Internationally Coordinated Extremes Indices

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(With help from
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The Netherlands)

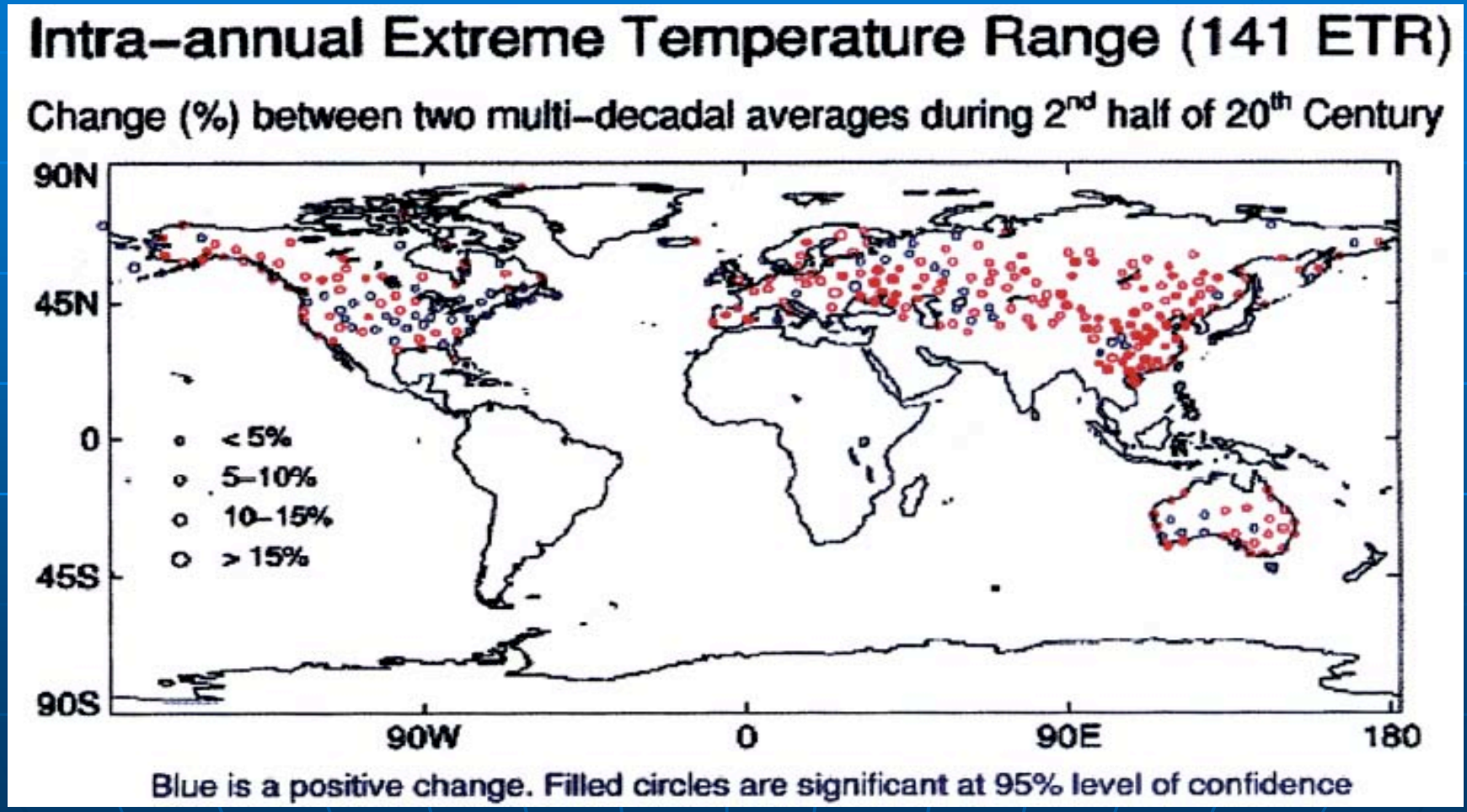
In the beginning . . . 1999

- WMO Commission for Climatology / CLIVAR Working Group on Climate Change Detection meets
  - "What could a small group of volunteers do to further global climate change detection?"
    - Internationally coordinate a suite of indices
      - Mainly highlighting changes in extremes
      - Derived from daily data
      - Builds on a 1998 indices workshop Chris Folland

2001: Two workshops were held

- In Kingston, Jamaica for the Caribbean
  - Produced a workshop report
  - Produced a multi-authored *JGR* paper
  - Released all daily data used in the analysis
    - But not for re-release in other datasets
  - Released suite of indices
    - Which have been used by impacts people
- In Casablanca, Morocco for various countries in Africa
  - Produced a workshop report

