EMS Annual Meeting Abstracts Vol. 11, EMS2014-464, 2014 14th EMS / 10th ECAC © Author(s) 2014



Issues in estimating past climate change at local scale. Case study: the recent warming (1959-2009) over France.

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A new dataset of monthly homogeneous series of temperature covering metropolitan France over the last 50 years has been produced by Météo-France. It provides an unprecedented coverage of the territory, up to 1500 meters in altitude. We use it to estimate the recent past warming (1959-2009) over France. Three issues are investigated: first, the quality of the homogenized dataset, second, the method applied to estimate the warming signal, and third, the significance of the estimated signal. The first point is addressed by checking consistency between the French homogenized series and other reference datasets. For the second point, we compare the Ordinary and Generalized Least Square estimators (the first is much more commonly used while the latter has optimal properties), and the impact of different assumptions regarding the temporal shape of the change (e.g. a linear trend vs a more refined temporal pattern deduced from the response of climate models to anthropogenic forcings). The third point depends on assumptions concerning the internal variability. Tests are performed assuming either independence over time, a first-order auto-regressive (AR1) memory effect, or a non parametric covariance inferred from the CMIP5 control simulations. The two main results are: 1) a parametric approach based on AR1 process is acceptable to estimate internal variability, nor the location. These results, beyond documenting recent climate change over France, constitute advances with regards to detecting climate change at local scale.