Towards a homogenization of the long-term surface solar global radiation series over Europe
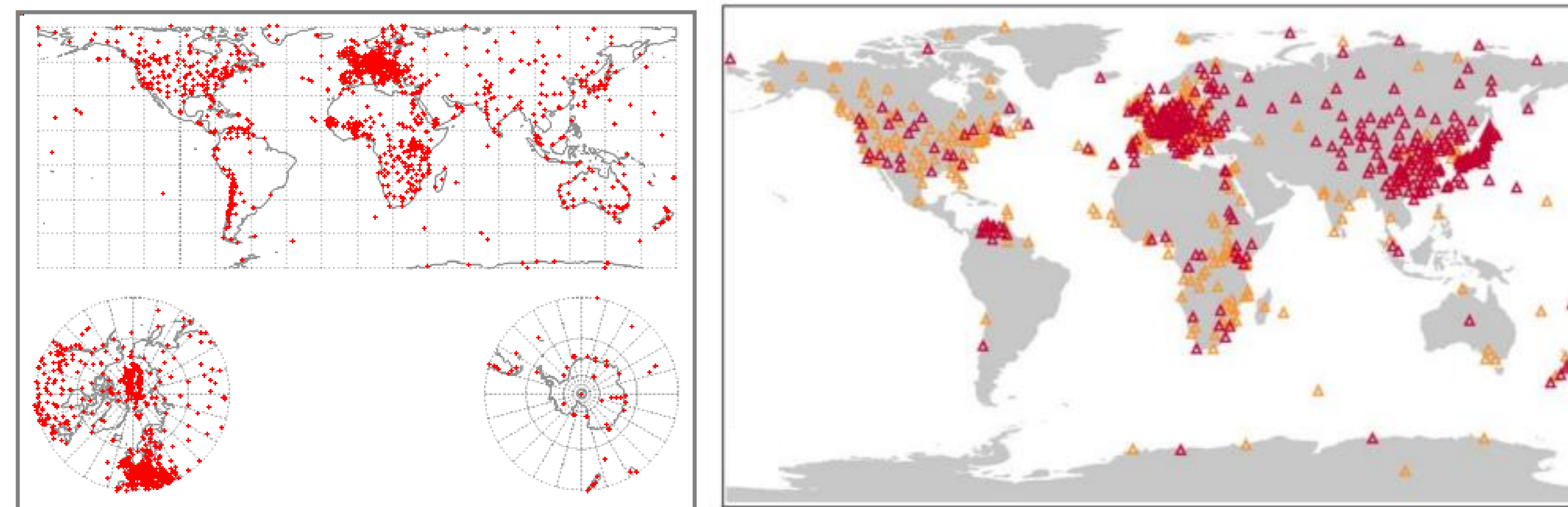
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Introduction

Surface measurements of solar radiation series (SSR) have been used to suggest that SSR has not been constant on decadal time scales. Observations dating back to 1920s are available, measurements becoming more common after the 1957/1958 International Geophysical Year. A widespread reduction of SSR has been well established and documented from the 1950s to the 1980s, and since the 1980s an opposite trend has been detected in many regions of the world. This decrease and increase in surface solar radiation has been defined as "global dimming" and "global brightening", respectively. Comparisons between surface measurements and remote sensing estimations of SSR are currently of great interest in order to provide a global coverage for this climatic variable. Another useful application of the SSR measurements is to check the reliability, and improve the well-known limitations, of Global Climate Models (GCM) simulations of downward irradiance. For these and other purposes the availability of good SSR data is very important, particularly with respect to the quality and homogeneity of the databases.

