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Atmospheric Chemistry and Physics Discussions

Interactive comment on "A regional real-time forecast of marine boundary layers during VOCALS-Rex" *by* S. Wang et al.

Anonymous Referee #1

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Review of "A regional real-time forecast of marine boundary layers during VOCALS-Rex"

Simulations using the COAMPS model over the southeast Pacific region are compared to observations (in situ and satellite) during VOCALS-REx to assess model performance and highlight model strengths and weaknesses. The impact of the grid-scale convection is discussed using a nice figure comparing the observed and simulated surface downward LW radiation. The effect of resolution on the near-shore bias, which is also present in many other models, is shown explicitly and demonstrates its impact on the near-shore representation of the MBL (and an associated over-prediction of coastal subsidence and cold air advection).

This work is a valuable contribution to the community and should be published in the

VOCALS special issue in ACPD, but there are several points that must be addressed before it is in its final form.

General comments:

For most of the southeast Pacific, I agree that the comparison is fairly good, but there appears to be some important differences in the model along the coast of Peru that are not really discussed in any detail. The Peruvian coastal jet was also a focus during VOCALS-REx, and so I think that this warrants some attention. While the R/V José Olaya took measurements off the Peru coast from 5-17 October, which is before the simulation period, much of the comparison uses satellite data to compare with the model, and so can be used along Peru as well.

Differences along the coast of Peru include a wind speed that is greater in the model than in satellite data (Fig 2c,d) and the maximum wind in the simulation occurs in late night/early morning while the maximum from satellite data is late afternoon/early evening (Fig. 5, bottom). These seem to be differences worth mentioning. The specific comments below point to the particular locations in the text and offer more details on this general comment, which I hope will improve the discussion.

Specific comments:

18426, line 2-15: I agree that the wind field is generally pretty good between QuikSCAT and the 45-km resolution COAMPS for most of the area (Fig. 2c,d). However, it is important to remark on the wind field along the coast of Peru, which is greater in the model than in the satellite observations. The 15-km grid (Fig. 3c,d) appears to be a bit better. Figure 5 shows some further discrepancies in amplitude and phase along the coast of Peru (detailed in the next two comments). Is the COAMPS data taken for all model output times or just the times of the QuikSCAT passes? This might contribute to some differences, especially in the near-coast region.

18428, line 15-25: The amplitude of wind in the model and observations does indeed

compare well for most locations, except at 80 W; 26 S as mentioned in the text. Offshore of north-central Chile (centered around 23 S; 73 W) the amplitude in wind speed in Fig. 5 (top) is also different. It looks like 1.5-2 m s-1 in the model, but 0.5-1 m s-1 in the satellite. An interesting side note is that at 23 S; 73 W the Muñoz (2008) average PM-AM QuikSCAT winds from 2000-2006 (cf. Fig. 1 in Muñoz 2008) actually seems to agree better with COAMPS than the satellite data presented here. I realize that this is a bit picky since it is a relatively small region compared to the entire southeast Pacific, but it is important because it demonstrates a difference in the offshore extent and amplitude of the diurnal cycle associated with the Chilean coastal jet.

18428, line 28-29: Near the Peru coast, the phase (Fig. 5, bottom) in the model is around 8 AM (light blues), while in the observations it is around 8 PM (dark reds). A 12 hour difference is considerable. Is this a consequence of the smaller amplitude in wind (<0.5 m s-1) that would lead to a weaker signal and thus to more uncertainty in when the maximum occurs? If this is the case, it should be mentioned in the text or only data that is statistically significant should be plotted so the reader better understands how robust this phase is.

18430, line 11-13: For 15 days the model predicts more or less the same MBL height offshore. Does COAMPS show large changes in the MBL offshore during synoptically active periods (e.g., on 23 Oct. the C130 measured heights $\sim$2 km at 83 W)? If not, what would cause the consistently stable MBL height? Is it from weaker synoptic forcing in the model? If the synoptic variance is indeed much smaller, this would imply that the total variance (diurnal + synoptic) is dominated by just the diurnal component.

18431, line 11-23: It is not clearly stated if these estimates (temperature, MBL slope) come from COAMPS or observations. Bretherton et al. (2010) calculate the change of vg in the same manner using a composite of RHB observations. Perhaps a direct comparison using data from just COAMPS to the calculation from observations presented in Bretherton et al. (2010) would be a good addition to help build the discussion.

18432, line 20: Another observation is that the wind direction is $\sim$180° in the observations and $\sim$210° from the model. The difference in the model's wind direction contributes to an onshore component. For example, a 4 m s-1 wind speed from 210° has a 2 m s-1 onshore component. Does the modeled zonal wind become more southerly with higher resolution and resemble the observations more?

18435, line 6-11: Are these comparisons taken between 89-80W like the previous figure?

18441, line 29: Did a higher vertical resolution also help improve the simulation of the thin stable layer present at 1450 LST (Fig. 15a)?

Minor editing and technical points:

18422, line 3: Is 'Woods et al. 2006' meant to be 'Wood et al. 2007'

18422, line 16: Is Wang et al., 1994 meant to be 1993?

18422, line 18: Is McCaa and Bretherton, 2003 meant to be 2004?

18435, line 8: Typo: 'biase' should be 'bias'

18439, line 20 and 25: Change 14:45 to 14:50 to be consistent with both the time listed previously and also the time used in the corresponding figure.

18443, line 20: Missing reference for Rahn and Garreaud (2010).

References: Could not find a reference in text for: Bretherton et al. (2004), Hignett (1991), and Klein et al. (1995).

Fig. 5: Make note of the different scale used in the correlation (center row) from the previous figure; it changes from 0-1 to 0-0.5.

References:

Bretherton, C. S., Wood, R., George, R. C., Leon, D., Allen, G., and Zheng, X.: Southeast Pacific stratocumulus clouds, precipitation and boundary layer structure sampled

along 20 S during VOCALS-REx, Atmos. Chem. Phys. Discuss., 10, 15921-15962, doi:10.5194/acpd-10-15921-2010, 2010.

Muñoz R. C., 2008: Diurnal cycle of surface winds over the subtropical southeast Pacific. J. Geophys. Res., 113, D13107, doi:10.1029/2008JD009957.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 18419, 2010.