

Atmos. Chem. Phys. Discuss., referee comment RC1 https://doi.org/10.5194/acp-2021-149-RC1, 2021 © Author(s) 2021. This work is distributed under the Creative Commons Attribution 4.0 License.

Review of acp-2021-149

Anonymous Referee #1

Referee comment on "Effects of enhanced downwelling of NO_x on Antarctic upperstratospheric ozone in the 21st century" by Ville Maliniemi et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-149-RC1, 2021

Maliniemi et al. show in their manuscript WACCM model simulations for different greenhouse gas scenarios over the 1850 – 2100 time frame with a focus on NOx descent from the MLT region into the stratosphere and its effect on polar stratospheric ozone. Their main conclusion is, that due to the enhanced descent of NOx in the SH high latitudes, ozone super recovery will not take place over the Antarctic. The study is well conceived, the results clear and convincing. This is a nice focussed study that should be published in Atmos. Chem. Phys. The paper is well written and I have only a few minor specific comments (below) that should be taken into account before publication. I am, however, unsettled regarding the title: "Ozone super recovery cancelled in the Antarctic upper stratosphere", which is a bit of a catchy phrase. I guess the meaning is the counteracting effect of NOx enhancements that cancels super-recovery? Maybe better say so. As Johnson says "where ever you meet with a passage which you think is particularly fine, strike it out" ...

Specific comments

L23: "especially from equatorial lower stratosphere" sounds strange, as ozone is not predominantly transported directly from the equatorial lower stratosphere to high latitudes. Suggestion: "...leads to enhanced transport of ozone to high latitudes, and a reduction of ozone in the equatorial lower stratosphere..." (btw "enhanced" was also spelled wrong)

L35: maybe you can spend a few words, why the descent will be stronger in a stronger vortex. From a dynamical point of view, the opposite may be expected, I believe? Are you referring to a stronger apparent descent of tracers, because of reduced meridional mixing, or is also w-bar-star increasing?

L49: "the mean of ensemble members" = "ensemble mean", or does this mean something different?

L63: My understanding of LOWESS (or LOESS) is that this is a regression method. The abstract of Cleveland & Devlin (1988) states: "loess, is a way of estimating a regression surface through a multivariate smoothing procedure, fitting a function of the independent variables locally and in a moving fashion analogous to how a moving average is computed for a time series." However, as I understand, here you have just used a moving average on the time series? Please provide more details on the method you applied.

L150: "It is clear that stratospheric ClO_x will decrease in the future, following the adoption of the Montreal protocol": It is not precisely clear to me what the meaning of this sentence is. Do you just mean "Following the adoption of the Montreal protocol, stratospheric ClO_x will decrease in the future"? Or: "Stratospheric ClO_x will decrease in the future, if the Montreal protocol is adhered to"?

L152: "following winter darkness when its chemical lifetime is long": why "following"? The lifetime is longest "during winter darkness", not "following winter darkness", or do I misunderstand something here?

L157: "effect on winter weather" is not exactly true: Previous studies showed the largest effect of the Antarctic vortex on SH surface during December, which is mid-summer.

Technical corrections

L91: "there are" -> "there is"

L137: greenhouse