NEEDS AND APPLICATIONS OF CLIMATE INFORMATION IN MEXICO

APEC CLIMATE CENTER
September 14-16

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National Meteorological Service

Overview

- **Climate forecast activities at the National Meteorological Service (SMN)**
- **International activities**
  - **North America Drought Monitor**
  - **Climate Extremes Monitoring**

Climate Forecast in Mexico

- Operationally the climate forecast at the SMN started in 1999 (after the big El Niño 1997-1998)

- The main user is the National Water Commission (CNA), as a result, precipitation is the most important variable to forecast

- During recent years the number of users has increased drastically, however the format of the forecast remain the same

- Users needs on climate information has also increase dramatically:
  - Regional and local information
  - Onset and extend of the rainy season
  - Dry and wet spells
  - Extension and intensity of the mid-summer drought (canícula)
  - Drought diagnostic and forecast
  - Wildfires activity

Climate forecast in Mexico

Currently the CNA is demanding a rainfall forecast on a regional level to deal with specific problems:

- Rio Bravo/Rio Grande (for the management of the international waters with the US)
- Lerma-Chapala Basin (the main water source for central Mexico, which is the most populated area in the country, and recently affected by a long-term drought)
- Frontera Sur (Tabasco and Chiapas, for the management of the Grijalva dams system, the most important in the country for electric power generation)

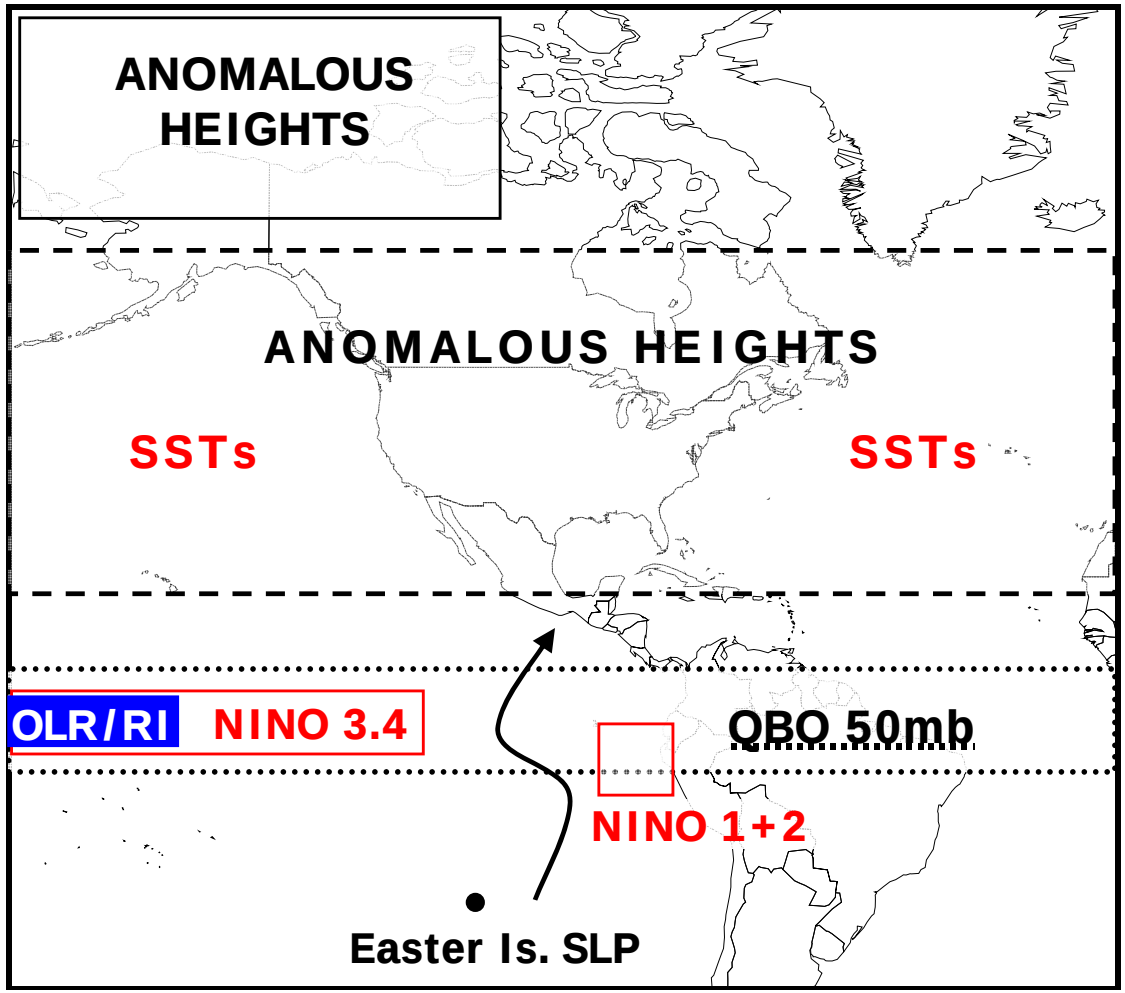
ANALOG FORECAST: Cluster Analysis Method

