

# ***Interactive comment on* “The role of North Atlantic-European weather regimes in the surface impact of sudden stratospheric warming events” by Daniela I. V. Domeisen et al.**

## **Anonymous Referee #1**

Received and published: 11 February 2020

General comments: The paper investigates response in the troposphere in the North Atlantic/European (NAE) region following stratospheric sudden warming (SSW) events in reanalysis data. The study finds that Greenland blocking and Atlantic trough (AT) are more likely weather regimes weeks after SSWs. In addition, the study investigates the role of tropospheric weather patterns during SSW onset in the subsequent tropospheric response. It is found that it is mostly for SSWs with European blocking at their onset that the canonical response of cold surface extremes over Europe is observed weeks following SSWs. In contrast, for SSWs with AT at the onset, mild conditions over NAE region after SSWs are observed. The remaining tropospheric flow patterns at the onset of SSWs were not associated with clear surface response following SSWs.

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Given the large case to case variability of surface responses following SSWs, this study is a step in the right direction in trying to further understand when an SSW is likely to be followed by surface extremes. The paper shows that not all SSWs are followed by anomalous tropospheric weather patterns, therefore suggesting that caution must be exercised when generalising results from composite analysis involving all SSWs. Such knowledge is important for subseasonal to seasonal predictability when trying to assess if the downward impact from SSW is to be expected.

I commend the authors on statistical rigour and strongly encourage to carry out similar analysis (in the future) in the context of sub seasonal to seasonal prediction models where the robustness of the results to sampling uncertainty and the impact on predictability can both be assessed. I recommend this paper for publications and have only very minor comment detailed below.

Specific comment:

It would be helpful if the authors could put their study in the context of previously published studies that assessed which SSWs give stronger response. In particular the persistence and amplitude of lower stratospheric anomalies following SSWs are known to affect surface response (Hitchcock et al, 2013, JCLim; Kodera et al., 2016, JGR; Runde et al., 2016, GRL; Karpechko et al, 2017; QJRMS; Polichtchouk et al, 2018, JAS). For example, is there any evidence to suggest that SSWs that had European Blocking at the onset also have larger and longer lasting anomalies in the lower stratosphere than the other cases?

Technical comment:

P7, L180: “NAM), the number”->“NAM), and the number”

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Interactive comment on Weather Clim. Dynam. Discuss., <https://doi.org/10.5194/wcd-2019-16>, 2020.

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