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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Evaluating WRF-Chem aerosol indirect effects in Southeast Pacific marine stratocumulus during VOCALS-REx" *by* P. E. Saide et al.

Anonymous Referee #1

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The authors' response describes the novel aspects of their work well, and I find the points 5, 6, and 7 most relevant; the manuscript would gain if these are highlighted. At the same time, I challenge that the approach to switch aerosol wet scavenging on and off reduces WRF-Chem aerosol indirect effect uncertainties; see my response to points 1 and 2 below.

1) "*In our work we go one step further and compare two simulations with different aerosol loads coming from using two different WRF-Chem configurations, both with indirect effects included ... Moreover, as observations are available in the study region,*

we use them to show that the simulation with aerosols loads closer to the observations actually produces cloud properties that are in better agreement to clouds observations.

What is described here is switching one process (wet scavenging of aerosol) in the model on and off. Improved aerosol and cloud properties are diagnosed in the latter case, relative to observations. Then,

"*This fact reduces WRF-Chem aerosol indirect effect uncertainties to a point far beyond the first-order "meteorology with and without indirect effects" question that others have previously addressed.*"

I challenge that switching on/off wet scavenging of aerosol can lead to reduced WRF-Chem aerosol indirect effect uncertainties. After all, the model is still the same, only higher aerosol concentrations are obtained in the latter case because a process that overestimates aerosol removal has been disabled, which results in clouds that agree better with observations - how exactly does this reduce aerosol indirect effect uncertainties?

I also wonder how this leads to a point far beyond the "*meteorology with and without indirect effects question that others have previously addressed*" - a reference to Yang et al. (2011). Yang et al. (2011) coupled the Morrison cloud microphysics scheme to aerosol processes, thereby improved the process representation in the model and showed by comparison to observations that this leads to improved aerosol and cloud properties. I do not support the notion that simply switching a process on and off can go far beyond an actual improvement of the model.

2) "*We quantify how aerosol deposition processes affect aerosols and their impacts on*

clouds in the region."

That's not entirely true, because aerosol deposition is overestimated in the model - what is done is to quantify how the *overestimated* aerosol deposition processes affect aerosols and their impacts on clouds in the region.

References

Yang, Q., W. I. Gustafson Jr., Fast, J. D., Wang, H., Easter, R. C., Morrison, H., Lee, Y.-N., Chapman, E. G., Spak, S. N., and Mena-Carrasco, M. A. (2011), Assessing regional scale predictions of aerosols, marine stratocumulus, and their interactions during VOCALS-REx using WRF-Chem. *Atmos. Chem. Phys. 11*, 11951–11975, doi:10.5194/acp-11-11951-2011.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 29723, 2011.