Summary and Conclusions

5

The selected 27 indices are based on daily temperature and precipitation data at some European climate stations (ranging from 3 to 86 depending on period and variable), which have among the most extensive climate records in the world. The stations used here are required to have daily records starting before 1901. Seasonal linear trends of the indices during three periods (1801–2000, 1851–2000, and 1901–2000) were estimated by simple regression. The significance of the trends was determined by a t-test (see earlier) of the estimated trend. For the most data-rich period 1901–2000, the stations are grouped into three regions (northern, central and southern Europe) and regional means are calculated as an arithmetic mean of all the stations in each region. The long term trends of the temperatures and precipitation at these stations are shown in figures and tables which provide valuable information for past extreme climatic condition based on reliable instrumental records over Europe.

In summary, the estimated trends for the temperature indices indicate a shift in the frequency distribution of temperature. Higher frequency and greater amplitude of warm and hot extremes were detected for all the three periods. At the same time, cold extremes have become rarer. A large number of these trends are found to be statistically significant at the 5% level. On the other hand, the pattern of the trends is much more heterogeneous and less significant for the precipitation indices than for the temperature ones. Nevertheless, a tendency towards increased precipitation intensity, not necessarily combined with increased precipitation totals, was established. There is strong evidence that climate in Europe has changed during the three periods analyzed, such that the occurrence and intensity of warm temperature extremes have increased. Precipitation extremes have also changed with a likely shift of the rainfall moving towards higher precipitation rate.

Based on the summary statistics of the estimated trends, the following conclusions can be highlighted:

- The majority of the trends estimated for temperature indices over all the three periods is positive and a large part of these positive trends are statistically significant. In terms of regional difference, SEU stands out as a region which experiences higher and more significant warming trends, particularly in summer.
- The increased/decreased frequency and intensity of high/low temperature extremes are associated with increased mean temperatures. Extremely cold days and nights have become fewer whereas extremely warm and hot days and nights occurred more often.
- The majority of the trends for precipitation indices suggest increased rainfall amount, increased extreme level and frequency, although there are large regional differences. There are also some differences in the trends of the indices among the three time periods. Over the recent 100 years, NEU has most significant increases, especially in autumn, while there is practically no significant change in SEU. In terms of seasonal distribution, cold seasons (SON and DJF) show more significant changes than those of warm seasons (MAM and JJA).
- Generally, similar patterns of trends with regard to season for all indices over different periods of time are established. This is particularly true for the temperature indices. The trends for the last 100 years are often higher and more significant than the two longer time periods, indicating higher speed of change over the most recent 100 years.

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