1. The Global Energy Balance Archive (GEBA)

➤ The GEBA comprises over 2,500 worldwide stations with quality-controlled monthly means values of various surface energy parameters, mainly SSR.
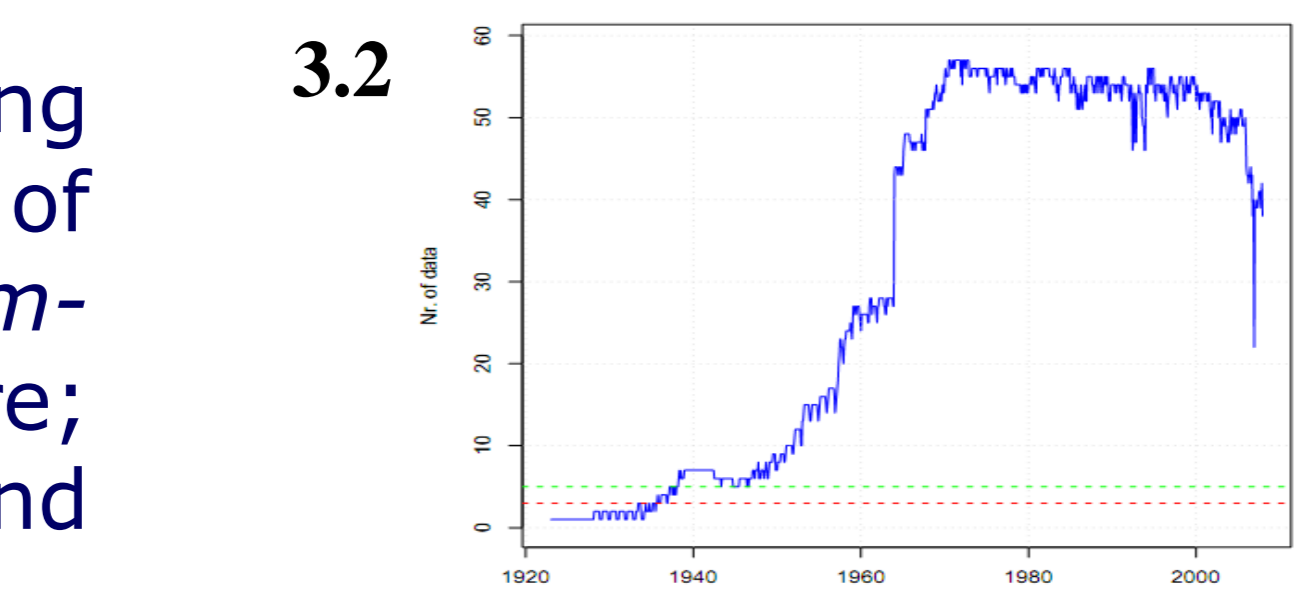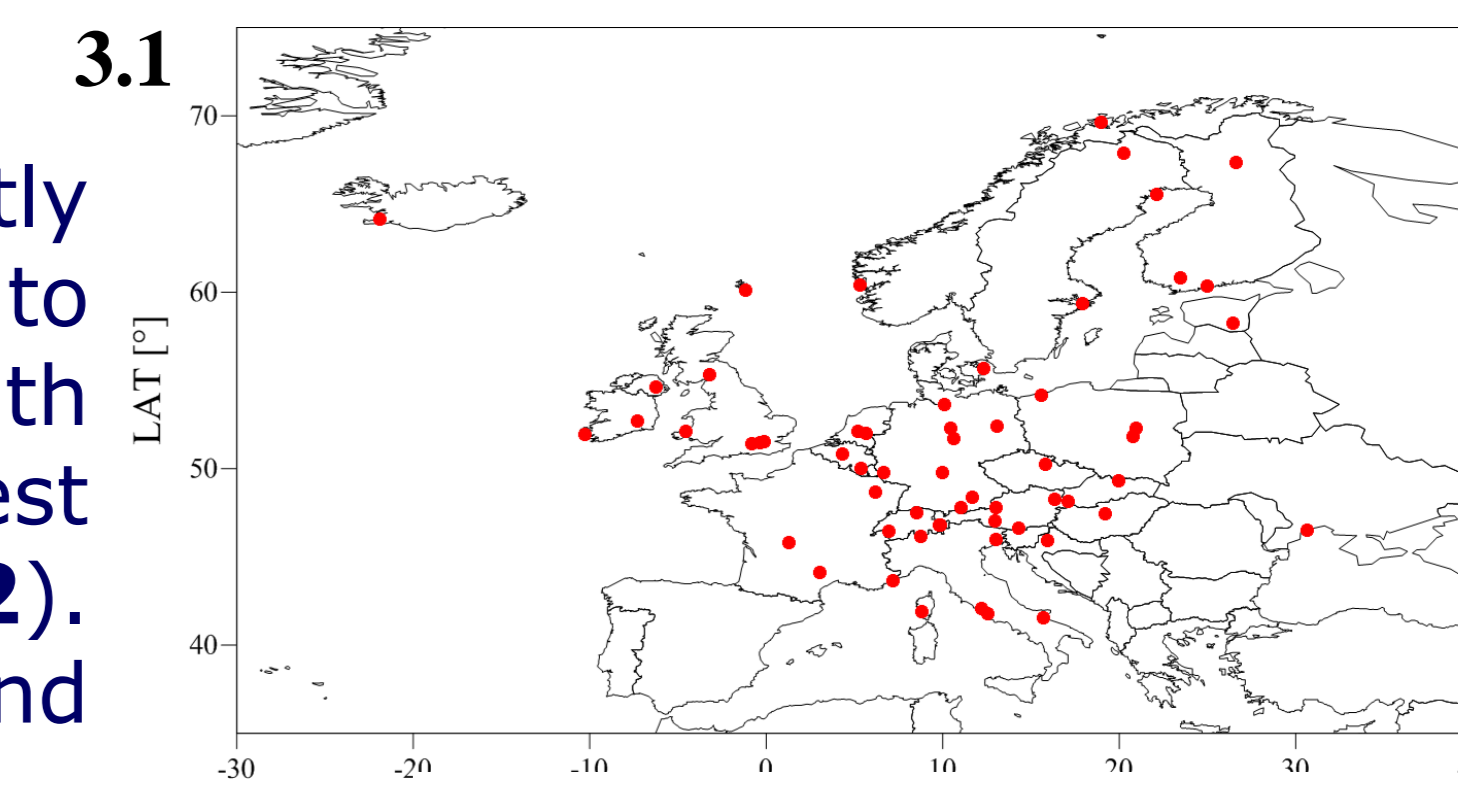