2002: Frich et al. *Climate Research* "global" indices paper

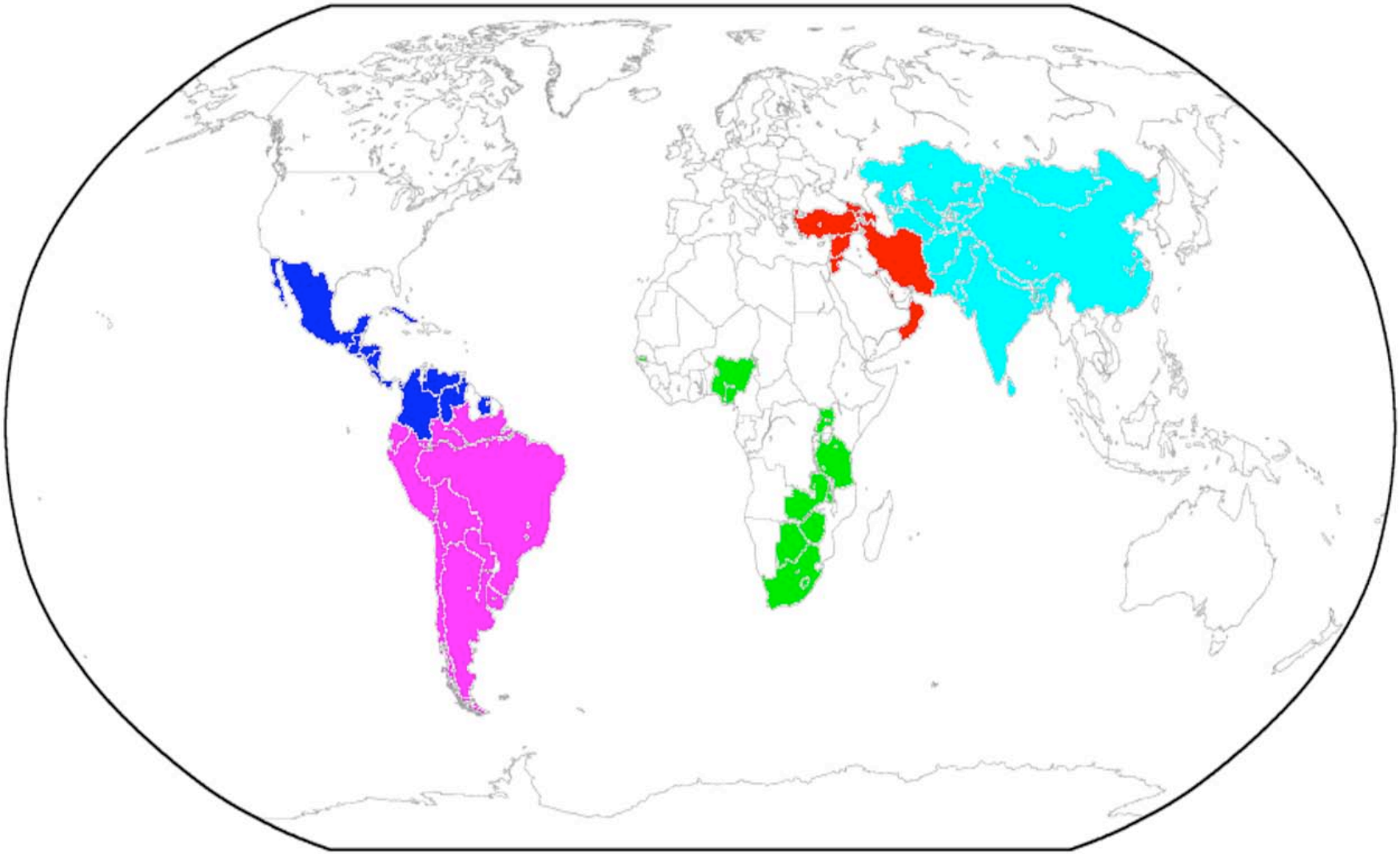


Note large blank areas in "global" indices map

2003

- *A WMO CCl/CLIVAR Expert Team* on Climate Change Detection, Monitoring & Indices is coordinating improved indices and additional workshops
  - Tom Peterson is not on the team
    - But is chair of the ET's CCl OPAG
  - Francis Zwiers is the CLIVAR co-chair
  - Workshop support from U.S. State Department, START, WCRP and IAI

