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Perspective

Expanding the observational foundation for climate studies

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The capacity of theoretical models for faithfully simulating real phenomena is generally checked by comparing their outcomes with experimental data corresponding to the modelled situation. Natural phenomena are controlled by a large variety of unknown or unidentified parameters. When dealing with such phenomena, the only way to overcome this imperfect knowledge is through using multiple observations in various conditions. A typical example is the climate models on which the projections of future dangerous climate changes are based. They can be checked against reliable observations of past climate over large periods of time at various locations only. However, the network of meteorological observatories has evolved in time, even in the recent past. Sometimes, they have been moved from one location to another. Moreover the environment may have changed as well, mainly due to urbanisation. Lastly, the measuring devices have been improved to correct errors identified when analysing their data and to take advantage of the technical developments. Quite often, even the definition of the recorded parameter has been modified. The present sunshine-duration definition has been adopted in 1981 only. It is based on a threshold of the energy received per square metre. The very first definition was based on visibility of the solar-disk boarders. Later, the existence of shadows clear cut boarders was a preferred criterion. A full methodology has been developed within Meteo France to properly detect and correct such discontinuities and to homogenize the data.

The paper by Moisselin and Canellas [24] deals with the homogenization and the analysis of sunshine-duration series recorded in eighteen French stations over the period 1931–2000. The behaviour of water vapour is a major source of uncertainty in the projection of future climates and the cloud cover is a sensible test of the capacity of models for accurately simulating the actual meteorological phenomena. To that extent, this study relative to France follows the IPCC recommendations aiming at 'expanding the observational foundation for climate studies'. There is a need for consistent data to validate the models used for projecting the climate warming induced by the anthropogenic emissions of greenhouse gases. This global change is a source of great concern for future generations and has been discussed in several thematic issues of *Comptes rendus Geoscience*: in December 2001, *Énergies et Climat* [2,5,8–11,20,22,27,33], in June–July 2003, *Effet de serre, impacts et solutions : quelle crédibilité* ? [3,4,6,7,13–15,17–19,21,28–32,34], and in March 2005, *Incertitudes scientifiques et risques climatiques* [1,12,16,25,26], which is part of the preparation of the IPCC Fourth Assessment Report to be released in 2007 [23].

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This study is important from a domestic point of view, as the impacts of climate change on populations depend on the phenomena they will experience at their local scale. From 1931 to 2000, the sunshine duration exhibits a progressive evolution from a decrease in the northern half of France to an increase in southern France. The sunshine duration decreased by 0.6 to 1% per decade to the north of the Loire River. On the contrary, in Marseilles, it increased by 0.7% per decade. The seasonal behaviour has been investigated as well. The spring data exhibit the most striking evolution, a significant decrease everywhere but in the southeast of the country. Those findings are consistent with temperature measurements, which have been homogenized through an independent processing. It is well established that clouds limit the night-time cooling and reduce during day time the solar energy absorbed by the Earth. It is therefore nice to check that the observed behaviour of the daily temperature variation exhibits, over the same period of time 1931–2000, the same north–south gradient as the sunshine duration. However, the temperature variations are controlled not only by the cloud cover, but also by phenomena such as plants evapotranspiration and soil water content. Therefore, the observation in the southwest of the country of both an increase of the sunshine duration and a decrease of the daily temperature variation is not really disturbing.

Moisselin and Canellas' paper [24] contributes significantly to increase the observational foundation against which numerical models can be checked and to assess more precisely the impacts of the global climate change on the French territory.

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