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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Evaluating transport in the WRF model along the California coast" *by* C. Yver et al.

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General comments:

The discussion paper describes simulations with several different model configurations and evaluates them against ACARS data. The topic is interesting and appropriate and the analysis is generally sound. It is based on relatively long simulations that explored a number of configuration issues. It is very commendable that the evaluation considers vertical profiles, not merely surface data. I think the paper should be published after some refinements to the presentation to make it clearer and more useful.

The evaluation shown primarily considers monthly (or longer) averaged mean quantities or monthly averaged diurnal cycles. Since the transport phenomena of interest

are somewhat episodic, it is important to also evaluate the variation of the results, for example on a day-to-day or synoptic basis. Specific suggestions are below but should not be considered complete. This will require recasting many of the figures to remove extraneous simulations or symbols and adding error bars, or adding panels to show standard deviations or percentiles. In general, the figures attempt to show too much in each individual figure at the expense of legibility.

Specific comments:

Introduction: A number of papers have been recently published or are in press on modeling for the CalNex field campaign. It would be helpful to readers to cite some of these papers, for example [Fast and Coauthors, 2011] and [Angevine et al., 2012].

Section 2.1, line 70: Why only 28 levels? How much compression is used?

Section 2.2, line 90: The PBL has a distinct diurnal cycle only over land, the diurnal cycle over water may be diminished, non-existent, or even reversed.

line 103: The more recent reference for MYJ is [Janjic, 2002].

Line 108: TEMF is a non-local scheme.

Section 2.4, second paragraph: The descriptions of the NAM and ERA-Interim products are unclear. Is the NAM used an analysis or forecast? ERA-Interim is a reanalysis, that is, an analysis using a fixed model configuration.

Section 3.1: Something should be said about the ACARS data in terms of sampling and quality. A major issue with ACARS is that the data are taken on slant paths during aircraft ascent and descent. In complex terrain situations, which these definitely are, this can be quite important. When comparing to coarse model output, on the other hand, it may not matter. As for sampling, are the numbers of samples in each vertical bin (including the surface) roughly the same? Is there a diurnal cycle in sampling, in other words, are some times of day sampled more than others? Finally, do the "surface" data (chosen here to be >990 hPa) agree with standard surface data from the same

ACPD

12, C4848–C4851, 2012

airports?

Line 205: It is better practice to use local standard time or UTC rather than daylight saving time.

Line 226: The model misses the land breeze in August according to the presented mean or median (which is it?). Is it always missed? This is a place where some presentation of the variation of the result would be very helpful.

Line 243: A "wind inversion" is mentioned here and in several following places. This is not a standard term. The simulated winds are stronger in a shallow layer near the ground than in the (poorly resolved) measurements. Again, some presentation of the variation in the simulations would be helpful in determining whether this is, for example, a low-level jet that is sampled differently in the simulations and measurements. The distance between upper and lower quartiles of the measurements is shown.

Line 300: The conclusion that nesting down to 800 m does not improve the results is consistent with other findings in the literature. However, it should be noted that this may not be an optimal test. The 800 m domain is very small, which with one-way nesting may mean that its solution is dominated by the coarser boundary conditions. It is also nested at a factor of 5, rather than the recommended factor of 3. It should also be noted that the model physics may not be reliable at very fine resolutions, especially for convective boundary layers.

Section 4.4: The point that it is not appropriate to run tracers in WRF (except in WRF-LES) because they are not properly handled by the physics is an important one. However, the erroneous results need not be shown. At most one such result could be included in figure 7 as a caution to other WRF users.

Line 366: When the sea breeze is present, the diurnal cycle of PBL height is not likely to follow the canonical inland shape. The PBL height at SIO is probably not the same as at SAN in reality, even if it is in the simulations. The PBL over the ocean has little or

ACPD

12, C4848–C4851, 2012

no diurnal cycle. The explanation here should be clarified.

Lines 396-401: The presentation is unclear. Perhaps a table of station pressures would help.

Line 402: Can we be confident that the air mass is actually recirculated? This is quite difficult to establish by looking at wind vectors. Some kind of trajectory analysis would be more convincing.

Line 408: The LAX winds are from the east only for the main event, not for the other periods shaded in gray.

Line 409 and 411: The use of "elevated" in this context is confusing. It would be better to use "stronger" so that there is no confusion between speed and altitude.

Line 414: Are the surface observations at SAN as variable as the ACARS data?

References: Angevine, W. M., L. Eddington, K. Durkee, C. Fairall, L. Bianco, and J. Brioude (2012), Meteorological model evaulation for CalNex 2010, Monthly Weather Review, in press.

Fast, J. D., and Coauthors (2011), Transport and mixing patterns over Central California during the Carbonaceous Aerosol and Radiative Effects Study (CARES), Atmos. Chem. Phys. Discuss., 11, 29949-30008.

Janjic, Z. (2002), Nonsingular implementation of the Mellor-Yamada level 2.5 scheme in the NCEP meso model, in NCEP Office Note 437, edited, p. 60.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 16851, 2012.