Collection, management and use of observational data in Romania

Constanta Boroneant
National Meteorological Admnistration, Climate Research Group
Bucharest, Romania
WMO CCl OPAG1 ET1.2- Expert Team on Observing Requirements and Standards for Climate
e-mail: boroneant@meteo.inmh.ro

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NMA

Outline

- Brief description of the Romanian Meteorological network (collection of data), database (management) and use of observational data
- Synthesis results of the experiment on parallel observations with automatic and classical stations
- How can Romanian contribute to the implementation of the Nairobi Work Programme
  - Data and observations
  - Methods and tools
  - Research

Meteorological network in Romania:

- **sistematic/reliable measured data starting in the XIX-th century**
- **1884: National Meteorological Service**
- **163 weather stations / 99 AWS**
- **Vaisala: 97 MAWS 301 + 2 Thies**

Management of data

Description of Climatological database

- The Romanian Climatological Database stores an amount of ~30 Gb of data.
- The Operating System is Windows Server 2000
- The Database Management System is Oracle 10g Database
- The available data series are described in a parameter catalogue available on-line on the National Meteorological Administration's web site (http://www.inmh.ro/index.php?id=67)

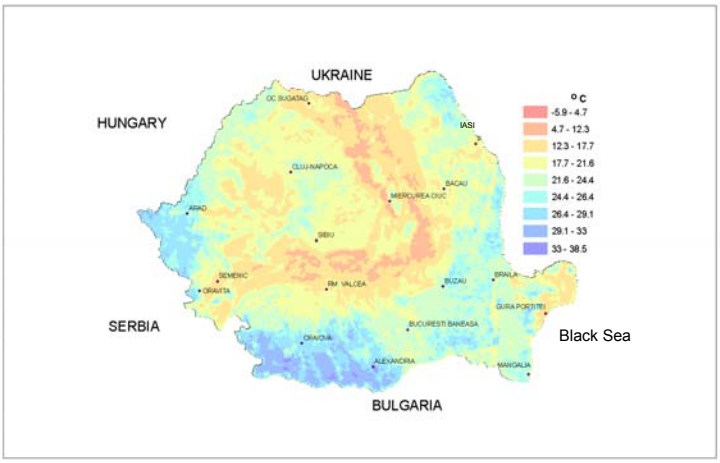
- For each meteorological station and rain gauge there is a list of parameters with the available period and missing data by class (*operational, climatological, metadata*) and subclass (*monthly, daily, hourly, statistics*)
- There are about 800 parameters available for each station
- The database stores climatological and synoptical data for:
  - ***260 stations*** **- climatological data from 1961 – present (163 stations, out of which 99 automatic)**
  - ***42 stations*** **- daily temperature (max, min, average) from 1848-present**
  - ***1800 rain gauges*** **- daily rainfall data 1848 – 2001 from (360 rain gauges)**
  - ***163 stations*** **- SYNOP data from 1990 – present**

Availability and data exchange

- According to the WMO Resolution 40/1992 + national policy on data exchange
- Data for 23 stations are freely available in the international network
- Processed data (statistics, etc) provided on request or as results of the national and/or international projects NMA research teams are involved

Results of the parallel observation experiment with automatic and classical stations

Period of parallel observations: October – December 2004
January – September 2005
at 15 automatic and classical stations in Romania



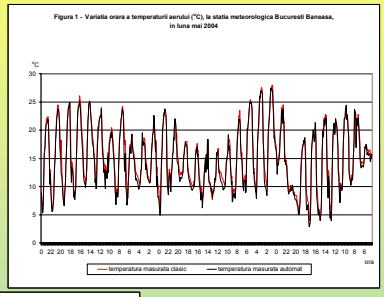
Results of the parallel observations experiment with automatic and classical stations