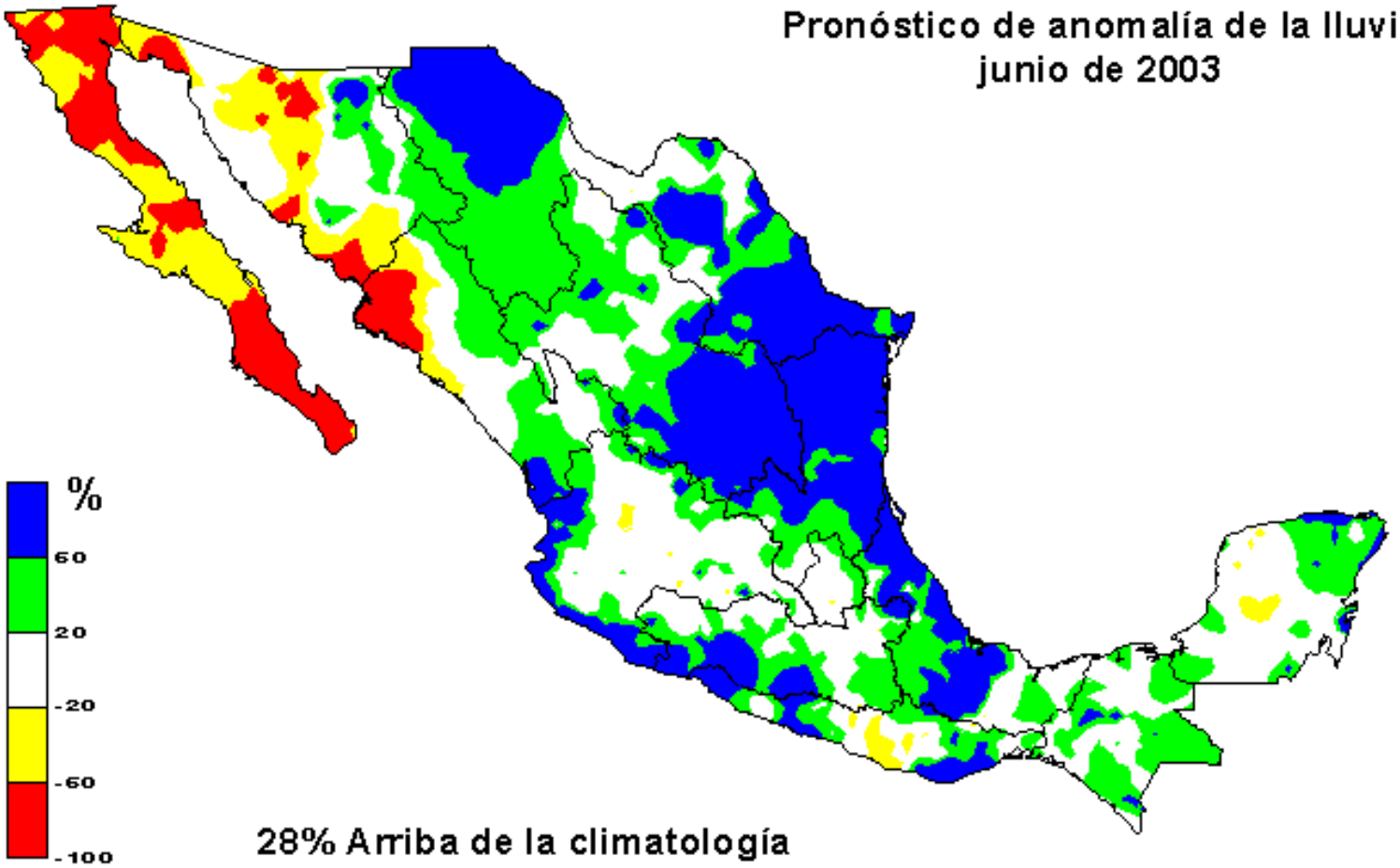
Time Period: 1950 to present
Objective: Definition of a set of analog years that exhibit the greatest similarity with the current year.

Method:

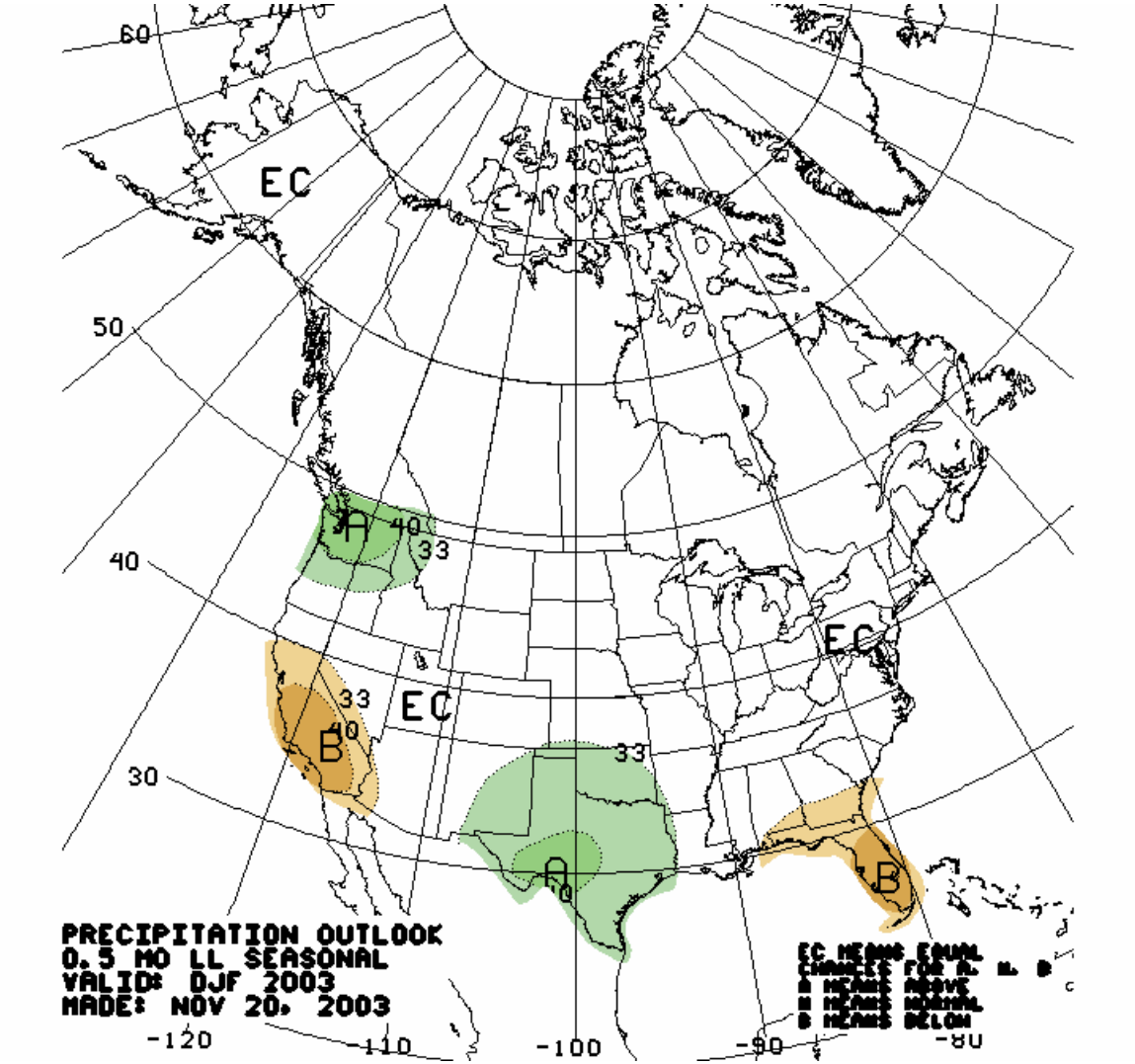
- **Agglomerative, hierarchical clustering**
- **Clustering based on time series of key indices (e.g., SSTs, 700mb height anomalies, etc.)**
- **Refinement of analog year selection with ensemble model runs for days 8-14.**
- **Forecast represents average values for all years in the analog set.**
- **Forecast product provides regional or country wide anomalies of precipitation and temperature**
- **Forecast product can provide an estimate of expected class limit occurrence (e.g., 4 of 6 analog years being wetter than normal).**

