Contribution to Panel Discussion on International Perspectives on Nonstationarity

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Observed climate change in Central Europe:

- Warming

- Changes in seasonality:
  - Decrease of the ratio of summer precip to winter precip
  - Decrease of the ratio of solid to liquid precip in winter
  - Less snow cover and earlier snow melt
  - Rivers freeze less frequently and shorter

Observed non-climatic changes: land-use change; systemic change; economic growth
Racibórz-Miedonia

Exceedence probability of maximum annual flows

$Q_{\text{max}} [\text{m}^3/\text{s}]$

$3260 \text{ m}^3/\text{s} (1997)$
Record level of Elbe at Dresden: 940 cm on 17 August 2002
Floods on the Vltava in Prague (Czech Republic)

Source: CHMU
Karjaanjoki, Lohjanjarvi-Peltokoski (SF)  Maximum annual flow  Rhine, Kaub (D)

Main, Schweinfurt (D)  Source: Kundzewicz et al. (2004)  Morava, Moravicany (CZ)
Wilby et al. (2008):
Detection of climate change at global or regional (let alone catchment) scales is inherently difficult, because of the low signal-to-noise ratio. The relatively weak climate change signal is superimposed on a large natural, inter-annual variability of rainfall and river flow (under a confounding effect of land-use change). Hence, statistically robust trends are unlikely to be found for several decades more.
Poland:

The observed climate change has not been strong enough to persuade the water management community. Projections for the future largely differ between models (and scenarios), hence GCM-based information is found too vague to be used. No changes, in terms of new standards, criteria, and evaluation procedures have been made.

However, water management community shows interest in climate change observations, projections, and impact assessments.

Hydrological research dedicated to detection of change in hydrological variables; development of methodologies to tackle non-stationarity; and projections for the future has been undertaken (nationally or EU-funded).
Recurrence interval of today’s 100-year floods (i.e. flood with a recurrence interval of 100 years during the period 1961-1990) at the end of the 21st century (2071-2100), for emission scenario SRES A2. Source: Dankers & Feyen, J. Geoph. Res. (2008).
• In parts of **Germany** (e.g. Bavaria), flood design values have been increased by a safety margin, based on climate change impact scenarios. The projections for 2050 include an increase of **40-50 %** in small and medium flood discharges and of **15 %** in 100-year floods.

• In the **UK**, the Defra’s precautionary allowance includes projection of increase in peak rainfall intensity (up to **20%** by 2085 and **30%** by 2115) and in peak river flow volume (up to **10%** by 2025 and **20%** by 2085), to reflect the possible effects of climate change, based on impact assessments.

• Measures to cope with the increase of the design discharge for the Rhine in **the Netherlands** from **15 000** to **16 000** m³/s must be implemented by 2015 and it is planned to increase the design discharge to **18 000** m³/s in the longer term due to climate change.
European Union Floods Directive

• Preliminary flood risk assessment (including assessment of the projected impact of climate change trends; forecast of estimated consequences of future floods, …).

• Preparation of flood maps and indicative flood damage maps, covering the geographical areas which could be flooded with a high probability (e.g. return period of 10 years); with a medium probability (100 years), and with a low probability (extreme events).

• Preparation and implementation of flood risk management plans, aimed at achieving the required levels of protection.

„Firstly, the scale and frequency of floods are likely to increase in the future as a result of climate change, inappropriate river management and construction in flood risk areas. Second, there has been a marked increase in vulnerability due to the number of people and economic assets located in flood risk zones.”

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