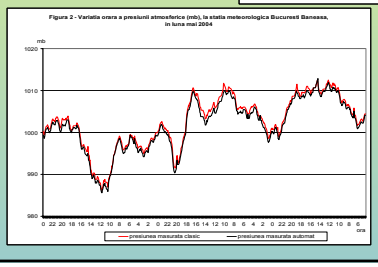
Hourly and daily data

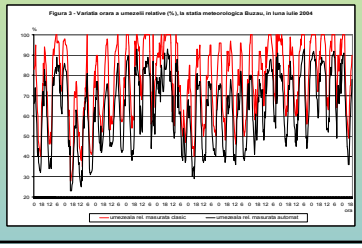
- characteristics of the differences CWS – AWS (magnitude, frequency, variability)
- causes of the differences CWS – AWS
- regionalization

Results of the parallel observations experiment with automatic and classical stations

Hourly temperature, pressure and relative humidity

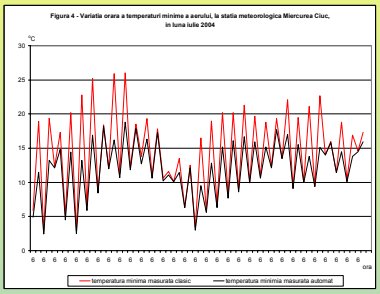


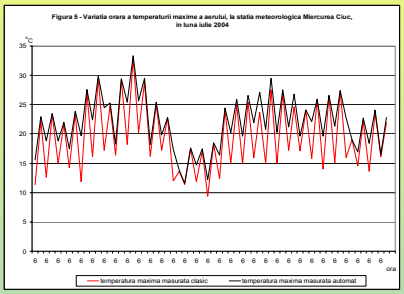




Results of the parallel observations experiment with automatic and classical stations

Minimum and maximum temperature





Conclusions on the results of the parallel observation experiment with automatic and classical stations

Possible causes for the differences between CWS and AWS (hourly and daily data):

- Human causes: observation errors, registration and/or transfer gaps etc.
- Technical causes: different placement of the sensors, different sensibility of the sensors etc.

Results of the parallel observation experiment with automatic and classical stations

Monthly data
Essential climatic elements

- Mean temperature
- Minimum temperature
- Maximum temperature
- Air pressure
- Relative humidity

Results of the parallel observations experiment with automatic and classical stations

Some statistical parameters

- Monthly means calculated from daily means (24hrs and 1,7,13,19 local time)
- Standard deviation of the difference between classical and automatic records
- Correlation coefficient between classical and automatic records
- Amplitude of the difference between classical and automatic records

Summary of the results
of the parallel observations experiment with automatic and classical stations

➢ Monthly average of the difference between classical and automatic observations ranges between
- 0.24ºC and 0.71ºC for mean temperature
- 0.28ºC and 0.87ºC for minimum temperature
- 0.01ºC and 0.55ºC for maximum temperature
- 0.62 mbar and 2.01 mbar for air pressure
- 4.85% and 13.29% for relative humidity

➢ Std dev of the difference between classical and automatic observations ranges between
- 0.51ºC and 1.10ºC – mean temperature
- 0.43ºC and 2.03ºC – minimum temperature
- 0.07ºC and 3.97ºC – maximum temperature
- 0.41mbar and 1.37 mbar – air pressure
- 6.95% and 8.51% - relative humidity

Summary of the results (…cont.)

➢ Difference between classical and automatic monthly mean calculated from daily means (1,7 ,13,19 local time) ranges between
- 0.20ºC and 0.70ºC for mean temperature
- 1.00 mbar and 2.0 mbar for air pressure
- 3.30% and 10.00% for relative humidity

➢ Difference between classical and automatic monthly mean calculated from daily means (24hrs) ranges between
- 0.30ºC and 0.70ºC for mean temperature
- 1.00 mbar and 2.0 mbar for air pressure
- 2.80% and 11.00% for relative humidity

