

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.

Anonymous Referee #1

Received and published: 21 November 2007

General Comments

This paper compares the distributions of SO₂ from ground based measurements and a high resolution 3D modelling simulation for a day on which a moderate sea breeze was identified. The impact of the sea breeze on the distribution of SO₂ is analysed. It is found that before the sea breeze onset SO₂ is advected offshore by the synoptic scale flow. The onset of the sea breeze reverses the wind and the lower branch of the sea breeze circulation advects this SO₂ back onshore. SO₂ is lifted at the sea breeze front and is then advected offshore by the upper branch of the sea breeze circulation. Evidence of transport of pollutants by the sea breeze circulation is not new. However, the assertion that the sea breeze circulation acts to keep SO₂ close to its source

and hence can lead to an amplification of air pollution the following day is new and interesting.

Specific Comments

- Why was 15 September 2003 chosen as the case study? Is there any motivation for this choice? Is this a typical sea breeze event?
- When giving an overview of the case study it would be helpful to provide a synoptic chart showing the synoptic flow pattern for this specific case study.
- How is the sea breeze identified? Are other variables such as temperature, humidity and gustiness used or only wind speed and wind direction?
- In the introduction extreme values for rain PH and SO₂ concentrations are given. It would be useful to have some average rain PH and SO₂ values to compare to.
- I'm unsure what is meant by 'the sea breeze front brought up air masses from the gravity current in the above layers'. Could this be explained better?
- How is the upper highly reflective layer measured? What does it represent? Is it a proxy for the top of the gravity current?
- Which part of the sea breeze circulation does the term headwind refer to? Is this the upper branch of the circulation which is advecting air offshore?
- How are the SO₂ concentrations normalised in figure 5?
- Why are comparisons between measured and modelled SO₂ concentrations only shown for two sites? Does the model capture the peak in SO₂ seen at the seashore site (DK3)?

Full Screen / Esc

Printer-friendly Version

Interactive Discussion

Discussion Paper

- I don't understand how pollution can be channelled up to the sea breeze front (line 26, section 5.1). From figure 7 there does not appear to be any low-level convergence.
- What causes the layering of gas and aerosol pollutants above the sea breeze circulation?
- What does the lidar measure? Are the positive and negative values in figure 8(c) aerosol layers? Could the coastline be marked on this figure?
- Most of the SO₂ appears to have been advected large distances from the source regions in figure 9. If this is the case how can it contribute to the photochemical activity at the start of the next day? It would be interesting to calculate by how much the SO₂ concentrations are enhanced the following day due to the sea breeze circulation. More evidence is needed to support the conclusion that the SO₂ is recycled the next day and thus adds to the pollution levels.
- The cumulus cloud in figure 10 appear to be 1 gridpoint only. Does this mean that it is < 1km wide and <60m thick? Better vertical resolution is needed to identify clouds this as a cloud. There is also another grid point further inland showing high condensed water, this is not referred to.
- In the conclusions you state that you have made comparisons between the model simulations and the sodar observations. Are these comparisons discussed in the paper?
- Have you done any correlations between surface measurements and simulations of SO₂ or only qualitative comparisons? In the conclusions you state that correlations have been made.
- The modelled vertical distribution of SO₂ (figure 8(b)) does not show the multi-layer structure seen in the lidar measurements (figure 8(c)). Why is this? In the

conclusions you state that the model does generate these layers.

Technical Comments

- For clarification, does a south east wind refer to a wind coming from the south east (i.e. south-easterly) or a wind towards the south east (south-eastwards)? Several different terms are used to describe wind direction in the paper, should one be used for consistency?
- Should 'coming offshore' read, 'advected onshore' in line 22, section 2.2?
- It would be easier to compare the surface and low-level SO₂ concentrations in figures 6(a) and 6(b) if the same colour scale were used in both figures.
- In figures 6,7,8,9 and 10 it is very difficult to see the wind vectors and there is no scale for the vectors. Also the dark blue colour is used to represent two values, this is confusing.
- What do the dashed contour and block arrows refer to in figure 7? They are not referred to in the figure caption or in the text.
- Can the coastline be plotted on figure 8(a) for reference. The black dots and colour scale on figure 8(a) are also too small to see.

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