WCRP NEWS
World Climate Research Programme

More evidence for man-made changes in precipitation

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An international team of scientists has detected the first direct evidence of human influence on changes in global patterns of rain and snowfall.

The study published in *Nature* finds that precipitation has increased in northern regions during the 20th Century, a change which cannot be explained by natural forcing or internal variability.

Human activity can be the only explanation for the observed and modelled changes. "We find that anthropogenic forcing has had a detectable and attributable influence on the latitudinal pattern of large-scale precipitation change", says the study led by Drs Xuebin Zhang and Francis Zwiers from Environment Canada's Climate Research Division. Both, Zhang and Zwiers are members of the Expert Team on Climate Change Detection and Indices (ETCCDI) which draws on WCRP expertise amongst others.

The team examined trends in the observed data of global rain- and snowfall from 1925 to 1999 averaged over latitudinal bands, and compared these trends with changes simulated by fourteen climate models. Climate simulations and climate model intercomparison are WCRP-initiated techniques to compute the evolution of the climate and to test model performance quality. The outcome of climate simulations is stored in the multi-model data archive at PCMDI, the Program for Climate Model Diagnosis and Intercomparison in Livermore, California.

"Human-induced changes have not previously been detected in precipitation at a global scale, partly because changes in precipitation in different regions cancel each other out and thereby reduce the strength of the global average signal". The break-up of the Earth's land surface into latitudinal bands allowed the zone-by-zone comparison.

State-of-the-art complex climate models have suggested that man-made global environmental change has caused a small increase in global mean precipitation and a latitudinal redistribution of precipitation, but precipitation observations averaged over global land areas always masked regional trends. In addition, data coverage is sparse over much of the southern hemisphere. "We focused on the region 40°S-70°N because observational coverage elsewhere is limited".

The study confirms the reliability of modern climate models showing that observed changes are in line with computed simulations. But the changes are happening faster than predicted. "The observed changes, which are larger than estimated from model simulations, may have already had significant effects on ecosystems, agriculture and human health in regions that are sensitive to changes in precipitation, such as the Sahel" says the study.

Both observations and models show that precipitation has increased in the southern hemisphere deep tropics and subtropics, decreased in the northern hemisphere tropics and subtropics, and increased in the northern hemisphere poleward of 50°N.

Map indicating the different 10° latitude bands and whether trends agree in sign. Green (or yellow) shading identifies latitude bands with increasing (or decreasing) trends in both observations and models; grey shading indicates disagreement between observed and simulated trends. Areas with insufficient data are shown in white. Only land precipitation data are used. Source: Zhang et al. 2007.

A great challenge of the study was to separate the anthropogenic forcing on observed precipitation trends from natural forcing (e.g. volcanic eruption) and internal variability (e.g. El Niño Southern Oscillation). This was done in climate change detection and attribution studies. Analyses showed that "the detection of an anthropogenic influence on precipitation is robust." While there is little uncertainty in the "sign of the trend" (increase/decrease) for certain latitudinal bands, there is a considerable uncertainty in the magnitude of precipitation changes.

"It is expected that wet tropical regions would become wetter and dry regions drier", threatening already vulnerable regions such as the Sahel, southern Africa, the Mediterranean and southern Asia. The Intergovernmental Panel on Climate Change (IPCC) already reported on observed changes in the amount, intensity, frequency and type of precipitation and on increases in some regions in the occurrences of both droughts and floods. Zhang's study is the first to confirm a link between rainfall patterns and human-induced climate change. *[C Arndt]*

Links & references

ETCCDI http://cccma.seos.uvic.ca/ETCCDMI/index.shtml

IPCC http://www.ipcc.ch

PDMDI http://www-pcmdi.llnl.gov/ipcc/about_ipcc.php

Zhang, X., F. W. Zwiers, G. C. Hegerl, F. H. Lambert, N. P. Gillett, S. Solomon, P. A. Scott and T. Nozawa (2007) Detection of human influence on twentieth-century precipitation trends. Nature doi: 10.1038/nature06025
http://www.nature.com/nature/journal/v448/n7152/abs/nature06025.html