Ongoing activities

- Need for quality control (daily data), filling gaps and homogenization of monthly, seasonal, annual data
- This is an ongoing activity
- How are we doing that?
  - Using WMO recommendations in this respect
  - Collaboration in COST Action ES601 - Advances in homogenisation methods of climate series: an integrated approach (HOME)

    http://www.homogenisation.org/

Data and observations

- Extending the AWS network
- Quality control and homogenization of data
  - Operational activity using dedicated software

    http://www.climahom.eu/
  - Research activities
    - COST Action ES601 http://www.homogenisation.org/
- Contribution to the European Climate Assessment &Dataset ECA&D project

  http://eca.knmi.nl/

Methods and tools

- Climate monitoring
  - Annual yearbook on the climatological status for essential climatic elements including specific indices for extremes (temperature and precipitation)
  - Trends for essential climatic elements
- Monitoring and warning the extreme events

Methods and tools (cont.)

- Dynamical and statistical downcaling
  - Regional climate model RegCM3 – ICTP, Trieste, Italy
    - High resolution simulations (10 km) for impact studies 1961-2000; 2020-250; 2070-2100; A1B scenario (FP6 Project - Central and Eastern Europe Climate Change Impact and VulnerabiLIty Assessment – CECILIA (2006-2009)
      http://www.cecilia-eu.org/
    - Statistical downscaling – various methods (CCA, conditional weather generator)
- Extreme events (droughts, heat-waves, heavy precipitation)
131 specific indices
- Impact studies on crop yield using CERES, HYDRUS1D, WOFOST models

Research (selected projects)

- EU projects :
- FP5 - Statistical and regional dynamical downscaling of extremes for european regions STARDEX (2002-2005) http://www.cru.uea.ac.uk/projects/stardex/
- ACCRETE - Agriculture and Climate Changes: how to Reduce human Effects and Threats (2005-2007) http://www.accrete.eu/.
- FP6 Projects:
  - (Central and Eastern Europe Climate Change Impact and VulnerabiLIty Assessment – CECILIA, **http://www.cecilia-eu.org/**
  - ENSEMBLE - based Predictions of Climate Changes and their Impacts

    http://ensembles-eu.metoffice.com/

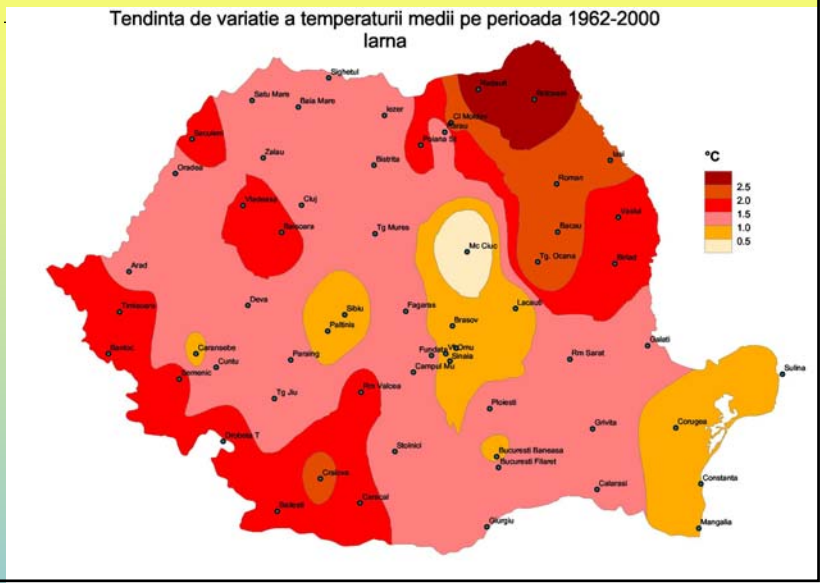
- Bilateral Collaborations:
- Italy: Changes in the characteristics of extreme climate events in southern and Southeastern Europe (2007-2008)
- Bulgaria : Observed changes in precipitation regime in the Danube river lower basin in the context of climate change (2008-2010)

