

Daily Maximum and Minimum Temperature Analysis at the Southern Region of South America Using Different Reanalysis Datasets and Station Data

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The Patagonia, southern region of South America, has been less studied than other regions of South America. Meteorological data coverage is poor, so it is very difficult to analyze the zone. The literature shows some works that compare stations data with reanalysis data in South America, but the researches principally analyze latitudes north of 40°S. Studies that take into account meteorological data southern 40°S are rare. In this work, daily maximum and minimum temperature of Patagonia are specially analyzed, considering station data (SD) and three reanalysis datasets: NCEP-NCAR reanalysis 1 (R1), NCEP/DOE Reanalysis 2 (R2) and ECMWF-ERA Interim (ERA-I). Daily maximum (T_{max}) and minimum (T_{min}) temperatures were considered at the periods 1979-2010 (R1 and R2 databases) and 1989-2008 (ERA-I).

Basic statistics of daily differences between the datasets (percentiles 99, 90, 75, 50 –the median-, 25, 10 and 1) were calculated. High differences were found in many days (differences of 10 °C, 15°C or even more), especially in daily maximum temperatures in summer. Nevertheless, these extreme differences have low frequency of occurrence.

All the reanalysis datasets exhibit a sub estimation of daily maximum temperature. ERA-I has the best performance in the representation of the extreme temperatures, particularly the minimum temperatures. When all the months were considered, the median of the differences (ERA-I – SD) generally is below (above) 2°C (-2°C). This result changes when one specific month is analyzed, showing some seasonal differences. When daily data of January (austral summer) and July (austral winter) are analyzed, it can be observed that the minimum temperature is over estimated in July, and the maximum temperature is more sub-estimated in January. Other aspect that must be mentioned is the difficult of ERA-I to represent minimum temperature in a zone near high elevation area (Bariloche). The minimum temperature is highly over estimated, mainly in summer. These high differences aren't observed at maximum temperatures.

R1 and R2 were compared between them and in relation with station data. As it was mentioned before, the maximum temperature is sub estimated in both databases. A previous study showed this characteristic for one reference station of Patagonia, using R1 dataset. In the present work it can be seen that it is a general condition for the area. The minimum temperature has other behavior: it is sub estimated at R1 and over estimated in R2, but not at all the studied stations. The minimum temperature is better represented in R2, especially in summer and the maximum temperature is better represented in winter. The results concur in the difficult of the reanalysis to represent the most extreme temperature cases in the year.

One aspect the must be analyzed in detail is related with the stationary (or not) of the differences found. Temporal series of daily differences (T_{max}R2-T_{min}R1 and T_{min}R2-T_{min}R1) corresponding to all the grid points studied (Patagonia area) were calculated. They present a shift by the end of 90's, with an increase of high differences between the two datasets (in some cases, as high as 20°C) and/or changes in the range of variability. Similar results are observed with the station comparison, but they are not related with a real "shift change" of extreme temperatures.

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