Workshops in 2004 and 2005



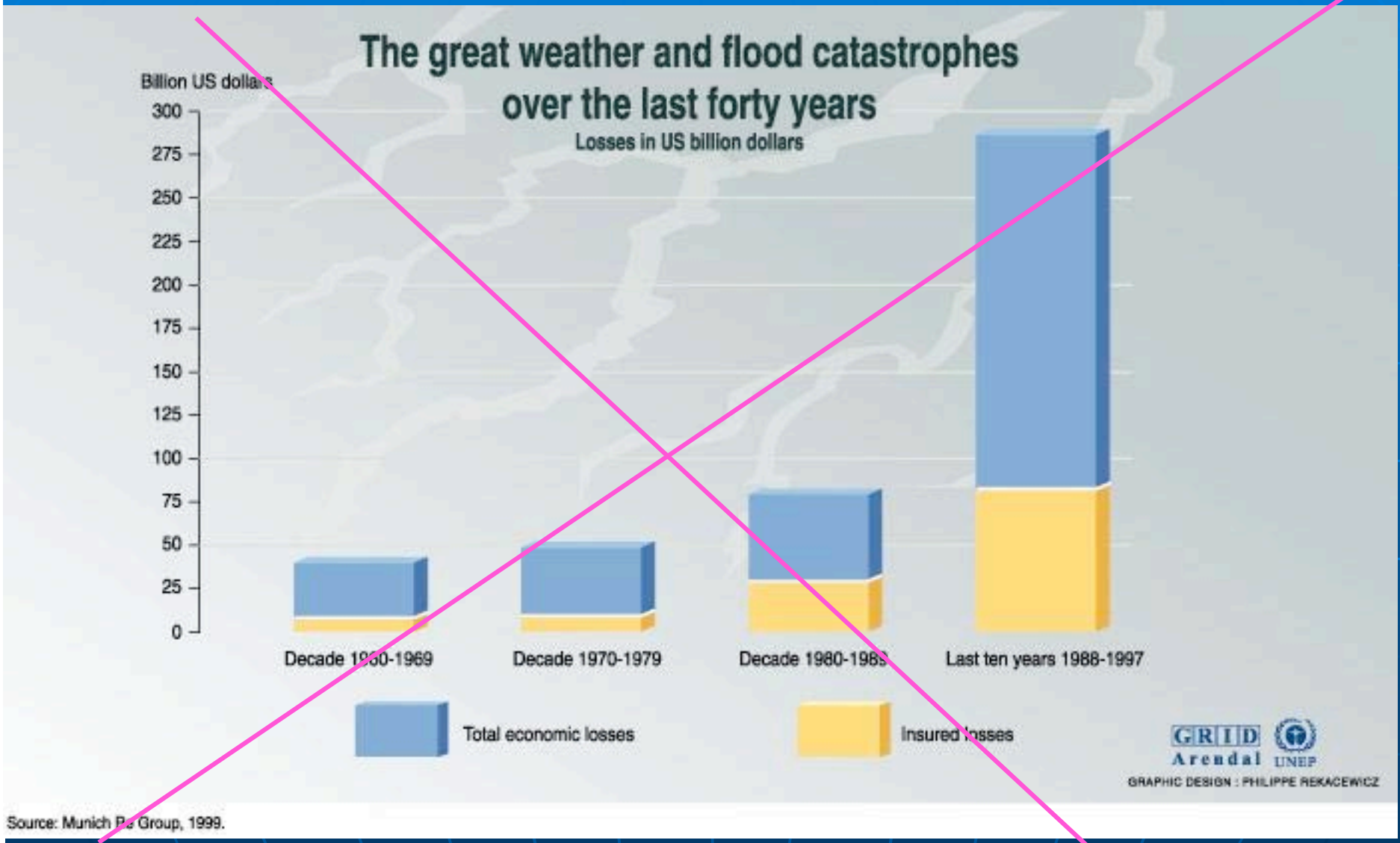
Indices software

- Workshop suitable software (RClimDex) as well as a FORTRAN version (FClimDex) produced on behalf of the ET by Xuebin Zhang of Environment Canada
  - http://cccma.seos.uvic.ca/ETCCDMI/
  - RClimDex uses the free "R" statistical package

Workshop results

- 6 regional workshop peer-review papers submitted
  - South America had separate temperature and precipitation articles
- One global peer-review paper with authors including:
  - Canada: Xuebin Zhang and Lucie Vincent
  - US: Tom Peterson and Byron Gleason
  - Mexico: Jorge Luis Vazquez-Aguirre
  - Along with people from the UK, Australia, China, Spain, Argentina, India, New Zealand, Jamaica, and the Netherlands
  - Lisa Alexander is the lead author
- Release of indices from most countries
  - Via Xuebin's web site

Many different ways to calculate indices


The great weather and flood catastrophes over the last forty years
Losses in US billion dollars
Billion US dollars
300
275
250
225
200
175
150
125
100
75
50
25
0
Decade 1960-1969
Decade 1970-1979
Decade 1980-1989
Last ten years 1988-1997
Total economic losses
Insured losses
GRID Arendal
UNEP
GRAPHIC DESIGN : PHILIPPE REKACEWICZ
Source: Munich Re Group, 1999.

What types of extremes?

- Trends in extreme events characterised by the size of their societal or economic impacts

NO

- Trends in "very rare" extreme events analysed by the parameters of extreme value distributions

Generally NO

- Trends in observational series of phenomena with a daily time scale and typical return period < 1 year (as indicators of extremes)

YES

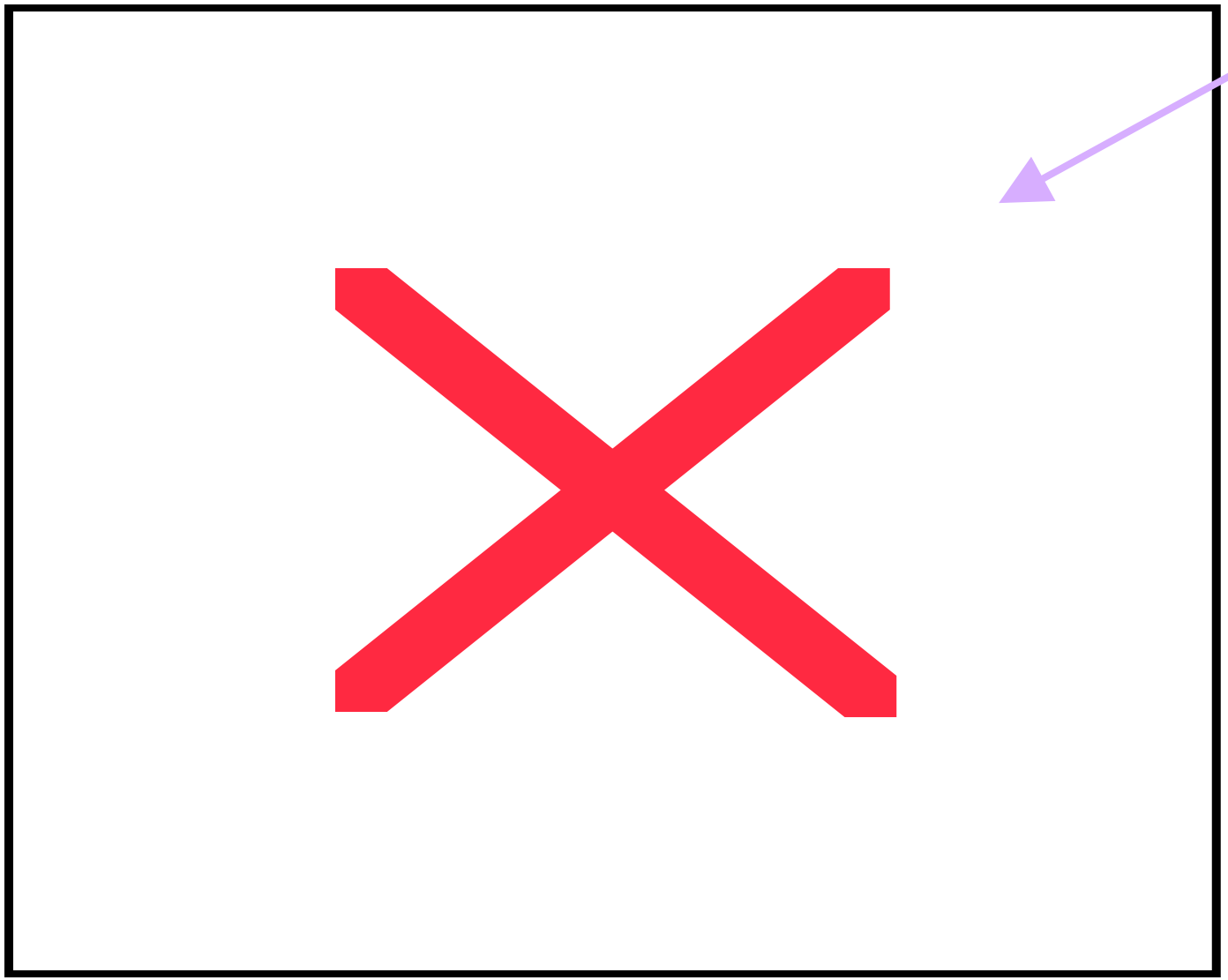
Motivation for choice of extremes from daily data