Some examples

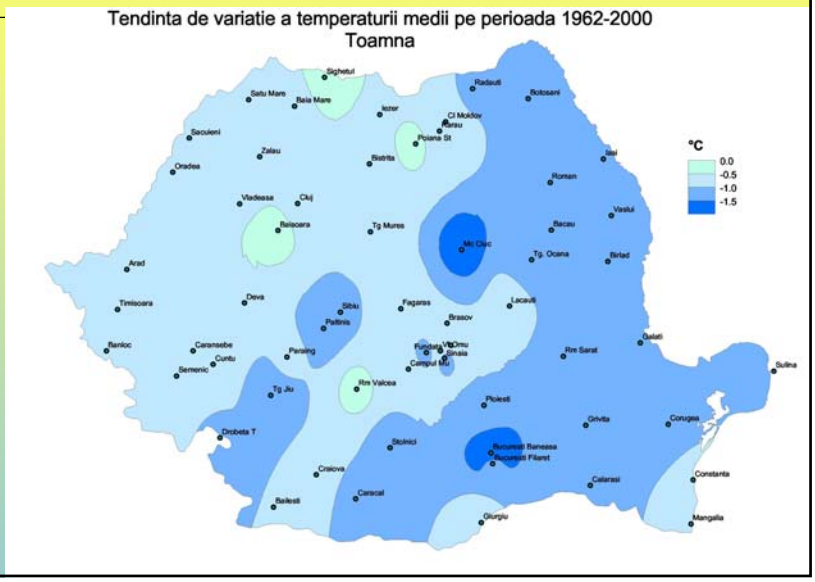
Monitoring

Observed trends in seasonal and annual temperature and precipitation

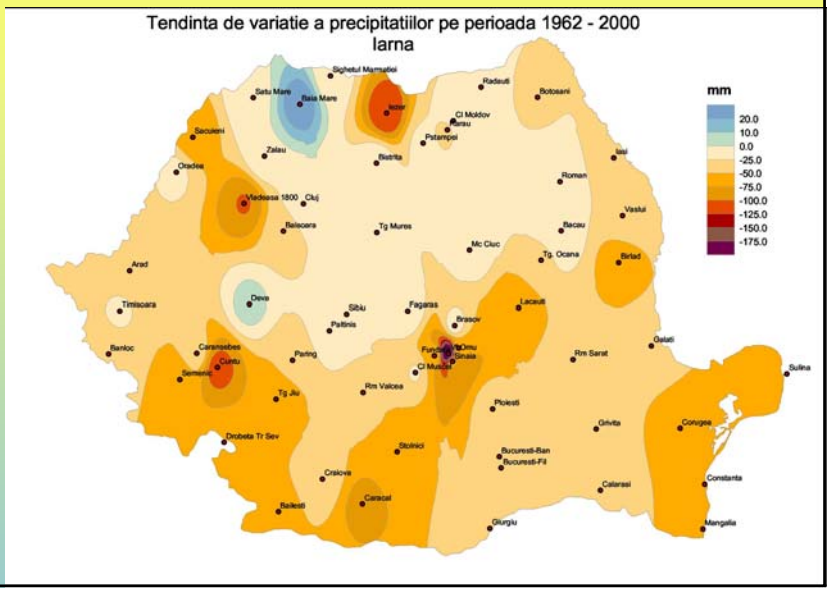
Linear trend – Winter temperature mean



