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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Transport and dispersion of atmospheric sulphur dioxide from an industrial coastal area during a sea-breeze event" *by* C. Talbot et al.

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The authors thank the ACP journal for letting us reply to the comments of the anonymous referee#2. We also thank the referee#2 for reviewing this article but we do not agree with his main comments. Before discussing them, we first regret that this referee replied at the very end of the period for the open discussion because this scientific exchange could have been fruitful for the paper. We are secondly astonished by the abrupt tone of his answer, which is not necessary for communicating scientific comments from our point of view.

The main reproach is that the current ACPD article would be a duplicate of our previous paper published in Boundary-Layer Meteorology (BLM), namely "Impact of a sea

breeze on the boundary-layer dynamics and the atmospheric stratification in a coastal area of the North Sea". The ACPD article certainly follows on our previous article but is certainly not its restriction. This ACPD paper is indeed the second part of a study concerning the consequences of the sea-breeze occurrence in an industrial region. The aim of the first paper (BLM) was to validate a simulation of the sea-breeze from a structural point of view (TIBL, sea-breeze front etc.), by using remote sensing measurements (lidar and sodar) and ground measurements. This ACPD paper concerns the potential impact of the sea-breeze on the regional pollution and we discussed that the sea-breeze created an elevated reservoir of pollution which remained close to the emission sources after the sea breeze until the next day. This reservoir has thus potentially participated to the pollution and photochemistry of the following day. These new results have not been discussed in the previous BLM paper or other works to our knowledge. In this study, SO2 is only used as a tracer but the post-breeze reservoir mechanism opens new questions about the associated chemistry. We thus discuss the potential chemical mechanisms but the whole chemistry is out of the scope of this study and deserve a specific analysis including the whole set of emissions inventory and background concentrations at a regional scale.

The reference campaign went on 4 days on September, 2003. Contrary to the referee#2's assertion, the BLM article only concerns the first day of this campaign (September 15th) and not the entire campaign of measurements (4 days). This day was chosen mainly for two reasons. On one hand, the southerly synoptic wind represents the most frequent meteorological conditions before the sea-breeze onset as stated by a three-year study and is thus typical. On the other hand, the first day has been studied because the atmospheric state is clear before the breeze and thus we are just looking at the sea-breeze effects. The campaign indeed showed that the atmospheric stratification (with lidar observation) gets more and more complex as the number of sea-breeze events increases.

The referee#2 also suggests studying the SO2 measurements from the air quality net-

ACPD

7, S9101–S9104, 2008

work for the whole campaign. From the previous points, it is clear that our goal is not to give climatology of pollutants under sea-breeze events, but rather examine the pollutants evolution according to dynamical features. Moreover, such a statistical study would need more than 4 events to be representative and a specific study with appropriate tools.

Concerning the model, the referee#2 asks if the model performs well. This point has been discussed extensively in the previous BLM paper which showed that the model well predicts the structure and the dynamics! This validation has been done by comparing the model with remote sensing instruments (lidar and sodar) for the first day of the campaign. This shows that the sea-breeze system well transports, mixes and redistribute the pollutants in this sea-breeze system. So, the model used in this ACPD paper has been demonstrated to be quite reliable and this question amazes us.

Concerning the passive tracers, the simulations are quite different in the BLM and ACPD papers. In BLM paper, passive tracers have been emitted with the same properties than ambient air from 2 punctual sources only during 4 hours - not less and not more. This was done for studying the redistribution of pollutants during the sea-breeze acceleration. The ACPD paper (as discussed previously) has a more realistic emission scheme with pollutants of molar mass of sulphur dioxide and which were emitted continuously during the whole sea-breeze day. Here we must also notice that the real description of pollutants does not exist since the model inputs rely on the inventory (averaged quantities) and moreover the plume direction and dispersion cannot be simulated accurately with reasonable spatial scale. It is thus unrealistic and useless to demand that the measurements well corresponds to the simulated quantities. Concerning the chemistry part: The H202 reaction with gaseous HSO3 could have been be presented in the paper but wasn't since this specie isn't abounding in the atmosphere. It can be effectively important to mention sea salt aerosols. These aerosols contain Cl- and Br- ions which can activate with contact of halogens. Halogens catalyse loss of ozone concentrations and degradation of VOC (Adams and Cox, 2002). Adams, J. W.,

ACPD

7, S9101–S9104, 2008

and Cox, R. A.: Halogen chemistry of the marine boundary layer, Journal De Physique Iv, 12 (PR10), 105-124, 2002.

Finally, the copyrights point concerning figures 3 and 8c isn't a real problem and it can be solved easily.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 15989, 2007.

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7, S9101–S9104, 2008

Interactive Comment