Geophysical Research Abstracts
Vol. 12, EGU2010-1885, 2010
EGU General Assembly 2010

Annual and seasonal analysis of temperature and precipitation in Andorra (Pyrenees) from 1934 to 2008: quality check, homogenization and trends

Pere Esteban (1), Marc Prohom (2), Enric Aguilar (3), and Olivier Mestre (4)

(1) Snow and Mountain Research Center, Andorran Research Institute, Sant Julià de Lòria, Principality of Andorra (pesteban.cenma@iea.ad), (2) Meteorological Service of Catalonia, Area of Climatology, Barcelona, Catalonia, Spain (mprohom@meteo.cat), (3) Center on Climate Change - C3, Geography Department, Universitat Rovira i Virgili, Tarragona, Catalonia, Spain (enric.aguilar@urv.cat),, (4) Ecole Nationale de la Météorologie, Météo France, Tolouse, France (olivier.mestre@meteo.fr)

The analysis of temperature and precipitation change and variability in high elevations is a difficult issue due to the lack of long term climatic series in those environments. Nonetheless, it is important to evaluate how much high elevations follow the same climate evolution than low lying sites.
In this work, using daily data from three Andorran weather stations (maintained by the power company Forces Elèctriques d'Andorra, FEDA), climate trends of annual and seasonal temperature and precipitation were obtained for the period 1934-2008. The series are complete (99.9%) and are located in a mountainous area ranging from 1110 m to 1600 m asl.
As a previous step to the analysis, data rescue, quality control and homogeneity tests were applied to the daily data. For quality control, several procedures were applied to identify and flag suspicious or erroneous data: duplicated days, outliers, excessive differences between consecutive days, flat line checking, days with maximum temperature lower that minimum temperature, and rounding analysis. All the station sites were visited to gather the available metadata. Concerning homogeneity, a homogeneous climate time series is defined as one where variations are caused only by variations in climate and not to non-climatic factors (i.e., changes in site location, instruments, station environment...). As a result, homogeneity of the series was inspected from several methodologies that have been used in a complementary and independent way in order to attain solid results: C3-SNHT (with software developed under the Spanish Government Grant CGL2007-65546-C03-02), and Caussinus-Mestre (C-M) approaches. In both cases, tests were applied to mean annual temperature and precipitation series, using Catalan and French series as references (provided respectively by the Meteorological Service of Catalonia and Météo-France, in the framework of the Action COST-ES0601: Advances in homogenisation methods of climate series: an integrated approach, HOME). For precipitation, an additional test – RhTestV3 – was applied over the station data to ensure the homogeneity of the series.
The analysis of the quality-controlled and homogenized maximum and minimum temperature series, shows an increase and statistically significant trend for the period 1934-2008. More precisely, the results are significant for both approaches (C3-SNHT and C-M) and for annual maximum temperature (0.12 and 0.10ºC/decade, respectively), maximum summer temperature (0.25 and 0.17ºC/decade, respectively), and minimum winter temperature (0.18 and 0.11ºC/decade, respectively).
The results were also obtained for the period 1971-2008. It is observed that the upward trend of the temperature has been reinforced in Andorra for this most recent period.
Regarding precipitation, with the application of different tests, non-significant results for all the seasons and for the whole period (1934-2008) were obtained, so it cannot be concluded any increasing or decreasing trend. Nevertheless, preliminary results for the 1950-2008 period aim clearly towards a significant decrease of the annual total accumulation (-4.26mm/decade [being -7.80/-1.03, the confidence intervals at 95% level]), being especially relevant and also significant for the summer totals (-2.44 mm/decade [being -3.74/-1.13, the confidence intervals at 95% level]). The obtained trends for temperature agree with those obtained in Spain (Brunet et al., 2007), France (Spagnoli et al., 2002 and Maris et al., 2009) and Catalonia (Meteorological Service of Catalonia, 2008).

Bibliography:

- Brunet M, Jones PD, Sigró J, Saladié O, Aguilar E, Moberg A, Della-Marta PM, Lister D, Whalter A, López D. 2007. Temporal and spatial temperature variability and change over Spain during 1850-2005. Journal of Geophysical Research,, 112, D12117, doi:10.1029/2006JD008249
- Butlletí Anual d'Indicadors Climàtics, 2008 (BAIC,2008). Àrea de Climatologia, Servei Meteorològic de Catalunya. (http://www.meteo.cat)
- Spagnoli B, Planton S, Mestre O, Déqué M, Moisselin, JM (2002). Detecting climate change at a regional scale: the case of France. Geophys. Res. Lett., 29, n.10, pp. 91-94.
- Maris M, Giraud G, Durand Y, Navarre JP, Mérindol L. 2009. Results of 50 years of climate reanalysis in the French Pyrenees (1958-2008) using SAFRAN and CROCUS models. International Snow Science Workshop, Davos 2009, Proceedings.