Linear trend – Autumn temperature mean



Linear trend – Winter precipitation totals



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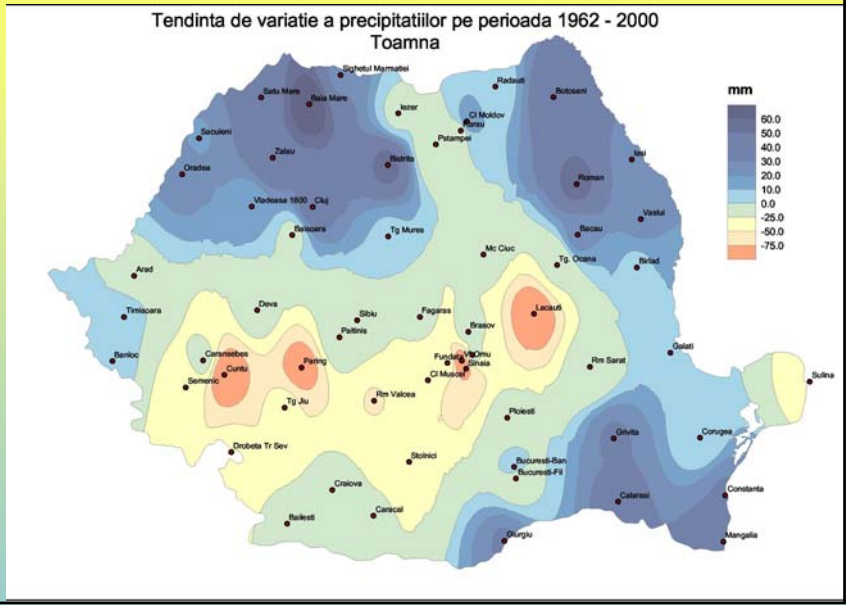
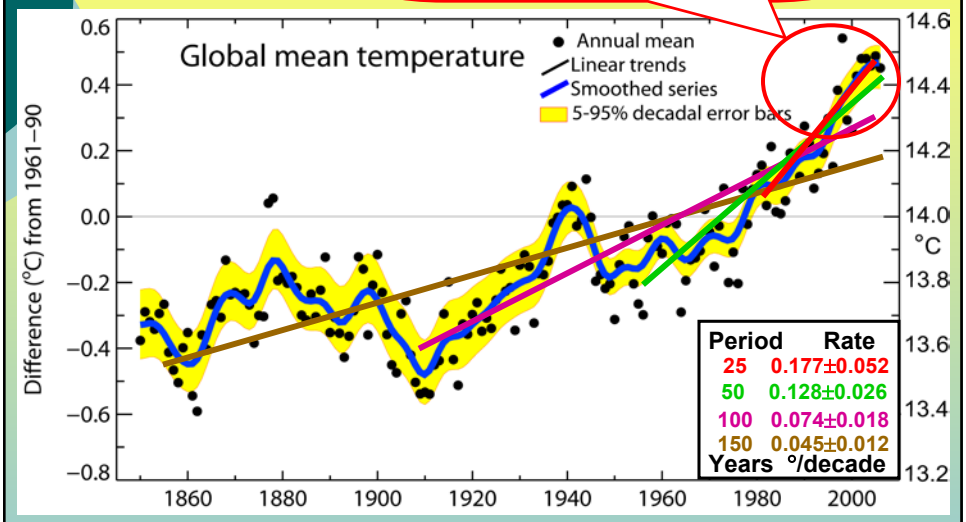


