EMS Annual Meeting Abstracts
Vol. 15, EMS2018-845, 2018

Sudden stratospheric warming variability in EC-EARTH

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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, control runs with fixed radiative forcing at year 2000 and horizontal resolution T255, one with top at 0.01 hPa (L91, high-top) and other with top at 5 hPa (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 coupling and the impact on surface climate in the North Atlantic-European region. This study represents the first comprehensive assessment of the stratospheric variability in EC-EARTH, particularly in its version 3.1 that contributes to the Quasi-Biennial Oscillation initiative (QBOi) of SPARC.