Global distribution of the over 2,500 stations included in the GEBA data set

Global distribution of stations including SSR data with more than 10 (orange triangles) and 20 (red triangles) years of measurements.

2. Homogenization of the long-term SSR series at GEBA

➤ The homogenization of the GEBA is still lacking. Thus, we want to homogenize the complete data set in the next 2 years, including the long (<1970s) and short (>1980s) term series.

➤ Any co-operation in the homogenization is highly welcome. More details and future analysis and results in: **http://www.iac.ethz.ch/people/arturos/homgeba**
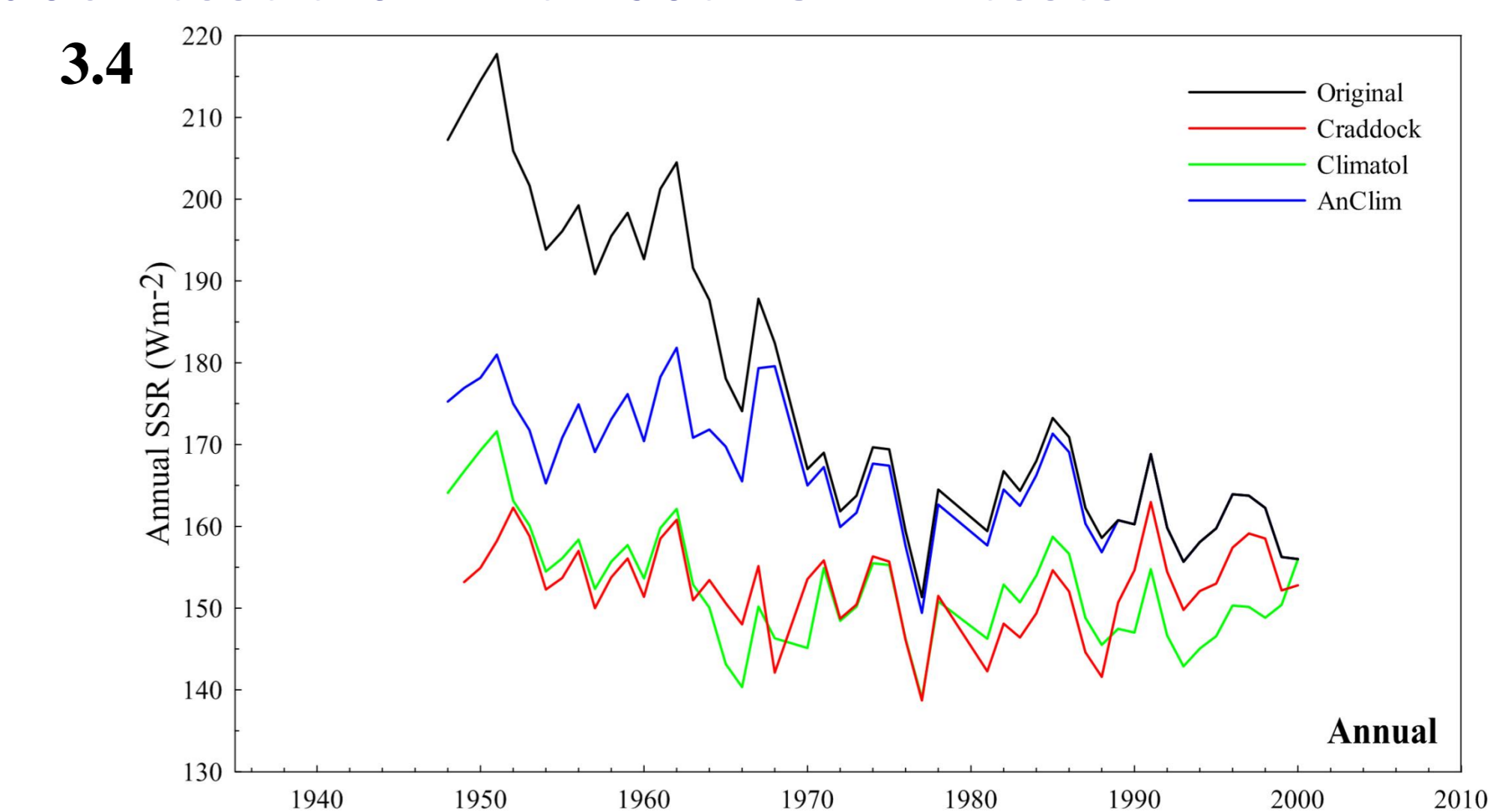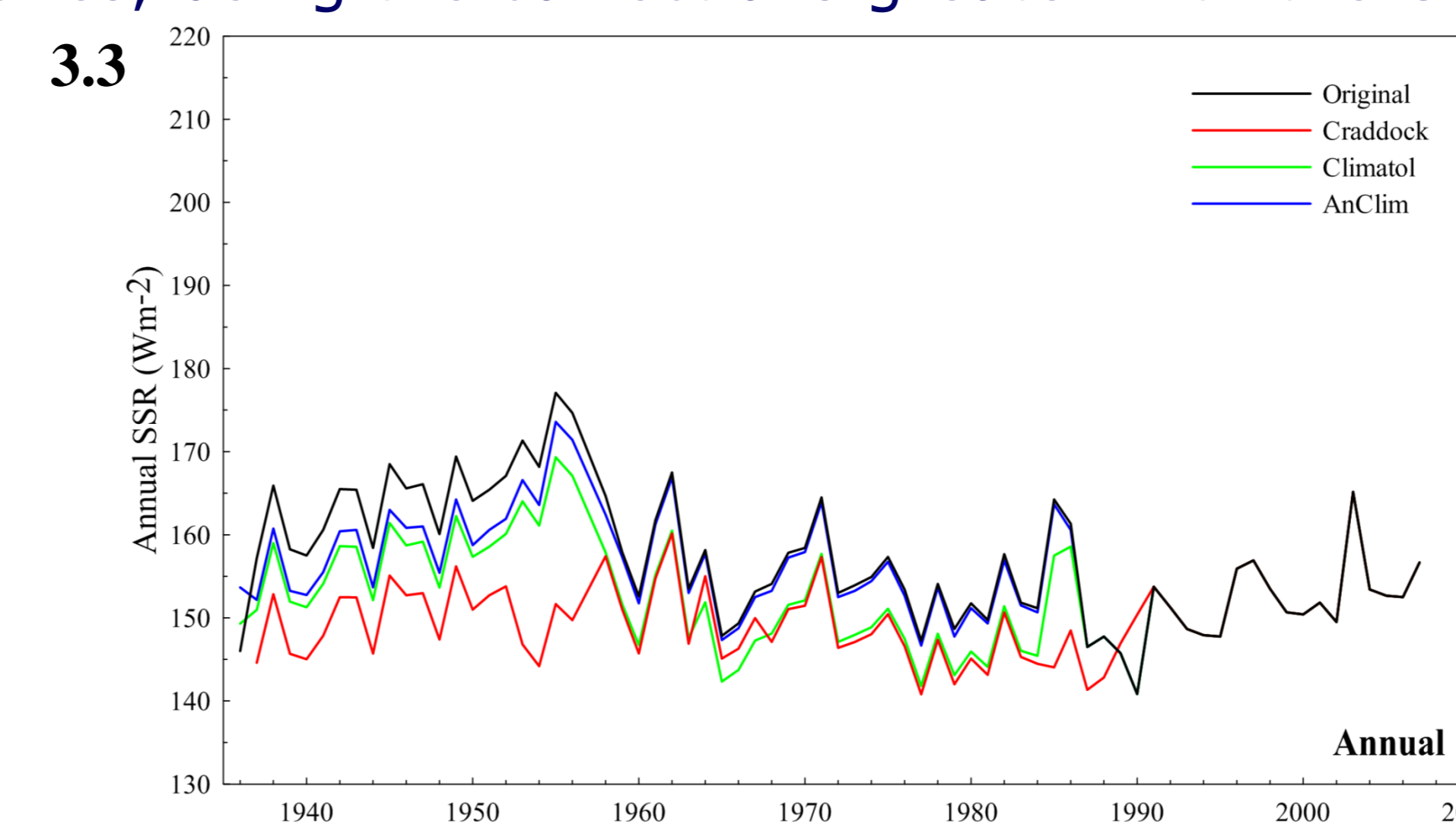