- The detection probability of trends depends on the return period of the extreme event and the length of the observational series
- For extremes in daily series with typical length ~50 yrs, the optimal return period is 10-30 days rather than 10-30 years

Approach

- Focus on counts of days crossing a threshold; either absolute/fixed thresholds or percentile/variable thresholds relative to local climate
  - Want each year to have a value
    - hence 90th percentile rather than 99th

After: Jones et al. (*Climatic Change*, 1999)
Yan et al. (…, 2002, IMPROVE- issue)



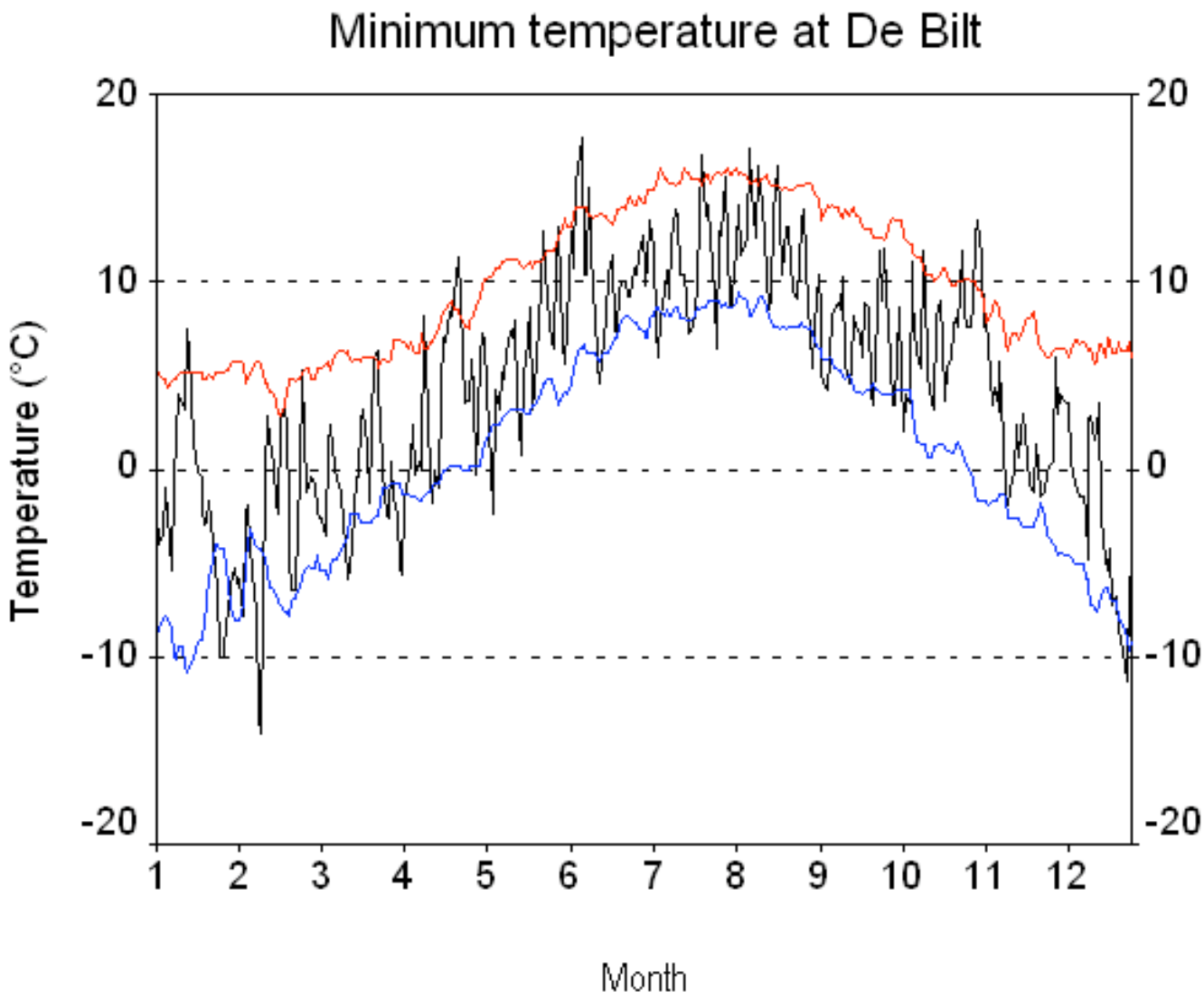
"warm nights"

