

Interactive comment on “Ozone over the Western Mediterranean Sea – results from two years of shipborne measurements” by K. Velchev et al.

Anonymous Referee #2

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This paper presents valuable results of ozone measurements made from a cruise ship making regular transects across the Mediterranean during two summers. The data and the analysis presented in this paper fill a gap in knowledge about how tropospheric ozone from various sources around the Mediterranean region influences the area over the open sea. Although ozone data from land regions around the Mediterranean and from island locations primarily in the eastern portion of the Mediterranean have been reported, this work provides new information for the western portion of the sea. Emphasis is placed on the meteorological influences that control both the larger and smaller scale patterns that are seen in the data. Chemical processes for ozone production and loss (primarily titration by NO) are assumed to take place primarily on or near the coast and the shipboard observations thus reflect the various processes that transport air over the open water.

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This work provides useful new information on the distribution of ozone over a region that is subject to significant high ozone events. The ozone data are presented in composite form averaged over the entire ship track or season. These are useful composites and as mentioned in the text they show a strong degree of consistency between the two years. Much of the discussion is based on composited meteorological information as well. It would be helpful to show an illustrative example of the ozone from an individual ship cruise to get some sense of what the data look like before they are all averaged together. It would be particularly interesting to see a cruise leg that includes both day and night observations even though there is some mixing of differences due to night and day and spatial variation. Based on the data from the island stations a weak diurnal variation is projected for the ship data. Was this verified by segregating the day and night data where they are available? Some of the figures have painfully small print in the labeling that makes them very hard to read, particularly figures 4, 6, and 7–11.

In Section 4.1 there are several descriptions of the meteorological situation that are difficult to follow. On page 6140 lines 17–19 it is not clear what the differences in the characteristics of the anticyclones are that described factors in determining the ozone distribution. On page 6141 line 23 the composite map of figure 8 does not convey to me any particular pattern of vertical velocity that is significantly different between the high and low ozone cases. In both cases it seems like a patchwork pattern of upward and downward vertical velocities that I could not connect to particular ozone features. I did not find this figure useful in explaining differences in ozone. In the discussion of figure 10 I am surprised that the relatively coarse resolution meteorological data can diagnose the diurnal cycle generated by the sea-land breeze circulation. Perhaps this circulation occurs at a larger scale than I normally associate with this phenomenon. On page 6144 line 1 refers to figure 8 but I believe that should be figure 10.

In Section 4.2 on page 6144 there is a discussion of the “large scale anticyclone” interacting with the “regional summer anticyclone”. Are these features identifiable in the

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maps in figure 7? If so, this figure should be referred to in order to get a better feel for this interaction since the position of the anticyclones is not obvious to me from the trajectories alone in figure 11. In general (not just in the case cited above) it would be helpful to have a visual connection to the location of the circulation features being described in the text. I found it somewhat difficult to locate geographically the positioning and interaction of these features when reading the text. In figure 12 it is difficult to locate the starting point (Savona) for the back trajectories and the yellow trajectory is barely visible. What is the starting altitude (at Savona) for these back trajectory calculations?

The connections between various meteorological regimes and the ozone measurements described in the manuscript are somewhat qualitative in nature but provide useful information by trying to establish some general relationships. A weakness of the paper is that the descriptions of the circulation patterns and their connection to ozone levels are sometimes difficult to follow even with several readings of the text. Perhaps a little less detail in describing the meteorological features would make it easier to follow.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 6129, 2010.