



Surface solar radiation variability and trends in Italy during the last 55 years and underlying causes

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A new dataset of 54 daily Italian downward surface solar radiation (SSR) records has been set up over the 1959-2013 period. Particular emphasis is placed upon the quality control and the homogenization of the records in order to eliminate gross-errors and not climatic signals contained in the original records. This step has been shown as necessary due to the large differences obtained between the raw and homogenized dataset, especially during the first decades of the study period as a consequence of instrument changes and recalibrations. In addition, SSR series under clear-sky conditions were obtained considering only the cloudless days from corresponding ground-based cloudiness observations. Subsequently, the records were interpolated onto a regular grid and clustered in two regions, Northern and Southern Italy, which were averaged in order to get all-sky and clear-sky regional SSR records. Their temporal evolution is presented, and possible reasons for differences between the two conditions and the two regions are discussed in order to understand which part of the SSR variability depends on aerosols or clouds. Specifically, the all-sky SSR records show a decrease until the mid-1980s (dimming period) and a following increase until the end of the series (brightening period) even if the strength and the persistence of the tendencies are not the same in all seasons. The clear-sky records present stronger tendencies than the all-sky records during the dimming period in all seasons, and during the brightening period in winter and autumn, suggesting that under all-sky the variations caused by the variations of the aerosol concentrations have been partially masked by cloud cover variations, especially during the dimming period. The peculiarity of a stronger dimming in the South than in the North under clear-sky could be a consequence of a significant contribution of mineral dust variations to the SSR variability.