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LONG-TERM SUNSHINE DURATION (1936-2013) AND DOWNWARD SURFACE SOLAR RADIATION (1959-2013) TRENDS FOR ITALY FROM INSTRUMENTAL TIME SERIES

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A dataset of 104 Italian sunshine duration (SD) and 54 surface solar radiation (SSR) records has been set up collecting data from different sources. The records have been quality checked, homogenized and completed by means of the neighboring records. Specifically, the records required an extensive homogenization procedure in order to eliminate non-climatic signals (e.g., caused by instrument changes, recalibrations and changes in the conditions of the corresponding meteorological station). Finally, the records have been gridded and averaged in order to get SD and SSR records for North and South Italy for the 1936-2013 and 1959-2013 periods, respectively. In this work, we present the main signals in SD and SSR records in order to understand which part of the SD/SSR variability depends on aerosols or clouds. Specifically, SD records show an increasing tendency starting in the 1980s (i.e. brightening period) and a decreasing tendency (i.e., global dimming) from the 1950s to the 1980s. Between the 1930s and the 1950s there is some evidence of an increasing tendency (i.e. early brightening) although it concerns a period in which data availability is very low, causing a greater uncertainty in regional records. A comparison with total cloud cover (TCC) records shows a positive correlation during the dimming period suggesting that there is an important fraction of SD evolution that cannot be explained by TCC. This could depend on other factors as, for example, changes in aerosol optical thickness and water vapor content. Decadal variations of SSR are in line with the trends observed for SD, although there are differences in the magnitude of the trends (e.g., stronger dimming in SSR as compared to SD). In addition, SSR series under clear-sky conditions were obtained considering only the cloudless days from corresponding ground-based TCC observations. 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. This suggests that under all-sky the variations caused by the increase/decrease of the aerosol content have been partially masked by cloud cover variations, especially during the dimming period. Under clear-sky the observed dimming is stronger in the South than in the North. This peculiarity could be a consequence of a significant contribution of mineral dust variations to the SSR variability.