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Analysis of Observed Global Mean Land-Surface Precipitation of the Period 1951 to 2000

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Precipitation is a major branch of the global water cycle. All evaporated water is to fall back on earth sooner or later. The average residence time of water in the atmosphere is about 7 days. Evaporation itself is closely linked to surface air temperature which itself is driven by natural and anthropogenic external forcing and internal climate variability. Therefore also the global water cycle should reflect the forcing that drives global mean surface air temperature.

The investigation is based on the recently published VASClimO v1.1 gridded data set of global land surface precipitation provided by the Global Precipitation Climatology Centre (GPCC, Beck et al., 2005). Compared to other data sets this one has the advantage that it is exclusively based on long and homogeneity tested station records.

It is shown that global mean land-surface precipitation does not reveal a significant linear 50-year trend for the second half of the 20th century. However, significant trend-like variability on decadal and shorter time scales is found.

Correlation analysis of the standardized monthly mean precipitation rates with the Southern Oscillation Index SOI reveals that the El Nino-Southern Oscillation phenomenon (ENSO) explains about 18% of the variability. No correlation, however, is found to the time series of sunspot numbers. Only after the elimination of the ENSO-related fraction in the precipitation record a small but significant correlation to global mean surface air temperature becomes visible.

Another small but significant fraction of variance can be explained by strong volcanic eruptions. The 5 major eruptions within the second half of the 20th century led to weak but significant signals for a period of 2 to 16 months after eruption. These signals

become visible in a contingency analysis.

Though these results do not support the concept of an enhanced water cycle as an immediate reaction to global warming, one has to keep in mind that global land surface precipitation accounts for only about 25% of the total precipitation. Furthermore, regional precipitation trends differ considerably from the global trend.

References

Beck, C., J. Grieser and B. Rudolf (2005): A New Monthly Precipitation Climatology for the Global Land Areas for the Period 1951 to 2000, Climate Status Report 2004, 181 - 190, German Weather Service, Offenbach, Germany. Reprint available at http://gpcc.dwd.de