upper 10-ptile 1961-1990

the year 1996

lower 10-ptile 1961-1990

After: Jones et al. (*Climatic Change*, 1999)
Yan et al. (…, 2002, IMPROVE- issue)



upper 10-ptile 1961-1990

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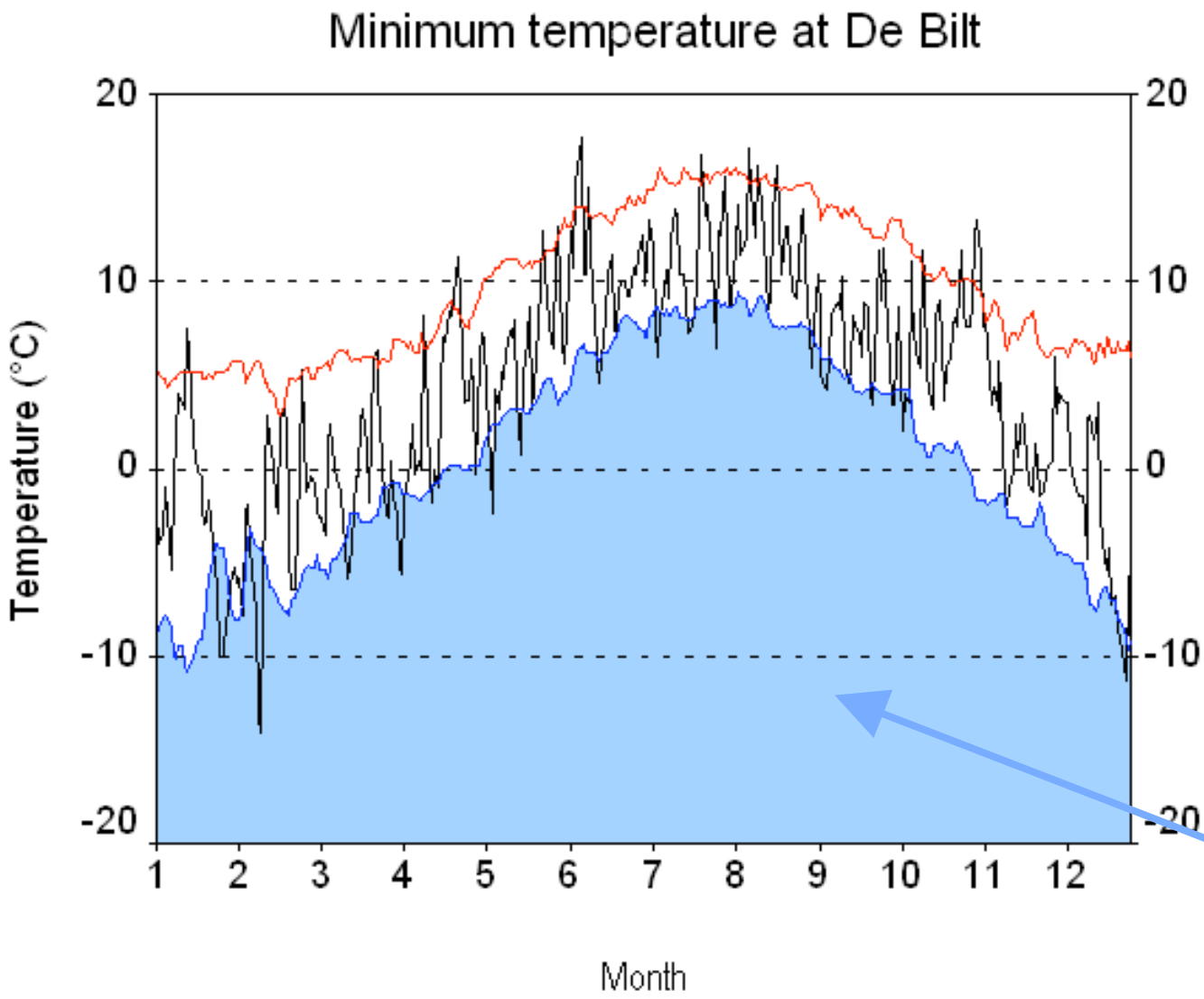

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the year 1996

lower 10-ptile 1961-1990

"cold nights"