Global mean temperat

Warmest 12 years:
1998,2005,2003,2002,2004,2006,
2001,1997,1995,1999,1990,2000



Majour extreme events

Heavy precipitation and floods 2005

Exceptionally warm year 2007

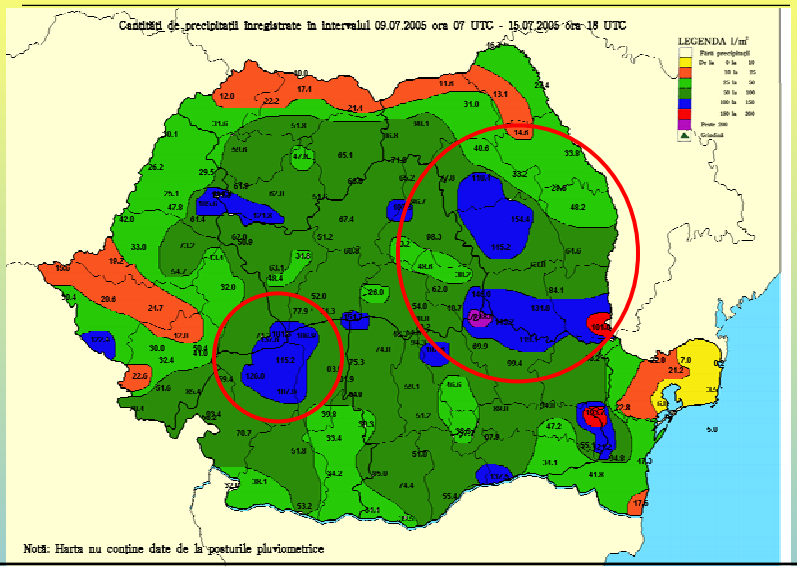
Heat waves 2007

Heavy precipitation and floods 2005

Precipitation accumulation
13.04.2005 h 21 - 27.04.2005 h 9

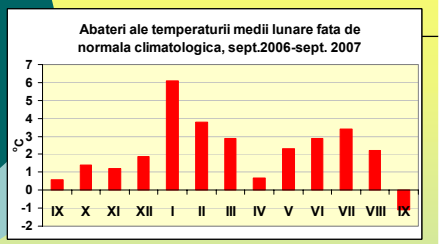
Heavy precipitation and floods 2005

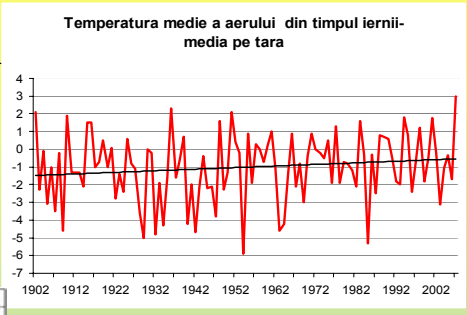
Precipitation accumulation
9.07.2005 h 7 – 15.07.2005 h 18

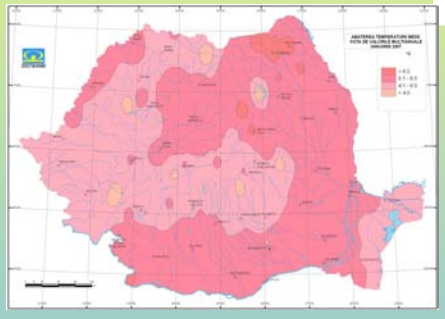


The Extremes of 2007

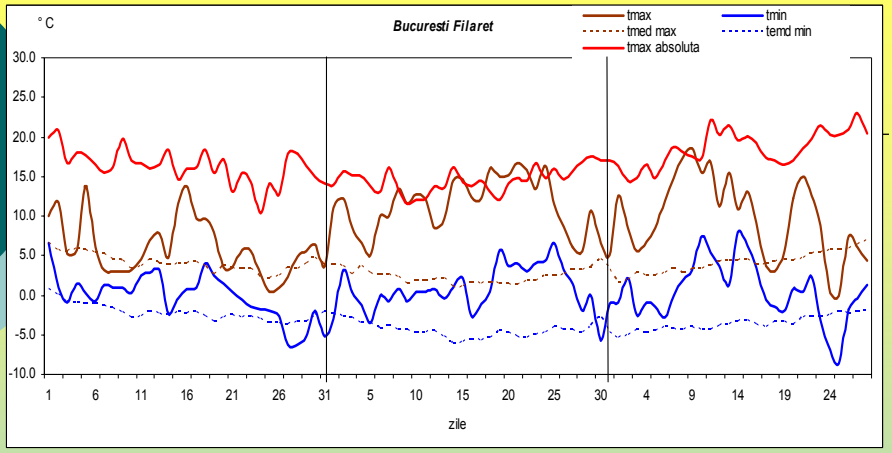
Winter 2006-2007 the warmest in the last century



