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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Advances and limitations of atmospheric boundary layer observations with GPS occultation over Southeast Pacific Ocean" *by* F. Xie et al.

Anonymous Referee #1

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This article provides a detailed account of the strengths and weaknesses of using GPS radio occultation (RO) to obtain the depth of the atmospheric boundary layer (ABL) over the subtropical southeast Pacific Ocean. An important contribution of these measurements is an independent measurement of the distribution of ABL height over the southeast pacific with a sufficient sample size to construct a regional climatology, which is shown to be significantly different than that of the ECMWF. The known limitations and areas of uncertainty are an important aspects of this paper that inform potential users of the weaknesses of the method. Overall, it is suitable for publication in ACP, but several issues detailed below should be addressed first.

General Comments

An important component of this study is that the distribution of ABL height over the southeast Pacific has substantial differences with the ECMWF. Is the ECMWF climatology constructed using the output at one time of day (e.g., just the 00 UTC analysis) or does it use all analysis times? Also, as a contrast to this study, it might be worthwhile to mention the recent article by Guo et al. (2011) in the Journal of the Atmospheric Sciences. They used a slightly different method to find the ABL height ('break point method') and show the global ABL height distribution. Radiosonde data from the island of St. Helena (16.0°S, 5.7°W) was used as their validation. They claim that the spatial pattern of the ECMWF does indeed agree with the spatial pattern from their ABL retrieval, but the ECMWF still had a low bias. Do the authors have any comments on this?

Since only 25 of the 190 radiosonde profiles during VOCALS-REx were near-coincident to quality-screened RO soundings, this leads to a small sample size for a comparison, which is already acknowledged by the authors. To increase the sample size of radiosonde observations that are collocated with the RO locations, the authors might want to consider using additional soundings from two cruises to the SE Pacific in 2006 and 2007 when there is also available data from the COSMIC RO. Information and data are available at the Tropical Eastern Pacific Synthesis webpage at the following address: http://people.oregonstate.edu/∼deszoeks/synthesis.html

In Fig. 8 there is a problem of an artificial decrease near the coast of the percentage of soundings that penetrate below 500 m due to the land eliminating possible soundings. Is there a way to alleviate this problem since we know what fraction of the bin's area is covered by land? Otherwise, the figure is misleading and does not give a good representation of the penetration near the coast.

Apart from the science, the general structure and organization is adequate, but there are several places where the writing could be improved or clarified. I offer some editing

help in the specific comments, but it is not an exhaustive list of corrections.

Specific Comments

22858, line 26: Do you mean that *despite* the decreasing number of soundings at low latitudes and the lower percentage of soundings that penetrate into the lowest 500 m there are small sampling errors in the mean ABL climatology? It reads as if those factors imply small sampling errors, which does not seem to make sense.

22859, line 7: Include temperature in “shallow inversion layer.”

22860, line 17: I do not know what ‘future remarks’ means. Do you mean remarks and future studies/work?

22860, line 15: Change present to presents. There are disagreements for other noun/verb pairs in the paper as well (22863 line 24, 22864, line 16, 22873 line 14, etc.). Please double check the grammar.

22862, line 21: Remove “less steeper”

22868, line 4 and 8: Units missing

22868, line 5: Typo: radiosndes

22869, line 20: What is a ‘GO simulation’?

22870, line 17: ‘to detect’ should be ‘of detecting’

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 22857, 2011.