Drought in Europe

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Drought in Europe

OUTLINE

• recent droughts in Europe
• few examples of recent EU drought research
• case study (climate variability)
• ongoing and upcoming EU drought projects

WATCH
XEROCHORE
Recent droughts in Europe

Major events:
- 2003
- 2005
- 2006
- 2007

Droughts happen often!

Tallaksen & van Lanen (2007)
Recent droughts in Europe

Drought has serious **impacts** on the European environment, economy and society

Some **key figures**:

- in 2003 more than 100 million people and one third of the EU territory was affected;
- cost of the 2003 drought to the European economy was at least € 8.7 billion;
- over the past 30 years drought’s impacts have dramatically increased in the EU (total costs € 100 billion);
- climate change is expected to make matters worse
Drought in Europe: achievements

Some **key achievements** of recent EU projects:

- prototype Pan-EU near-real time drought monitoring system;
- link atmospheric circulation patterns and streamflow drought;
- Pan-EU trend study on streamflow drought;
Drought in Europe: achievements

Have droughts become more frequent or severe?


- **red** - significant positive trend (towards drier conditions)
- **blue** - significant negative trend (towards wetter conditions)

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- prototype Pan-EU near-real time drought monitoring system;
- link atmospheric circulation patterns and streamflow drought;
- Pan-EU trend study on streamflow drought;
- underlying hydrological processes generating droughts, incl. winter drought;
- drought propagation (meteorological to hydrological droughts), incl. space-time development of droughts;
- impact of anthropogenic influences on droughts;
- textbook on hydrological drought;

Winter drought, empty reservoir, Norway, 2006, photo: Arne Nilsen
Drought in Europe: achievements

Textbook on Hydrological Drought

Teaching material summer courses:
• Montpellier (France, 2003);
• Wageningen (Netherlands, 2003);
• Kuala Lumpur (Malaysia, 2005);
• Rabat (Morocco, 2006)

Planned:
• Trieste (Italy, 2008);
• South Africa
• Bhutan
Drought in Europe: achievements

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- textbook on hydrological drought;
- European Drought Centre.
Drought in Europe: achievements

EDC in brief:
- virtual centre
- platform for:
  - dissemination of information
  - share views
  - different actors
- invitation to join
Drought propagation: forecasting & prediction

Processes underlying drought development

- hydroclimatological regions
- catchment control (soils, aquifers, lakes, streams,...)

Changnon, 1987
Processes: drought propagation

- case study (climate variability)
  - explorative conceptual hydrological modeling
    - Compiègne (France)
    - Thessaloniki (Greece)
Drought propagation

Deficit Volume

drought in **precipitation**

drought in **discharge** (slowly-responding catchment)

Compiègne, France

Thessaloniki, Greece
Summary:

- less droughts in discharge occur than in precipitation, irrespective of hydroclimatological region or soils
- slowly-responding catchments have less minor droughts, but experience longer droughts than quickly-responding catchments
- soils have effect on hydrological drought

still HARD to find relations between the meteorological and hydrological droughts
State of the art:

IPCC (2007) expects more severe hydrological extremes

Strong catchment control makes it hard:

- to distinguish between effects of climate change on hydrological drought and multi-decadal climate variability
- to discriminate climate change from other human influences (e.g. land use change, water abstractions)

Understanding of the development of past droughts and how they might change in future is very fragmented and highly uncertain

Current generation GCMs and RCMs is still expected to unsatisfactory reproduce historical hydrological extremes
Hydrological Drought: climate variability and climate change

EC-IP WATCH: WATer and global Change will:

• advance the knowledge and skills to predict the effect of climate change on drought by enhancing our understanding of the present situation (20th C)
• evaluate how the global water cycle and in particular droughts respond to future drivers of global change (21st C)
• investigate the attribution of changes in the hydrological cycle (incl. the droughts)
• assess the uncertainties
Hydrological Drought: climate variability and climate change

EC-IP WATCH: WATer and global Change:
Data and Modeling Framework

[Diagram of the data and modeling framework]

20th C
Drought in Europe

EU project
XEROCHORE

AIMS:
• to synthesize knowledge on past, current and future drought events
• to provide information on possible impacts
• to compile a roadmap on EU research needs
Concluding remarks:

- Europe is regularly hit by drought;
- Natural hazard that cannot be prevented;
- Might become worse in the 21st C;
- Catchment control (i.e. storages) converts the meteorological drought covering vast areas of land into a pathy pattern (poorly understood);
- EU projects, international (e.g. UNESCO) and professional organizations (e.g. IAHS, IAH), and network facilities, e.g. European Drought Centre are of great help for drought research, management and policy.
THANK YOU!

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European Drought Centre: http://www.geo.uio.no/edc

EC-IP WATCH: WATer and global Change: http://eu-watch.org/