

## INTENSE PRECIPITATION AND HIGH RIVER FLOWS IN EUROPE – OBSERVATIONS AND PROJECTIONS

Zbigniew W. KUNDZEWICZ<sup>1,2</sup>

<sup>1</sup>Research Centre for Agricultural and Forest Environment, Polish Academy of Sciences  
ul. Bukowska 19, 60-809 Poznań, Poland; e-mail: zkundze@man.poznan.pl

<sup>2</sup>Potsdam Institute for Climate Impact Research  
Telegrafenberg, D-14 412 Potsdam, Germany

### A b s t r a c t

Several destructive floods have occurred in the last decade in Europe, causing record high material damage. The question of detection and attribution of changes in various flood-related indices attracts increasing interest. Among the mechanisms that can impact flood risk are changes in socio-economic systems, which influence terrestrial systems, and changes in the climatic system. The atmosphere's water holding capacity (and hence potential for intense precipitation) increases with temperature and more intense precipitation has been documented in the warming world. However, a general and coherent increase in high river flows has not been detected. Results of change detection studies of daily river flow in Europe show that the overall maxima (for the 1961–2000 period) occurred more frequently in the subperiod 1981–2000 than in the subperiod 1961–1980. Regional changes in the timing of floods have been reported in many areas of Europe, with increasing incidence of late autumn and winter floods (caused by rain) and fewer spring snowmelt floods. Also, the number of ice-jam related inundations has decreased. On the other hand, intensive and long-lasting summer precipitation episodes have led to disastrous floods in Central Europe (cf. the 1997 Odra/Oder flood, the 2001 Vistula flood, and the most destructive 2002 deluge on the Labe/Elbe), and river flooding has been recently recognized as a major hazard in the region. Significant differences between future projections and the reference period, indicating the likelihood of increasing flood hazard, have been identified in both intense precipitation and high flows.

**Key words:** climate change, climate variability, floods, global change, hydrological extremes, river flow.