Geographic Location of Possible Predictors

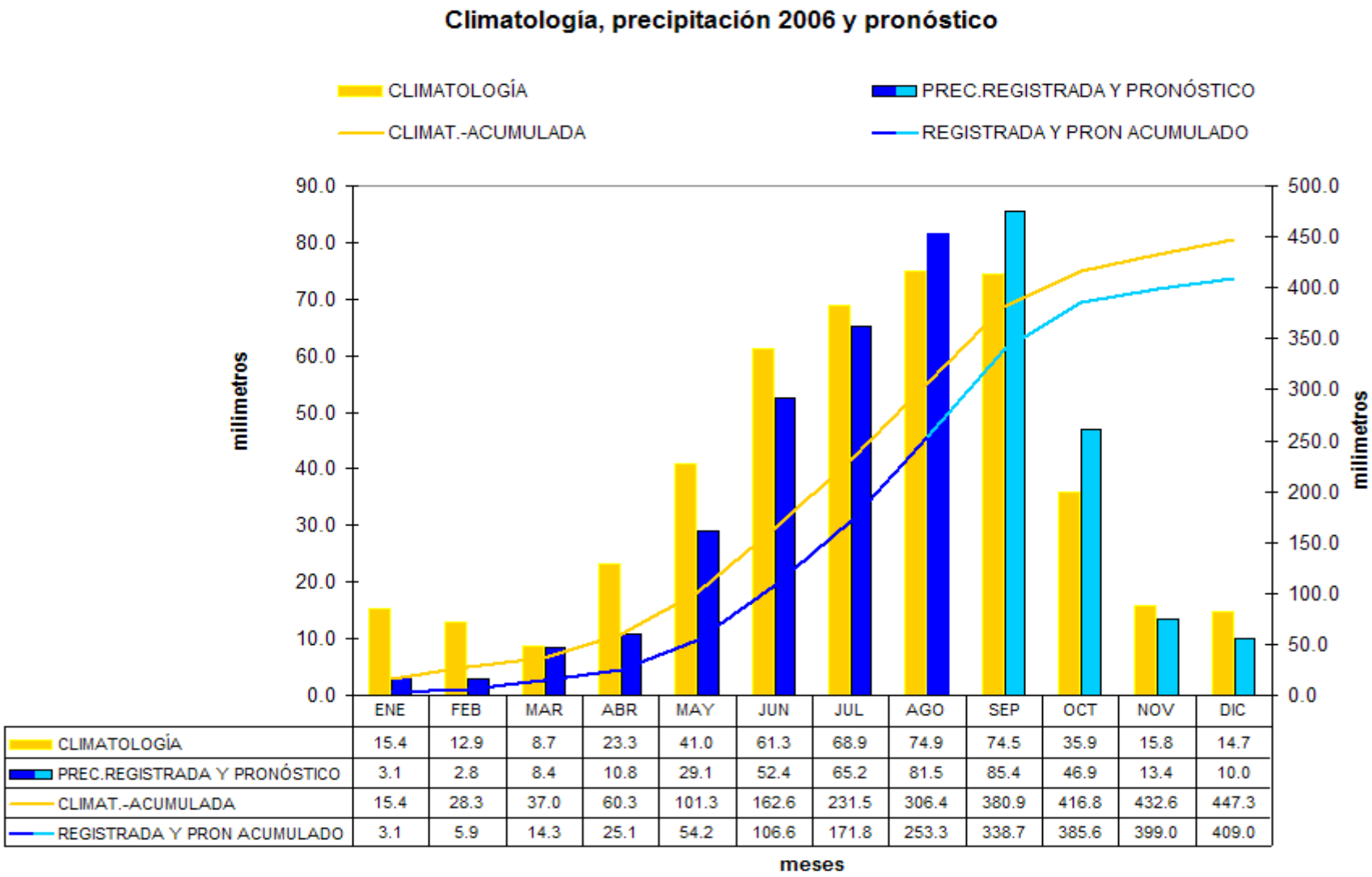



Pronóstico de anomalía de la lluvia
junio de 2003
%
60
20
-20
-60
-100
28% Arriba de la climatología

NCEP: 3-CATEGORY (TERCILE) FORECAST



Hydrological Region 24
Rio Bravo (Rio Grande Basin)



	ENE	FEB	MAR	ABR	MAY	JUN	JUL	AGO	SEP	OCT	NOV	DIC
CLIMATOLOGÍA	15.4	12.9	8.7	23.3	41.0	61.3	68.9	74.9	74.5	35.9	15.8	14.7
PREC.REGISTRADA Y PRONÓSTICO	3.1	2.8	8.4	10.8	29.1	52.4	65.2	81.5	85.4	46.9	13.4	10.0
CLIMAT.-ACUMULADA	15.4	28.3	37.0	60.3	101.3	162.6	231.5	306.4	380.9	416.8	432.6	447.3
REGISTRADA Y PRON ACUMULADO	3.1	5.9	14.3	25.1	54.2	106.6	171.8	253.3	338.7	385.6	399.0	409.0

Climatology base period 1941-2005

HYDROLOGICAL REGION 24
RÍO BRAVO (RIO GRANDE BASIN)

Climatology (1941-2005)

