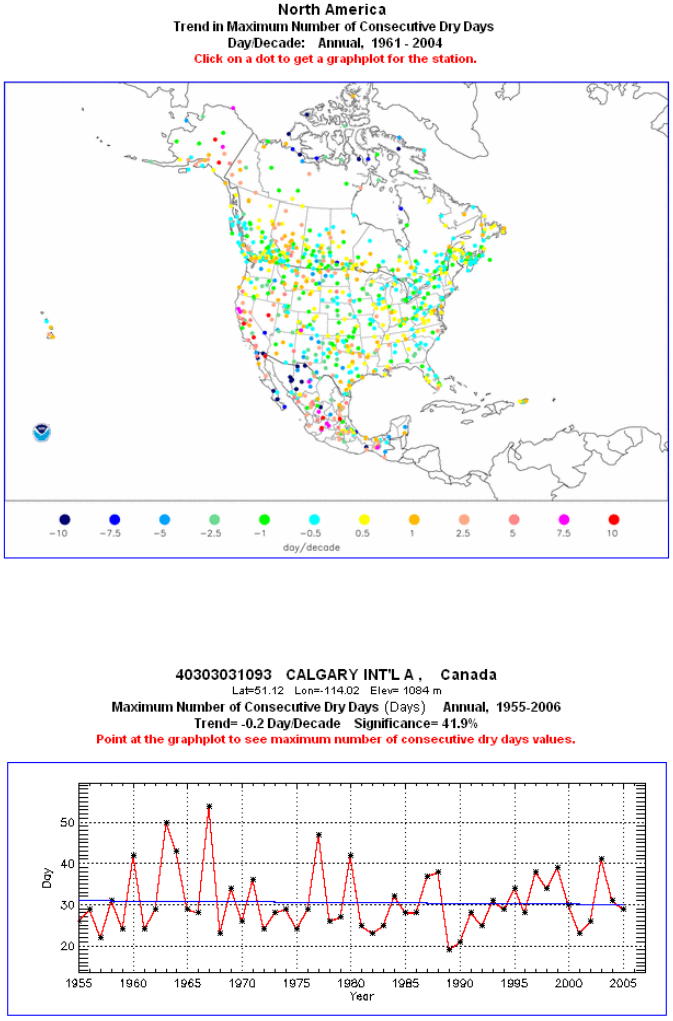

Figure 9. North America Climate Extremes Monitoring map of trend in annual maximum number of consecutive dry days, 1961-2004 (top) and time series of same parameter for Calgary International Airport, Canada, 1955-2006 (bottom).

NCDC partners with State Climatologists and the NOAA Regional Climate Centers to summarize climate extremes information in monthly State of the Climate reports. The reports are published online and can be accessed from the following web page: http://www.ncdc.noaa.gov/oa/climate/research/monitoring.html#state