



Analysis of recent trends of global radiation ground measurements

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This analysis is focused on long time series of global radiation with a duration of at least 40 years within the period 1950 - 2009. Like this work lies in-between the analysis for worldwide (satellite) data with approx. 20 years of duration and those for some few sites with very long measurements. A total of 24 sites based on Global Energy Balance Archive (GEBA, <http://proto-geba.ethz.ch>) have been used. These 24 sites have been grouped to 10 regional clusters including 2 – 13 stations.

The following three questions have been investigated: 1. Trend of the time series of monthly data (full period and several sub periods); 2. Trends of 5, 10 and 20 years means; 3. Dependence of the variability on the length of a measured period.

Trends of monthly values:

For the whole period between 1950 and 2009 and all sites a negative and statistically significant trend of -1.41 W/m² per decade could be found. For most grouped sites no significant trend is visible. Nevertheless for Germany / Austria a slightly positive trend can be seen and for Switzerland, Asia, India and Canada a negative trend. For the two sub periods 1950 – 1985 and 1985 – 2009 a significant trend could be found for most groups and stations. For the first period 1950-1985 only negative trends were found. For the second period 1985-2009 (including data for most sites up to 2005) all regions except India and Canada showed a positive trend.

For the mean of all sites the dimming for the period 1950 – 85 and the brightening for the period 1985 – 2009 is statistically significant. The negative trend during the dimming period is clearly stronger (approx. factor 2) than the positive trend during the brightening phase. The individual regions and groups show a great variety of different trends for the analyzed sub periods. The negative trend found in Hinkelmann et al. (2009) for the period after 2000 could be found only at 2 stations out of the 24.

Trends of 5, 10 and 20 year means:

Similar to the trends of the monthly values also the trends of the 5, 10 and 20 year means show a big dependence on the station. Also here the dimming and brightening phase is clearly visible. For 20 year means most sites show variations lower than 5-10%. However some sites in India, Beijing and Weissfluhjoch (Swiss mountain top station) do show a big negative trend with a decline of more than 20% during the analyzed period.

Dependence of the variability on the length of a measured period

The variation depending on the duration of measurement is also quite different from site to site. Most sites have a standard deviation of 5-7% for a 12 month mean which decreases to 2-4% at 10 years and 2% at 20 years. The biggest decline happens in the first 5 years. As a general rule it can be stated, that a climatology of global radiation should include at least 10 years. Only for regions with very high trends (more than 5 W/m² and decade) it makes sense to get as current data as possible.