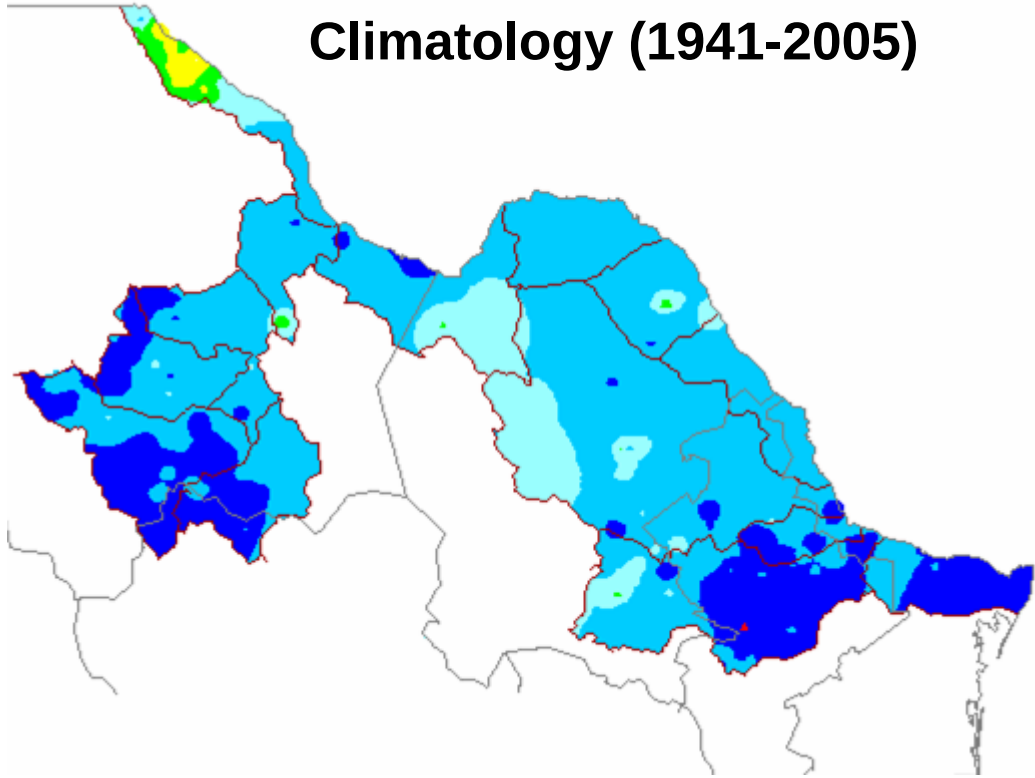


Lámina media acumulada 74.5 mm

September 06 rainfall forecast

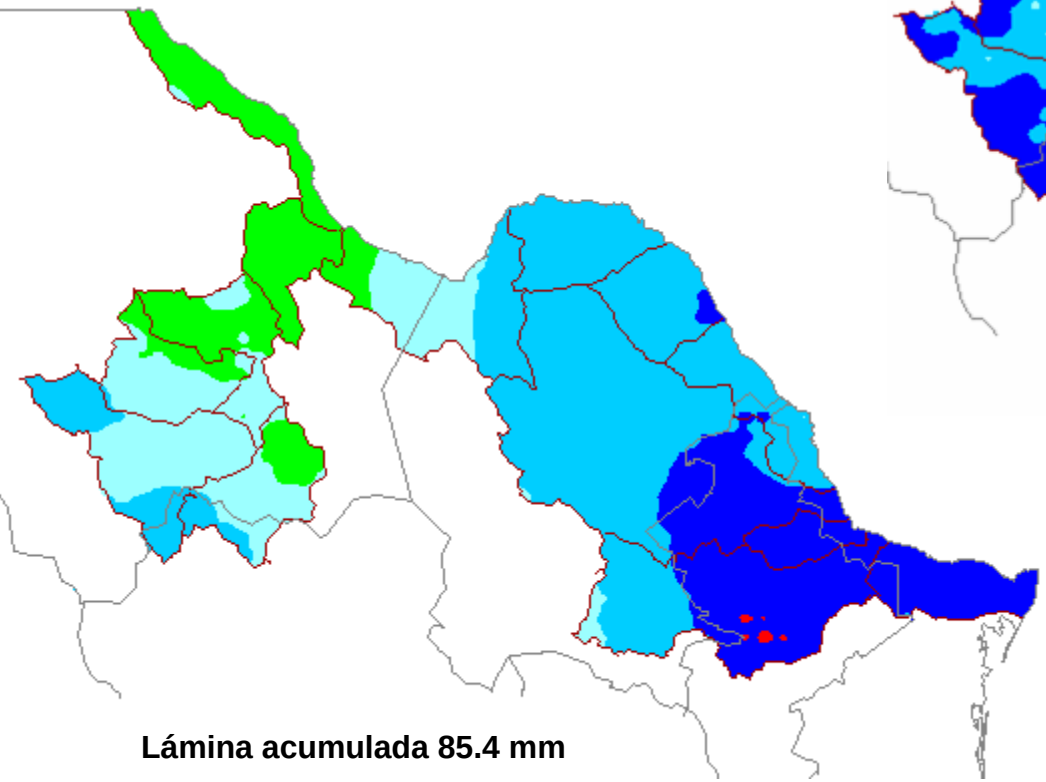
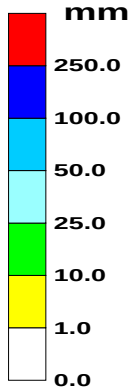


Lámina acumulada 85.4 mm



Analog years
1960, 1966, 1970, 1998 y 2001

International collaboration: North America Drought Monitor

Why A North America Drought Monitor?