3. First step: Longest GEBA series over Europe

➤ We want to homogenize the long-term series over Europe currently available at the GEBA. A **benchmark data set**, which will be used to compare different homogenization methods, consists of 59 series with monthly SSR data (**3.1**), Stockholm and Wageningen being the longest available records, going back to 1923 and 1928, respectively (**3.2**). Different relative homogeneity tests will be applied in order to detect and correct breaks in the series.

➤ Preliminary results are presented: 3.a) comparison for two stations using 3 methods: the Craddock test (Brunetti et al., 2006) and two versions of the SNHT (Alexandersson and Mober, 1997) implemented in the *AnClim-ProClim* (Stepanek, 2007) and *Climatol v.2.0* (Guijarro, 2011) software; 3.b) comparison of the pan-European SSR trends in the original data and the homogenized data set using the Climatol software.
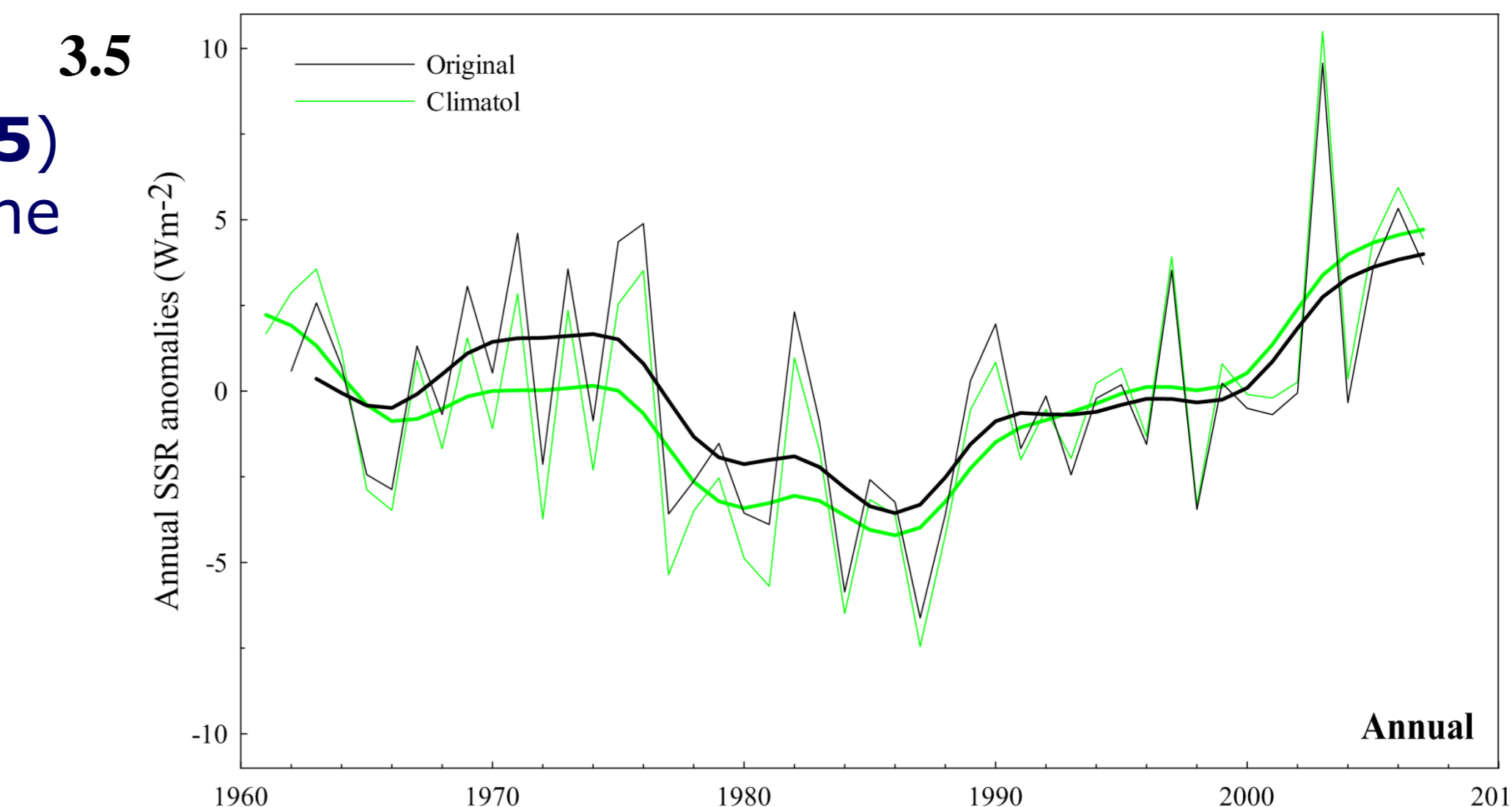
3.1

3.2

3.a. Davos (1590 m. asl) and Weissfluhjoch (2760 m. asl)

➤ In Fig. **3.3** and **3.4** are shown the results of the homogenization for the two nearby meteorological stations of Davos and Weissfluhjoch, in Switzerland. The results clearly show important inhomogeneities in both SSR series, being the corrections greater with the Craddock test than with both SNHT tests.

3.3

3.4

3.b. Annual SRR trends over Europe

➤ The annual mean SSR anomalies for the 59 series (**3.5**) show a more clear dimming/brightening distinction after the homogenization, with large trends in both subperiods.

3.5

Wm⁻²/decade	1961-2007	1961-1984	1985-2007
Original	+0.27	-1.25	**+3.30**
Climatol	+0.51	**-2.29**	**+4.06**

Bold values indicate trends with significance level higher than 95%. Linear trends of the series calculated by means of least-square linear fitting, with their significance estimated by means of the Mann-Kendall test.

• **References**
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• Guijarro, J.A. (2011), Climatol version 2.0, an R contributed package for homogenization of climatological series. State Meteorological Agency, Balearic Islands Office, Spain, http://webs.ono.com/climatol/climatol.html
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