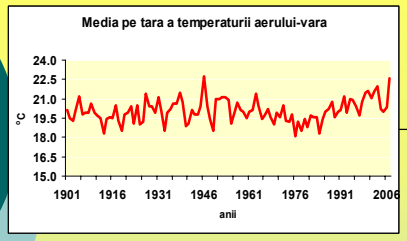


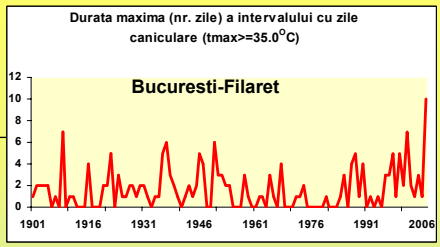


- **January 2007 – the warmest month of the winter; the positive anomalies of the mean temperatures about climatological mean were between 6.1 and 8.0 °C.**
- **Breaking of the absolute records of the daily maxima at 24 stations in Romania.**

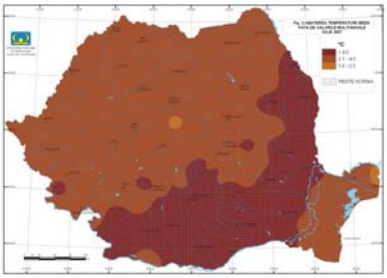


Daily maxima and minima temperature evolution in comparison with their multianual mean and absolute daily extremes at Bucuresti Filaret station, December 2006-February 2007.





- **Summer 2007** – as hot as the summer 1946 which was the hottest year during the observational period in Romania;
- Braking the absolute maximum temperature records: June (53 stations), July (94 stations), August (17 stations).
- July: Maximum number of daily maximum temperature >=40.0°C; 148 cases
- July: Maximum number of consecutive days with Tmax >= 35°C : 10 days at Calarasi, Buc-Filaret, Drobeta Tr. Severin