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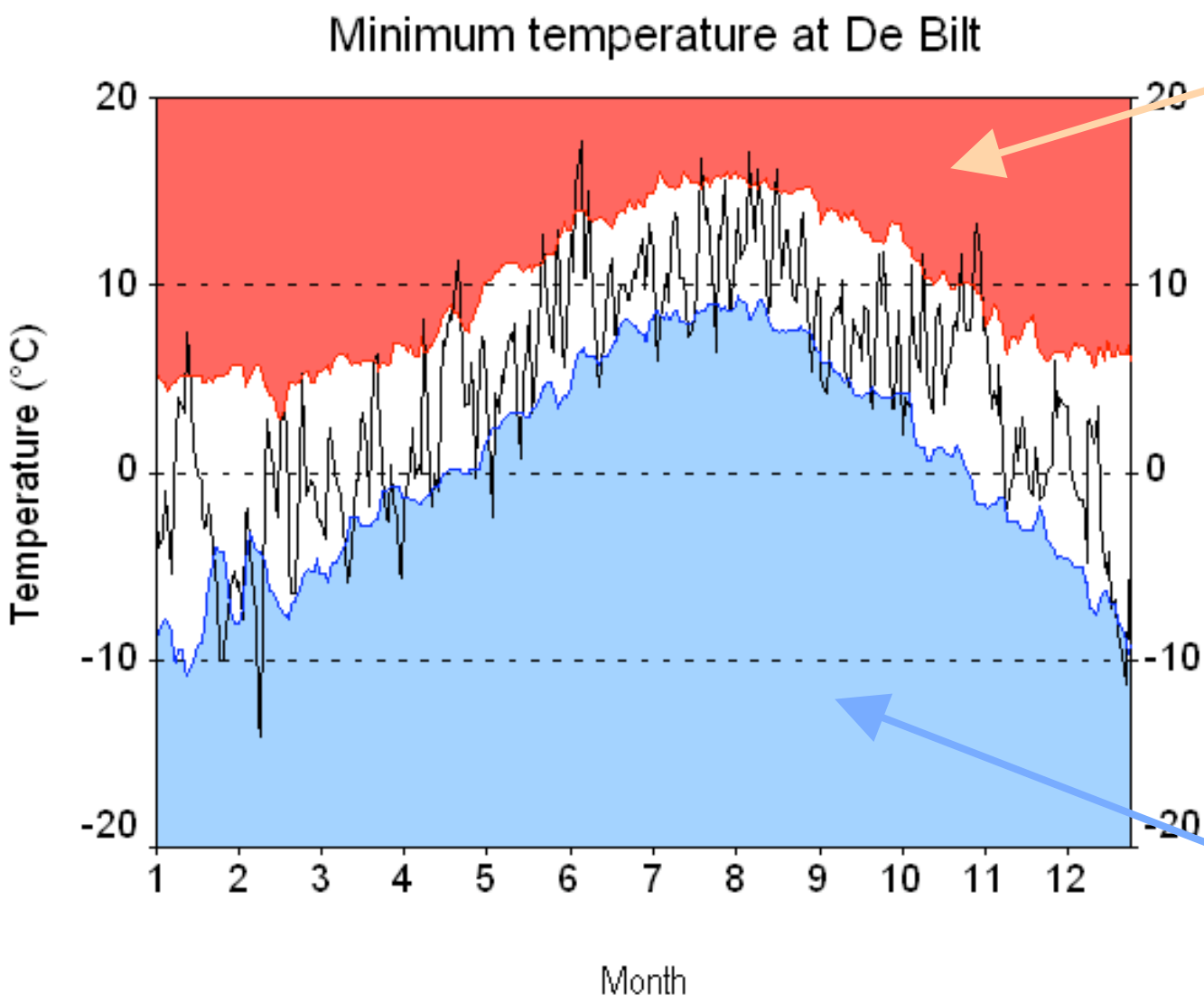


"warm nights"

upper 10-ptile 1961-1990

the year 1996

lower 10-ptile 1961-1990

"cold nights"

Percentile indices issue

- Using the 2000 WG formulation with GCM output, Gabi Hegerl discovered a discontinuity at the start and end of the base period
- Zhang et al., (2005) developed a boot-strap solution for the 2004 ET formulation:
  - For years outside the base period, calculate the 10th/90th percentile based on all 30 years in the base period
  - For each year inside the base period, use only the other 29 years (29 times with one year used twice so both periods use 30 years of data)
  - Therefore the data in any year does not determine the threshold exceedance value used for that year

ETCCDMI has 27 indices

Percentile temperature indices

- Cool nights (Tmin < 10th %)
- Cool days (Tmax < 10th %)
- Warm nights (Tmin > 90th %)
- Warm days (Tmax > 90th %)
- Warm spell duration indicator
  - Annual count of ≥ 6 days in row Tmax > 90th)
- Cold spell duration indicator
  - Annual count of ≥ 6 days in row Tmin < 10th)

Physically based indices (not necessarily extremes)

- Frost days (Tmin ≤ 0°)
- Summer days (Tmax ≥ 25°)
- Ice days (Tmax ≤ 0°)
- Tropical nights (Tmin ≥ 20°)
- Growing season length
- Diurnal temperature range

Extreme temperature values for the year

- Max Tmax
- Max Tmin
- Min Tmax
- Min Tmin

Precipitation indices

- Max 1-day precipitation amount
- Max 5-day precipitation amount
- Simple daily intensity index
- Number of heavy precipitation days – 10 mm
- Number of very heavy precipitation days – 20 mm
- Number of days above nn mm
- Consecutive dry days
- Consecutive wet days
- Very wet days – 95th percentile
- Extremely wet days – 99th percentile
- Annual total wet-day precipitation

NCDC extremes monitoring

- Just being developed
- Uses a subset of the ET's indices
- Starting focus is on North America
  - Plan for close collaboration with Canada and Mexico

Data for extremes monitoring

- U.S. data from those stations that the Menne-Williams homogeneity test could not find a discontinuity in
  - ~ 1,000 stations
  - Different station list for Tmax and Tmin
- Canadian data are the homogeneity adjusted daily temperature data provided by Lucie Vincent
- Mexican data from Art Douglas
  - Homogeneity assessments not yet made
- Will require regular updates of the daily data for the homogeneous stations from the U.S.,