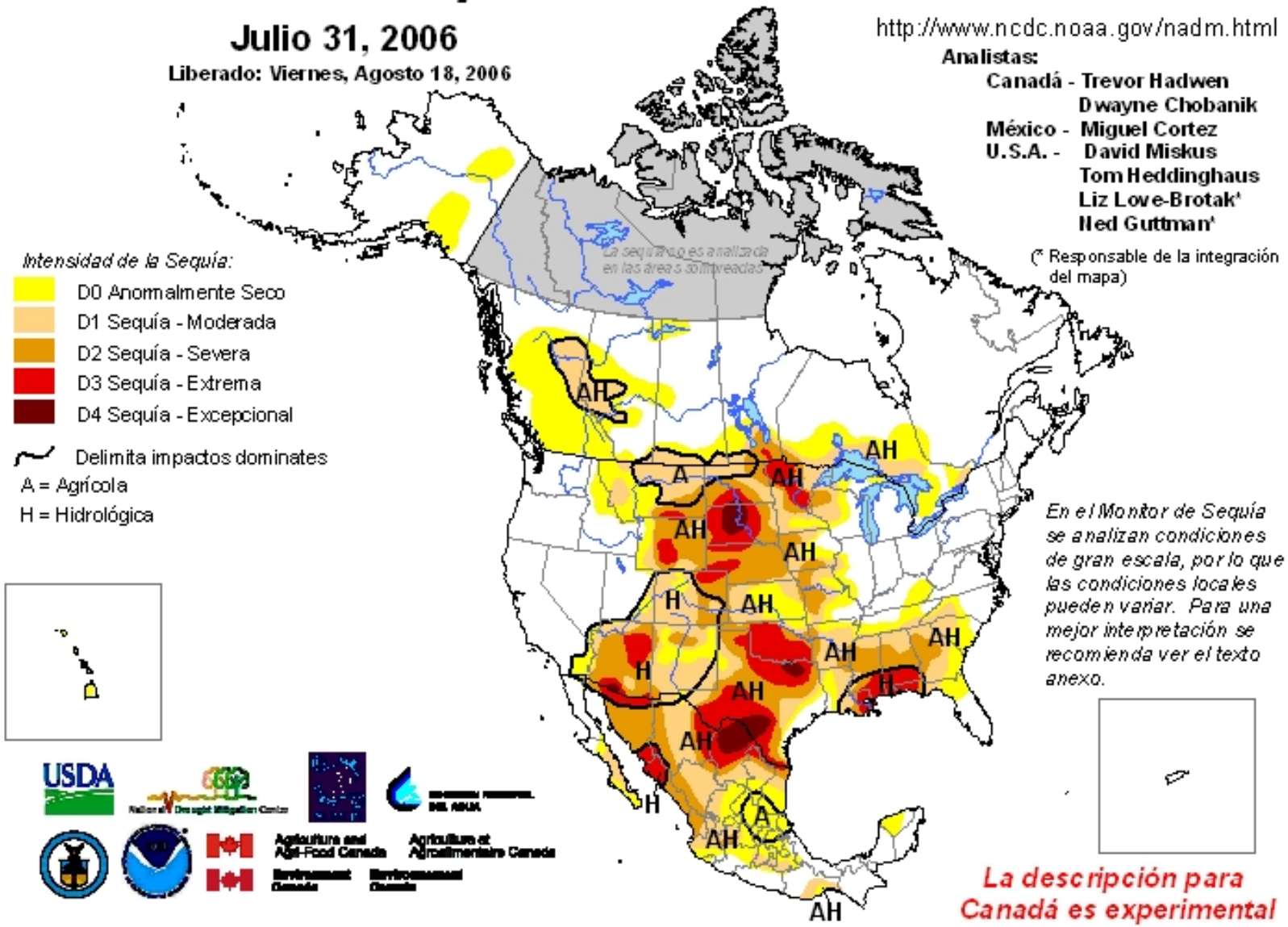
In today's global economy the costs and effects of drought often extend beyond international borders

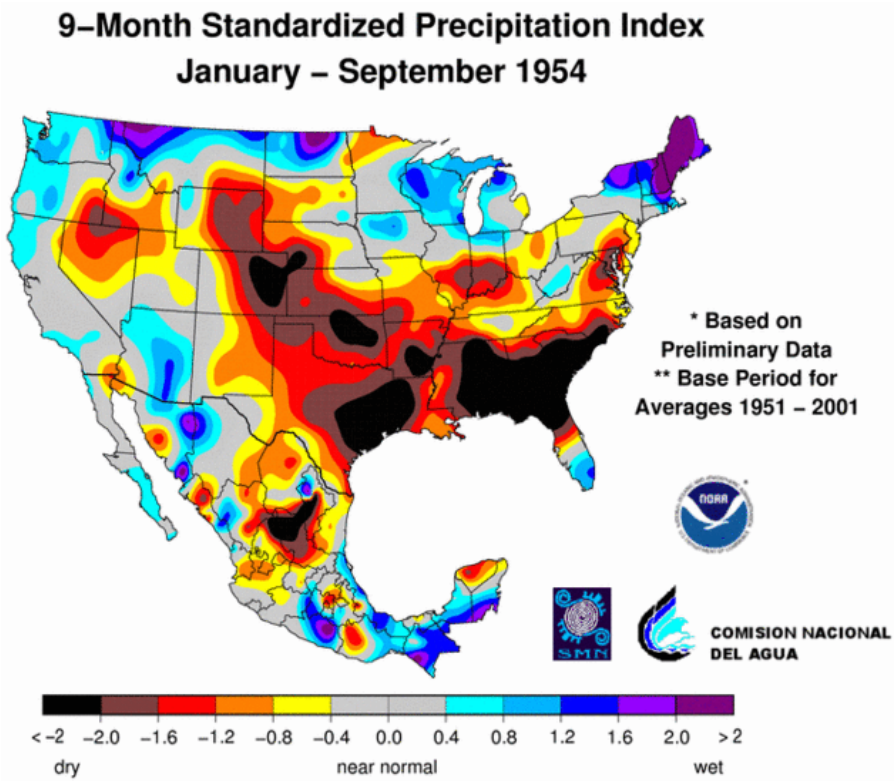
- **– Drought in the Southwest U.S. and a prolonged period of drought in Mexico led to debates about shared water rights**

