Geophysical Research Abstracts
Vol. 19, EGU2017-13872, 2017
EGU General Assembly 2017

Investigating precipitation changes of anthropic origin: data and methodological issues

Isabel de Lima (1,2) and Shaun Lovejoy (3)

(1) Civil Engineering Department, University of Coimbra, Coimbra, Portugal (iplima@uc.pt), (2) Marine and Environmental Sciences Centre - MARE, Portugal, (3) Physics Department, McGill University, Montreal, Canada

There is much concern about the social, environmental and economic impacts of climate change that could result directly from changes in temperature and precipitation. For temperature, the situation is better understood; but despite the many studies that have been already dedicated to precipitation, change in this process – that could be associated to the transition to the Anthropocene - has not yet been convincingly proven. A large fraction of those studies have been exploring temporal (linear) trends in local precipitation, sometimes using records over only a few decades; other fewer studies have been dedicated to investigating global precipitation change. Overall, precipitation change of anthropic origin has showed to be difficult to establish with high statistical significance and, moreover, different data and products have displayed important discrepancies; this is valid even for global precipitation.

We argue that the inadequate resolution and length of the data commonly used, as well as methodological issues, are among the main factors limiting the ability to identify the signature of change in precipitation. We propose several ways in which one can hope to improve the situation – or at least – clarify the difficulties. From the point of view of statistical analysis, the problem is one of detecting a low frequency anthropogenic signal in the presence of "noise" – the natural variability (the latter includes both internal dynamics and responses to volcanic, solar or other natural forcings). A consequence is that as one moves to longer and longer time scales, fluctuations are increasingly averaged and at some point, the anthropogenic signal will stand out above the natural variability noise. This approach can be systematized using scaling fluctuation analysis to characterizing different precipitation scaling regimes: weather, macroweather, climate – from higher to lower frequencies; in the anthropocene, the macroweather regime covers the range of time scales from about a month to ≈30 years. We illustrate this using local gauge data and three qualitatively different global scale precipitation products (from gauges, reanalyses and a satellite and gauge hybrid) that allow to investigate precipitation from monthly to centennial scales and in space from planetary down to 5ºx5º scales. By systematically characterizing precipitation variability across wide ranges of time and space scales, we show that the anthropogenic signal only exceeded the natural variability at time scales larger than ≈20 years, so that the disagreement in the trends can be traced to these low frequencies.