Climatic nowcasting: incorporating model-simulated climate change to estimates of present and near-future climate

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A. Introduction
For operational purposes, climate is usually defined by using a 30-year "normal period" from past observations, e.g. 1961-1990 or 1971-2000. For evaluating climatic extremes, even longer time series of observations are often used.

Today, the stationarity assumption behind this practice is compromised by the ongoing global climate change. Here, we present one approach for dealing with this problem. The method is described in more detail by Räisänen and Ruokolainen (2008a,b).

B. Overview of the method
We adjust past observations for the estimated effects of global climate change (Fig. B2). The adjustment is based on

1. The (temporally smoothed) change of global mean temperature, as observed this far and as simulated for the future

2. Regression coefficients linking the mean and interannual variability of local climates to the change in the global mean temperature, estimated from CMIP3 simulations of 20th-to-21st century climate change (Fig. B1). The variation of these coefficients between the CMIP3 models results in several alternative adjusted time series (grey lines in Fig. B2).

C. Hindcast for the years 1991-2005
The method was used to hindcast the frequency of "warm" months (above the median for 1961-1990) in the years 1991-2005, by only using observations from 1961-1990. The average hindcast frequency (67%) is in good agreement with CRU TS3 observations (69%) (Fig. C1). For both the hindcast and the observations, the frequency of warm months is highest in the tropics, where interannual temperature variability is small.

D. Present-day temperature climate
Fig. D1 compares the best-estimate present-day (~2010) temperature climate with the statistics for 1971-2000.

E. A case study of winter temperatures in Helsinki, Finland
Winter 2008 was record warm in Helsinki, with a DJF mean temperature of +1.3°C, whereas winter 2010 was the coldest since 1987 (-7.4°C) (see Fig. B2). How probable are such warm / cold winters

1. As estimated directly from observations from the years 1991-2005?
2. In the actual present-day climate?
3. In the future?

F. References