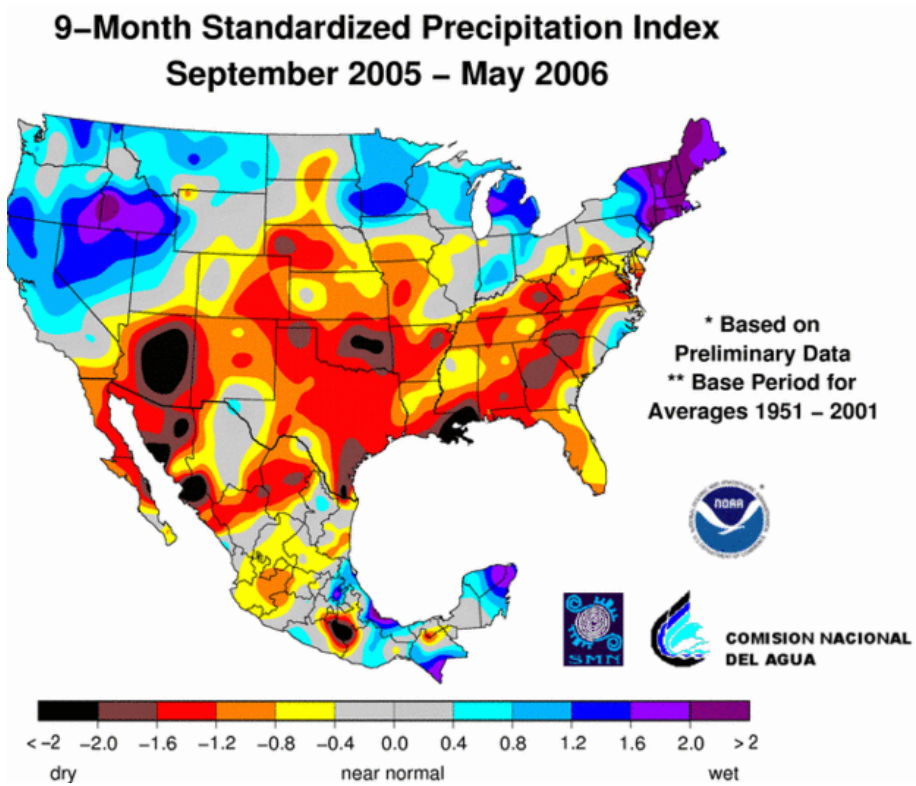
Purpose of the NA-DM

- ✓ Provide an ongoing comprehensive and integrated assessment of drought over the North American sector
- ✓ Synthesize multiple indices and local assessments to create the best assessment of current drought conditions
- ✓ Coordinate international efforts in monitoring climate extremes that potentially can impact society and natural systems

Monitor de Sequía de América del Norte




9–Month Standardized Precipitation Index
January – September 1954
* Based on
Preliminary Data
** Base Period for
Averages 1951 – 2001
COMISION NACIONAL
DEL AGUA
< –2 –2.0 –1.6 –1.2 –0.8 –0.4 0.0 0.4 0.8 1.2 1.6 2.0 > 2
dry
near normal
wet


9–Month Standardized Precipitation Index
September 2005 – May 2006
* Based on
Preliminary Data
** Base Period for
Averages 1951 – 2001
COMISION NACIONAL
DEL AGUA
< –2 –2.0 –1.6 –1.2 –0.8 –0.4 0.0 0.4 0.8 1.2 1.6 2.0 > 2
dry
near normal
wet

Other International collaborations

- Efforts are being taken at the SMN to improve historical data bases
- On this process NCDC/NOAA is providing support to the SMN.
- The North American Climate Extremes Monitoring project is taken advantage from the new Mexican data
- New steps are taken to provide web-based toll for monitoring climate extremes through the use of recently developed climate indices

P1.11

North America Climate Extremes Monitoring (NACEM)

The North America Climate Extremes Monitoring program was established by a trilateral partnership between the United States, Canada and Mexico in 2001. While the cornerstone of this effort, the North America Drought Monitor, was initiated in 2002, new steps are being taken to provide web-based tools for monitoring a wider range of climate extremes through the use of recently developed climate indices.

Jay H. Lawrimore, Thomas C. Peterson, Richard R. Heim, Xuebin Zhang, Miguel Cortez Vázquez and Nina Stroumentova • NOAA/NESDIS/National Climatic Data Center • Asheville, North Carolina

Partners and Data Sources

Environment Canada / Agriculture and Agrifood Canada

210 stations with homogeneity adjusted daily temperature data (Vincent *et al.* 2002). 493 stations with homogeneity adjusted precipitation data (Mekis and Hogg, 1999). All data have been adjusted through the year 2003. Data in the years following 2003 are unadjusted and available as part of NCDC's GHCN Daily dataset.

NOAA's National Climatic Data Center and Climate Prediction Center / USDA Joint Agricultural Weather Facility / National Drought Mitigation Center

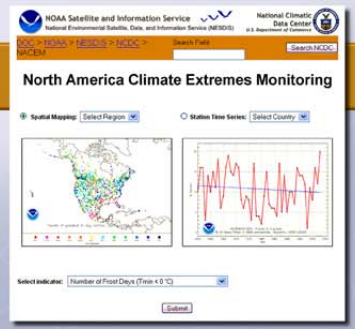
Adjustments have not been applied to U.S. daily data. Rather, stations selected for the contiguous U.S. were those that passed the Menne and Williams (2005) statistical homogeneity tests. Station selection for Alaska, Hawaii, Puerto Rico and the Virgin Islands consisted of a combination of statistical analysis, subjective assessment of graphs and metadata, and consultation with state climatologists. From this analysis, a set of approximately 750 stations with the fewest moves and instrument changes was identified.

National Meteorological Service of Mexico (Servicio Meteorologico Nacional)

No adjustments or estimates of the most homogenous daily temperature and precipitation records are currently available for Mexican stations. Station selection was based on length of record and reporting frequency. The inventory for Mexico consists of approximately 300 temperature and precipitation stations.

Web Portal

Trend maps and anomaly maps can be produced for North America as a whole, Canada, Mexico, or the United States. Station trends can be calculated and displayed for subsets of stations based on station elevation, significance level of the resulting trends, and percent of available data. Any set of years and seasons from 1955 to present can be selected for analysis and mapping. The underlying values for the trend analysis period can be viewed in time series format by clicking on any station on the map.



For any map, the corresponding data are available for download in flat ASCII format. The data values are also provided via a scrolling table.

Extremes Indices

A set of climate indices calculated using daily data from the mid-1900's to present and updated on an operational basis. These indices were recently developed by the World Meteorological Organization (WMO) Commission for Climatology/CLIVAR Expert Team on Climate Change Detection Monitoring and Indices (ETCCDMI) and are based on daily temperature values or daily precipitation amount.

