The paper is a self-contained study of the impact of mesoscale mountain wave-induced temperature fluctuations on the formation of polar stratospheric clouds (PSCs) over the Antarctic Peninsula. A simple parametrization of these episodic and localized wintertime stratospheric negative temperature fluctuations is implemented into the global chemistry-climate configuration of the UM-UKCA (Unified Model - United Kingdom Chemistry and Aerosol) model for two 30-year runs, a perturbation simulation with and a control run without parametrized temperature perturbations. Meaningful results are presented in form of probability distributions of the parameterized cooling-phases which are compared to AIRS observations and high-resolution radiosonde temperature soundings from the Rothera research station. Probably the main result of this study is that adding the parameterized, mountain wave-induced cooling to the resolved temperatures in the UM-UKCA model results in a considerable increase in the number of instances when minimum temperatures fall below the threshold temperatures necessary for the formation of PSCs in the transitional seasons of fall and spring.

The paper is clearly written, contains all information needed to follow the narrative, and the 10 figures are precise and easy readable. Although one could ask oneself why parametrizations like the one presented are necessary in the age of increasing computer power and finer spatial and temporal resolutions of general circulation models, the quantification of mesoscale temperature fluctuations and the evaluation on their impact on stratospheric chemistry are valuable contributions to our knowledge. I have only a few, really minor remarks that could be considered in the revised version of this paper.

line 57: The earliest paper stating the impact of mesoscale mountain waves on the PSC formation is by Ken Carslaw et al. and is worth mentioning here:

Carslaw, Ken et al. (1998). Increased stratospheric ozone depletion due to mountain-induced atmospheric waves. Nature, v.391, 675-678 (1998). 391. 10.1038/35589.

line 107-109: A very supporting paper about the blocking is the early GRL publication by Julio Bacmeister. I think, this contribution was the origin of all considerations using blocking heights in parametrizations. A paper also worth citing, especially, as it considers the same geographical region:

Bacmeister, J. et al., 1990: ER-2 mountain wave encounter over Antarctica: Evidence for blocking, GRL, https://doi.org/10.1029/GL017i001p00081

line 139: The Hersbach et al. ERA5 paper is now online published at the QJ web site: https://rmets.onlinelibrary.wiley.com/doi/10.1002/qj.3803

line 147: replace "km" by "km^2" twice

line 154: Hoffmann with double "nn" at the end

line 224, 235: One dominant characteristics of the mountain wave propagation from the Antarctic peninsula is the frequent occurrence of oblique ray paths. This process might lead to a horizontal shift of mountain wave activity away from the actual sources towards the Drake Passage. I believe, the difference between the AIRS results and the simple, linear mountain wave parametrization as shown in Figure 4 can be easily explained by this process without referring to non-orographic sources. If you hesitate to investigate this aspect in more detail I would at least suggest adding suitable references that point to these well-known processes:

Preusse, P. et al., 2002: Space-based measurements of stratospheric mountain waves by CRISTA, 1. Sensitivity, analysis method, and a case study. J. Geophys. Res., 107(D23), 8178, doi:10.1029/2001JD000699.

Sato, K. et al. (2012).Gravity wave characteristics in the southern hemisphere revealed by a high-resolution middle-atmosphere general circulation model. Journal of the Atmospheric Sciences,69(4), 1378-1396. doi: 10.1175/JAS-D-11-0101.1

There are more papers that also document the oblique mountain wave propagation into the polar night jet that are based on recent results from the DEEPWAVE campaign, e.g.

Ehard, B., et al (2017). Horizontal propagation of large-amplitude mountain waves into the polar night jet. Journal of Geophysical Research: Atmospheres, 122(3), 1423-1436. doi: 10.1002/2016JD025621

Jiang, Q., et al. (2019). Stratospheric trailing gravity waves from New Zealand. Journal of the Atmospheric Sciences, 76(6), 1565-1586. doi: 10.1175/JAS-D-18-0290.1

line 279: I would add " … towards longer vertical wavelengths" before the parenthesis " (Wu ....)". Additionally, the shear calculation by Eq. 2 neglects recent results by the DEEPWAVE campaign about the existence of the "valve" layer:

Kruse, C. G. et al. 2016: The Midlatitude Lower-Stratospheric Mountain Wave "Valve Layer". J. Atmos. Sci., 73, 5081–5100, https://doi.org/10.1175/JAS-D-16-0173.1.

Indeed, how the waves propagate into the stratosphere (vertically as well as horizontally) depends largely and critically on the wind profile as nicely documented by

Bramberger, M., et al. (2017). Does Strong tropospheric forcing cause large-amplitude mesospheric gravity waves? A DEEPWAVE case study. Journal of Geophysical Research: Atmospheres, 122, 11,422– 11,443. https://doi.org/10.1002/2017JD027371