Web based approach

- So any interested party can produce custom analysis
  - Maps and time series
- The lead programmer is Nina Stroumentova (Pasha Groisman's wife)
- Web page is not on line yet

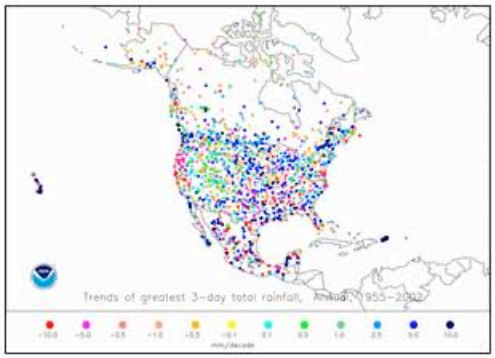
http://mesohigh:8080/nacem/nacem.html

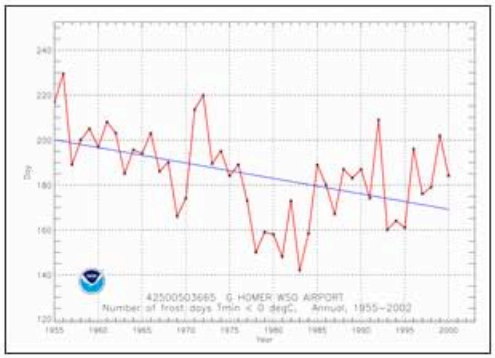
North America
Climate Extremes Monitoring

NCDC | Monitoring | NACEM

Spatial Mapping: Select Region

Station Time Series: Select Country





Select indicator: Number of Frost Days (Tmin < 0 °C)

- 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 Rainfall
- Simple Precipitation Intensity Index
- Maximum Length of Dry Spell

Indicators

These 12 selected indicators that co

FD -Total number of frost days (days with absolute minimum temperature < 0°C) (days);
SU -Total number of summer days (days with absolute maximum temperature > 25°C) (days);
ID -Total number of icing days (days with absolute maximum temperature < 0°C) (days);
TR -Total number of tropical nights (days with absolute minimum temperature > 20°C) (days);
GSL -Growing season length: annual count between first span of at least 6 days with daily Tmean> 5°C and first span after of 6 days with Tmean<5°C (days);
TX90p -Percentage of days when daily maximum temperature > 90th percentile (%);

Find: fin | Find Next | Find Previous | Highlight | Match case | Phrase not found

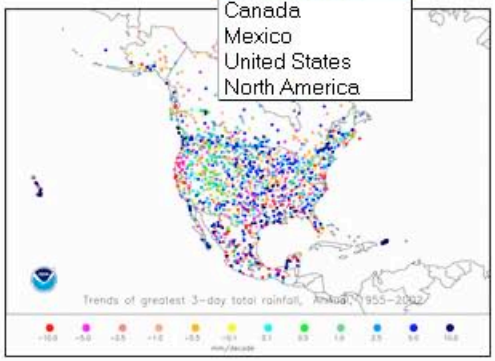
http://mesohigh:8080/nacem/nacem.html

North America
Climate Extremes Monitoring

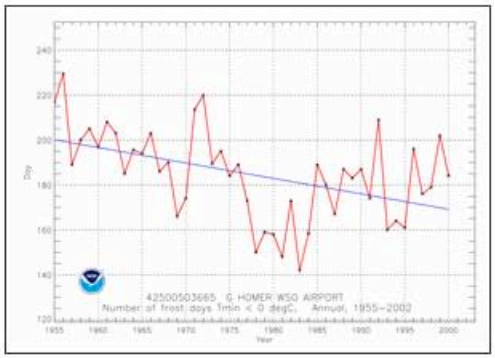
NCDC | Monitoring | NACEM

Spatial Mapping: Select Region

- Select Region
- Canada
- Mexico
- United States
- North America



Station Time Series: Select Country



Select indicator: Number of Frost Days (Tmin < 0 °C)

Submit

Indicators

These 12 selected indicators that cover many potential aspects of a changing climate.