Number of Frost Days
Annual count of days with daily minimum temperature <0°C

Number of Summer Days
Annual count of days with daily maximum temperature >25°C

Number of Ice Days
Annual count of days with daily maximum temperature <0°C

Number of Tropical Nights
Annual count of days with daily minimum temperature >20°C

Growing Season Length
Annual count of days between first span of at least 6 days with daily mean temperature >5°C and first span after having 6 days with mean temperature <5°C

Much below average minimums
Percentage of days when daily minimum temperature was < 10th percentile

Much below average maximums
Percentage of days when daily maximum temperature was < 10th percentile

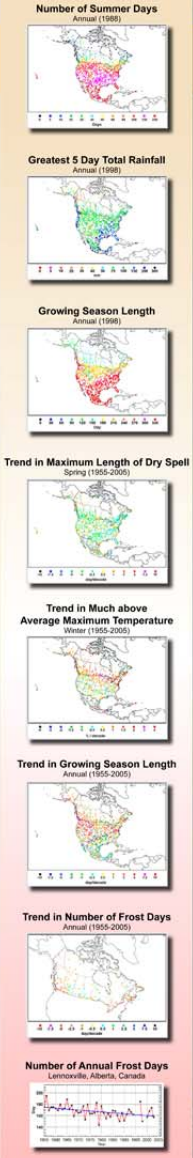
Much above average minimums
Percentage of days when daily minimum temperature was > 90th percentile

Much above average maximums
Percentage of days when daily maximum temperature was > 90th percentile

Greatest 5-day Total Rainfall
Maximum amount of rainfall falling within any consecutive 5-day period

Simple Precipitation Intensity Index
Amount of precipitation that fell on days with any amount of precipitation

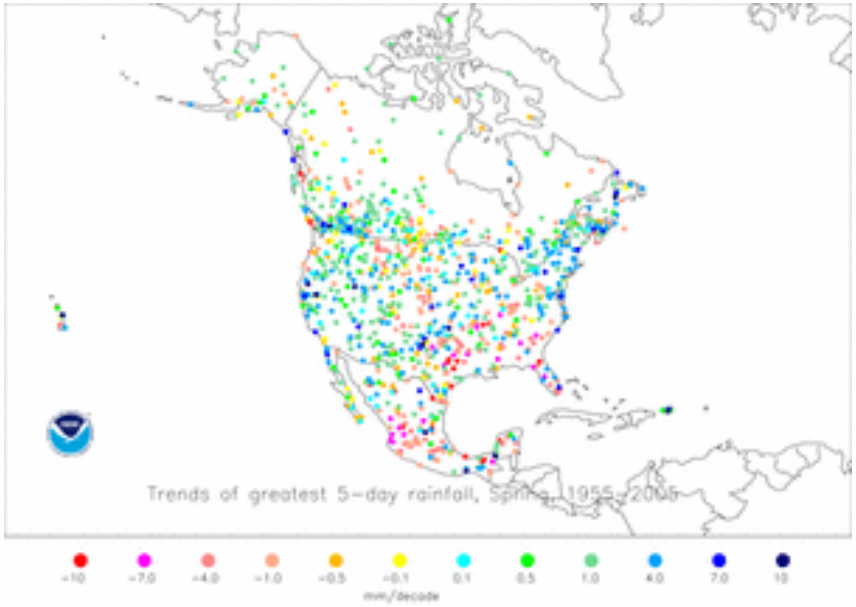
Maximum Length of Dry Spell
Maximum number of consecutive days without precipitation



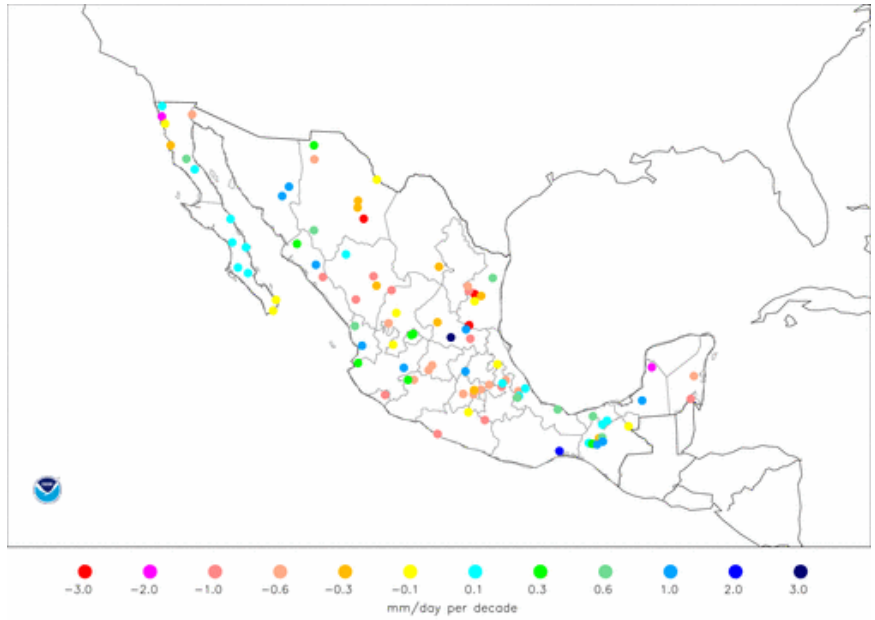
References:
Mekis, É. and W. Hogg, 1999: Rehabilitation and Analysis of Canadian Daily Precipitation Time Series. Atmosphere-Ocean, 37, 1, 53-85.
Menne, M. J., and C. N. Williams (2005), Detection of undocumented change points: On the use of multiple test statistics and composite reference series, *J. Climate*, in press.
Vincent, L.A., X. Zhang, B.R. Bonsal and W.D. Hogg, 2002: Homogenization of daily temperatures over Canada. *Journal of Climate*, 15, 1322-1334.

