

Atmos. Chem. Phys. Discuss., referee comment RC1  
<https://doi.org/10.5194/acp-2021-149-RC1>, 2021  
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## Review of acp-2021-149

Anonymous Referee #1

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Referee comment on "Effects of enhanced downwelling of NO<sub>x</sub> on Antarctic upper-stratospheric ozone in the 21st century" by Ville Maliniemi et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-149-RC1>, 2021

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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 NO<sub>x</sub> 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 NO<sub>x</sub> 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 counter-acting effect of NO<sub>x</sub> 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  $\bar{w}$  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  $\text{ClO}_x$  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  $\text{ClO}_x$  will decrease in the future"? Or: "Stratospheric  $\text{ClO}_x$  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