FD -Total number of frost days (days with absolute minimum temperature < 0°C) (days);
SU -Total number of summer days (days with absolute maximum temperature > 25°C) (days);
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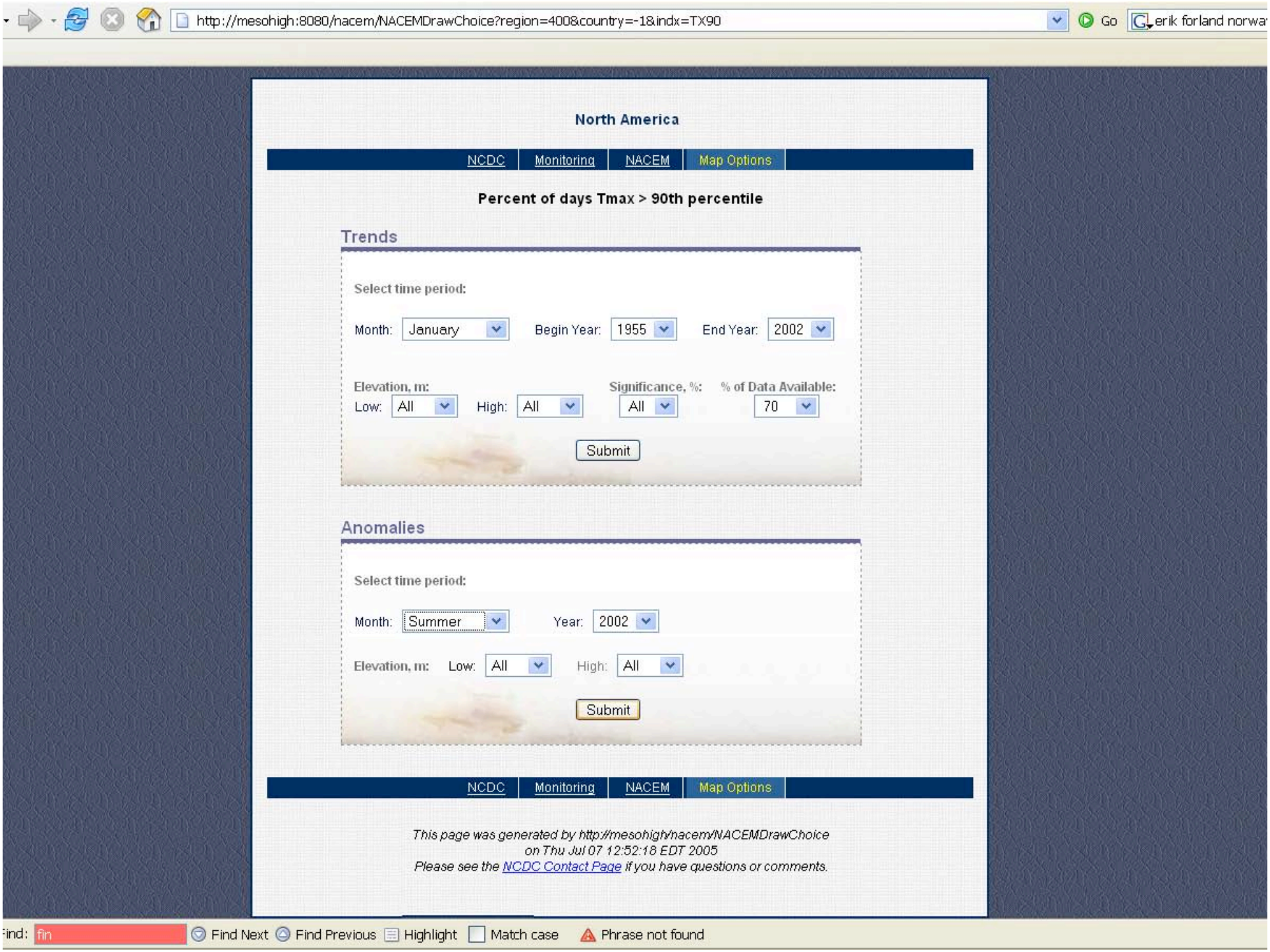
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Go
erik forland norwa
North America
NCDC
Monitoring
NACEM
Map Options
Percent of days Tmax > 90th percentile
Trends
Select time period:
Month: January
Begin Year: 1955
End Year: 2002
Elevation, m:
Low: All
High: All
Significance, %:
All
% of Data Available:
70
Submit
Anomalies
Select time period:
Month: Summer
Year: 2002
Elevation, m:
Low: All
High: All
Submit
NCDC
Monitoring
NACEM
Map Options
This page was generated by http://mesohigh/nacem/NACEMDrawChoice
on Thu Jul 07 12:52:18 EDT 2005
Please see the NCDC Contact Page if you have questions or comments.
Find: fin
Find Next
Find Previous
Highlight
Match case
Phrase not found

North American extremes monitoring coordination

- Success will require close collaboration
  - Perhaps with mirrored sites
- We've had some discussions already
  - The time is approaching for decisions
- Jay Lawrimore, the Chief of the Climate Monitoring Branch, is responsible on NCDC's side
  - Jay.Lawrimore@noaa.gov


The End

Notes about Mexican participant in the global paper, page 1 (of 2)

- Jorge Luis Vazquez-Aguirre is working in AGROASEMEX (Queretaro, MX), which is an agricultural insurance company for Mexico and he is in charge of the Climatological Branch for reinsurance. Among his responsibilities in this co, there is one dealing with compiling, generating and updating a daily climate dataset over the entire Mexico. According to him, this job allowed him to collect a relatively big daily dataset (composed of about 250 records) in close cooperation with Mexican Met Nat Service (MNS central headquarters and territorial services) and others met organizations in his country. Every year he s in charge to carry out field trips to different Mexican states to update this dataset. In fact more than a half part of the dataset s records were obtained from the Mexican MNS and the other one from others met services and his own contacts. He is now very aware that it is very important these data can be available to the scientific community, although this dataset belong to his co. For this reason, he has been supplying part of these data to the Mexican MNS, as well as he gave it to us/Lisa for employing them in the global paper, at the same time he got official permission from the Mexican MNS for employing the part of data belonging to the MNS for this global research (we have now both things, this letter enabling the usage of the data, and the data:

Notes about Mexican participant in the global paper, page 2

- about 60 records located south of 20 N, which were used by Enric in the CA assessment, and about 160 records more north 20 N, which were tested for homogeneity and QCed for the Lisa s global paper). With this last fraction of data, Jorge Luis and I were working together in a preliminary assessment of homogeneity and QC, and for this reason I can give you more details: 8 records started in the 1900s decade, 36 in the 1920s, 29 in 1930s, 52 in 1940s, and the rest as part from 1950s. However, these data are far away to be good and more extra efforts should be put in ensuring quality and homogeneity! In fact only 20 stations were used in the CA assessment and 52 selected for the Lisa s paper.

- Jorge Luis is now involved at the Met Dept. of Atmospheric Sciences at UNAM (in Mexico city) for carrying out his master in atmospheric sciences
  - Dr. Manola Brunet India (the source of this background information)
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    Geography Unit
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