Online at: **http://www.ncdc.noaa.gov/nacem/nacem.html**

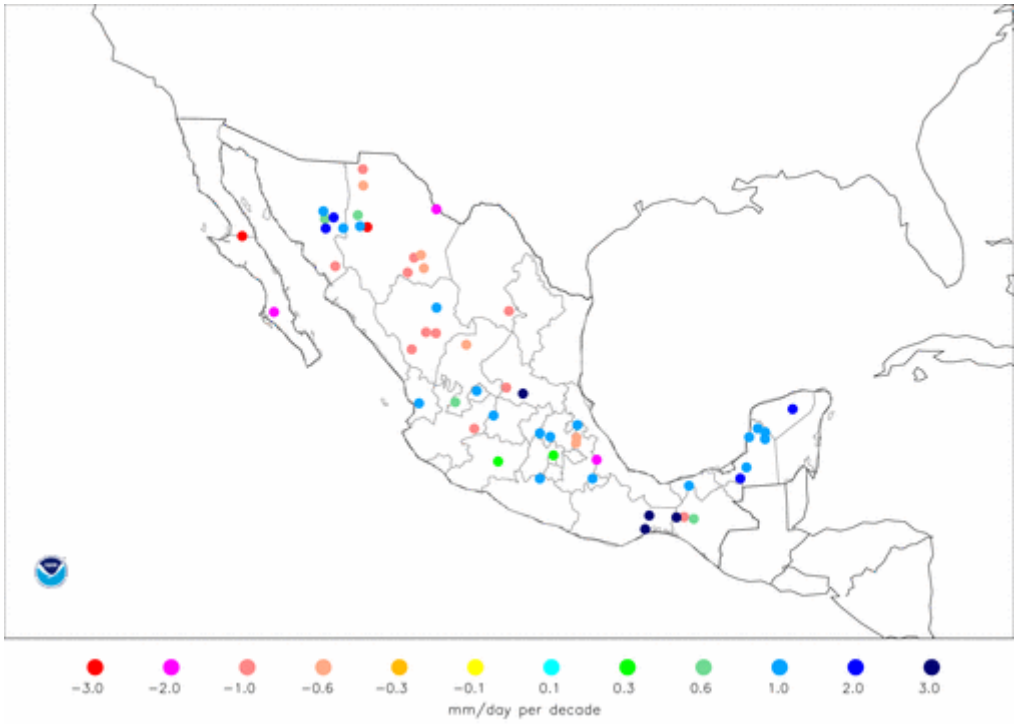
Trend maps and anomaly maps can be produce for North America as a whole and for each country



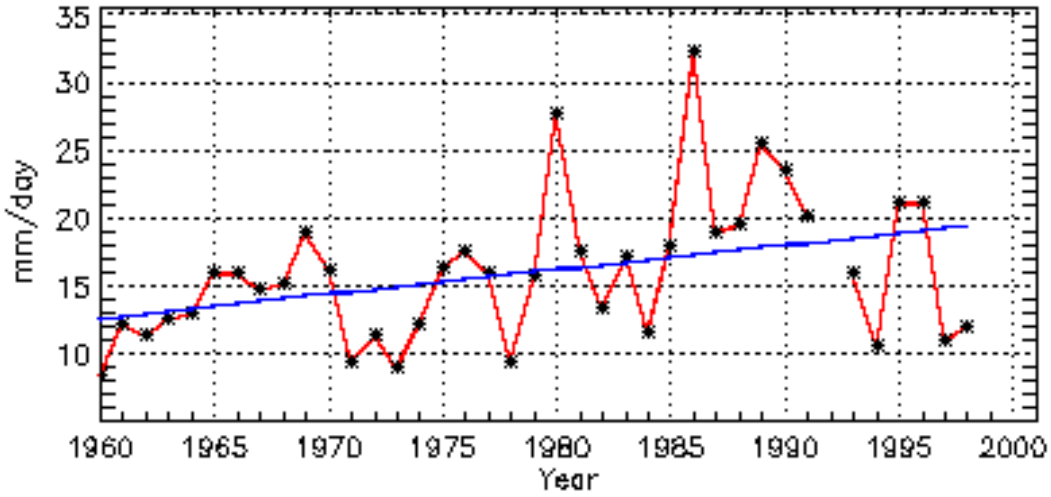
Trends of greatest 5 day rainfall
Spring 1955-2000



Approximately 300 Mexican stations were incorporated to this project

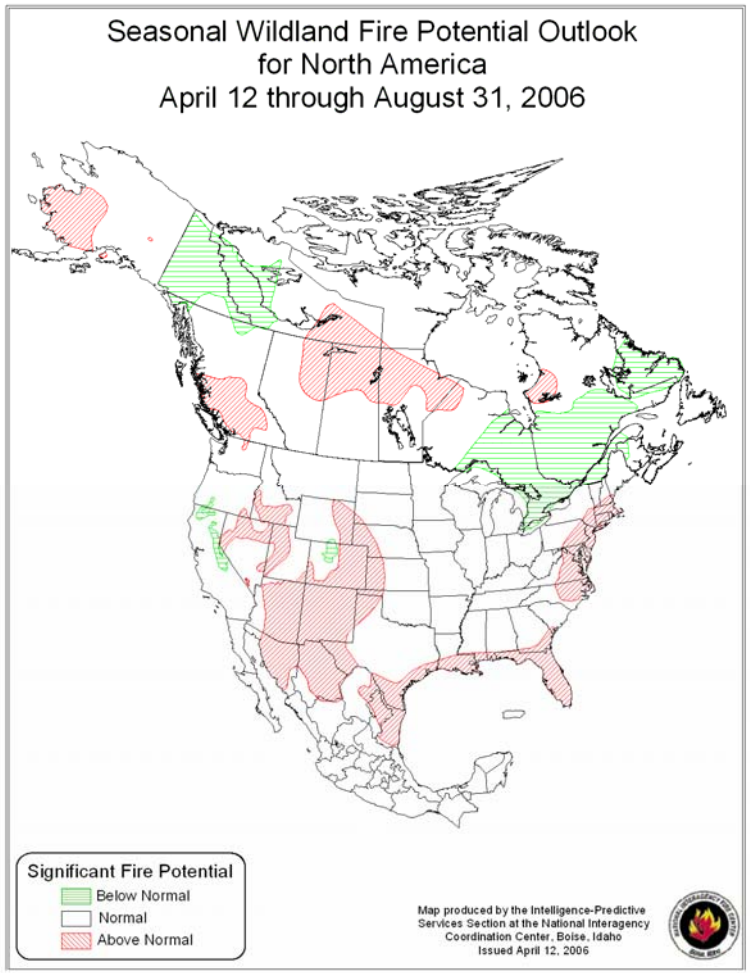


Trend in Simple precipitation Intensity Index
Summer 1960-2000
mm/day per decade



Precipitation Intensity Index
Tonichi, Sonora
Summer 1960-2000
Trend= 1.7 mm/day per decade
Significance = 99.6%

Representatives from different Mexican institution participated in the North American Fire Assessment Workshop (4-7 April, 2006) in order to discuss with Canada and US representatives the possibility to integrate a Seasonal Wildland Fire Potential Outlook for North AMérica



Final comments

In the SMN experience the international collaboration has contributed to:

- Enhance interactions between US-MX-Canada agencies and scientists
- Exchange historical climate data
- Integrate climate extremes products for the North American Sector using common criteria and indices
- Reduce confusions among users of the climate information (e.g., drought conditions along the US-MX border)

SMN Web Site

http://smn.cna.gob.mx

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