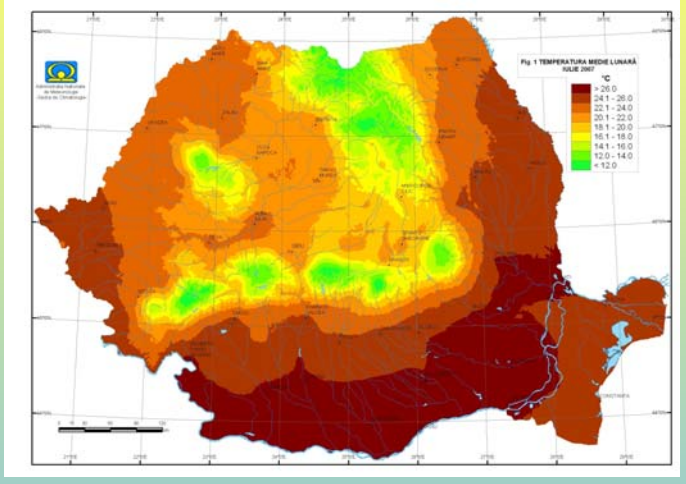


► Number of days with daily Tmax ≥ 40.0°C in July

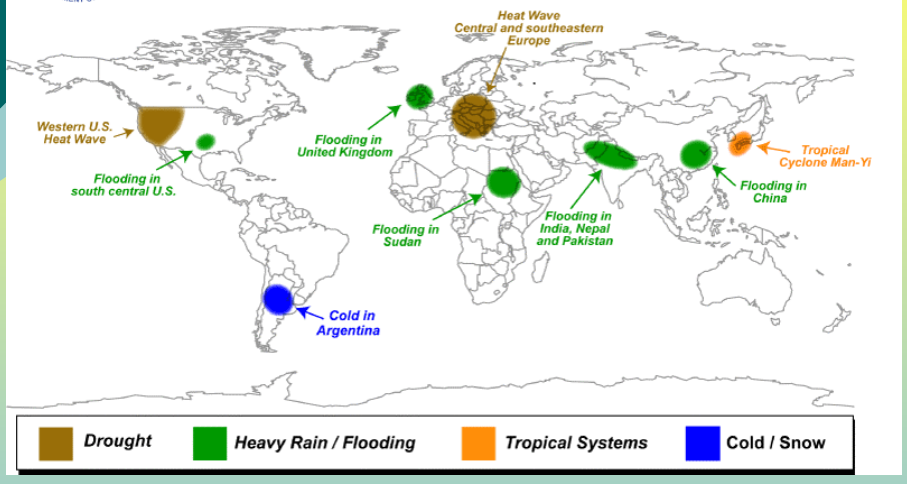
1909	1916	1927	1938	1945	1950	1965	1968	1985	1987	1988	1996	1998	2000	2002	2004	2007
1	12	2	2	2	2	2	1	24	44	19	2	4	100	1	2	148

Monthly temperature mean

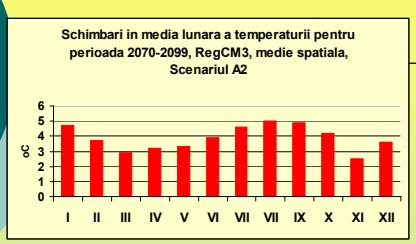
JULY 2007

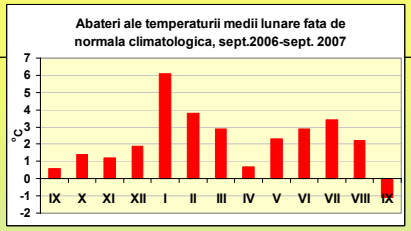


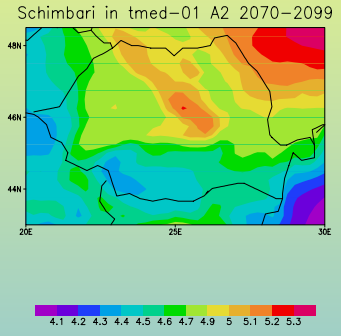
Selected Global Significant Events
July 2007

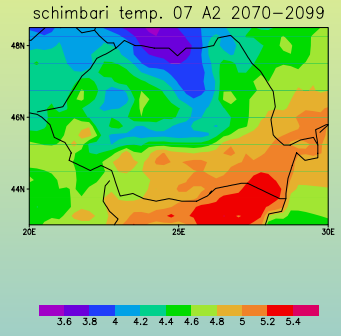


Temperature anomalies of the year 2007 compared to the temperature projections for the end of the 21st century

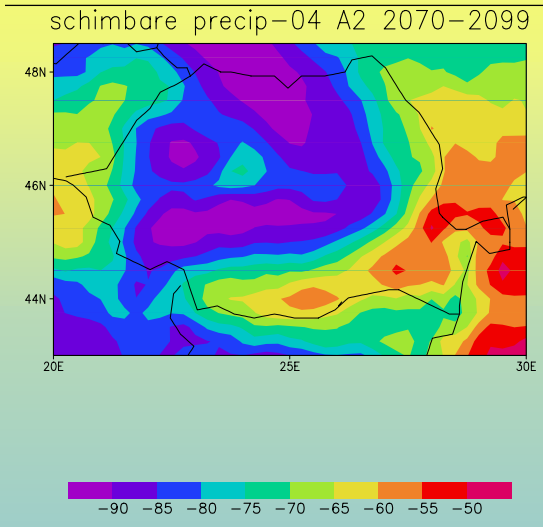








Precipitation anomalies of April 2007 compared to precipitation projection for the end of the 21st century (2070-2099)



Thank you for your attention !