Interactive comment on "Drivers of the tropospheric ozone budget throughout the 21st century under the medium-high climate scenario RCP 6.0" by L. E. Revell et al.

M. Lin

Lin et al (2014, Nature Geoscience) demonstrated the important role of decadal climate variability and related circulation changes on tropospheric ozone variability over the subtropical Pacific. Please consider citing Lin et al and discuss their findings in your literature review of various drivers of tropospheric ozone (Introduction).

Thank you for taking the time to comment on our discussion paper. We have included a citation for Lin et al. (2014) in our Introduction:

Ozone can also be transported, either from the stratosphere (stratosphere-troposphere exchange, abbreviated to STE), or within the troposphere on long-range scales. Long-range ozone transport within the troposphere is modulated by decadal climate variability (Lin et al., 2014).

Please also discuss the extent to which changes in atmospheric circulation in the 21st century under RCP6 affect tropospheric ozone?

We have done so at the end of Section 3.3:

Decadal variability will also influence long-range transport of ozone within the troposphere through the 21st century. Under RCP 6.0, there is an increased tendency towards more El Niño conditions (consistent with the findings of e.g. Cai et al. (2014), although they examined RCP 8.5), which is linked with a strengthening of the flow of ozone-rich air from Europe and Asia across the Pacific Ocean towards Hawaii in Northern Hemisphere autumn (Lin et al., 2014). As El Niño conditions become increasingly prevalent, more eastward transport of ozone across the Pacific Ocean may be expected to occur.

Lin, M., L.W. Horowitz, S. J. Oltmans, A. M. Fiore, Songmiao Fan (2014): Tropospheric ozone trends at Manna Loa Observatory tied to decadal climate variability, Nature Geoscience, 7, 136-143, doi:10.1038/NGEO2066.

Regarding the stratosphere-to-troposphere exchange, you might also want to cite the following papers:

Hegglin, M. I. & Shepherd, T. G. Large climate-induced changes in ultraviolet index and stratosphere-to-troposphere ozone flux. Nature Geoscience 2, 687-691 (2009).

Zeng, G., Morgenstern, O., Braesicke, P. & Pyle, J. A. Impact of stratospheric ozone recovery on tropospheric ozone and its budget. Geophysical Research Letters 37, L09805 (2010).

Lin M., A. M. Fiore , O. R. Cooper , L. W. Horowitz , A. O. Langford , Hiram Levy II , B. J. Johnson, V. Naik , S. J. Oltmans , C. Senff (2012): Springtime high surface ozone events over the western United States: Quantifying the role of stratospheric intrusions, Journal of Geophysical Research, 117, D00V22, doi:10.1029/2012JD018151

We have indeed cited two of the above-listed papers in our discussion of stratosphere-troposphere exchange. From Section 3.5:

(b) the overall meridional circulation, the Brewer-Dobson circulation, is projected to strengthen (thus transporting more ozone from the stratosphere to the troposphere) (Hegglin and Shepherd, 2009; Zeng et al., 2010).