Assessing sudden stratospheric warming variability in the EC-EARTH climate model

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The European Consortium EC-EARTH coupled climate model version 3.1 is here used to assess the importance of a well resolved stratosphere regarding sudden stratospheric warming (SSW) occurrence. Two simulations of 100 winters each, one with top at 0.01hPa (L91, high-top) and other with top at 5hPa (L62, low-top) are used to detect SSWs from November to March. Results show a strong difference in the SSW frequency through the season. While the high-top simulation shows larger SSW occurrence in mid-winter, which is similar to the documented observational record, SSW occurrence peaks by late-winter in the low-top simulation, despite both show a similar SSW decadal variability (i.e., around 8 events per decade). Interestingly, a similar tendency in SSW frequency is found between the pre and post 1979 period using different reanalysis datasets (Ayarzagüena et al., manuscript in preparation and contribution to S-RIP project, SPARC). Further analysis on tropospheric precursors also shows significant differences between the high-top and low-top integrations suggesting that different dynamical mechanisms may trigger SSWs in the model depending on its vertical resolution. Moreover, dynamical benchmarks which are considered representative of SSWs are compared between simulations to characterize the influence of SSWs on the model's stratosphere-troposphere system. This study is the first comprehensive assessment of stratospheric variability in EC-EARTH, particularly in version 3.1 that contributes to the Quasi-Biennial Oscillation initiative (QBOi) of SPARC.

Key words: EC-EARTH, SSW, S-T coupling, variability.