THE IMPACT OF EMISSIONS FROM SHIPS ON PHOTOOXIDANT PRODUCTION IN THE MEDITERRANEAN - A CASE STUDY

Problem

A large fraction of the world wide cargo transport by ocean going ships happens in the Mediterranean. These ships are emitting a considerable amount of gaseous and particulate matter including precursors of photooxidants.

Since January 1997 continuous ozone measurements have been carried out at Gozo, Malta (see the poster by Nolle et al.). Figure 2 gives daily cycles of the ozone concentration during an episode that occurred in 1998. During July 24 until July 26 the maximum ozone concentrations reach up to 90 ppb although the average surface wind direction during daytime was between 270 and 340 degree. Since the emissions of the islands can be excluded in that case, we addressed the following question:

Can ship emissions produce such high ozone values?

Method

We carried out numerical simulations with the comprehensive mesoscale model system KAMM/DRAIS (Vogel et al., 1995) to quantify the photooxidant production in the vicinity of Gozo (Fig. 1) on the local scale. The model considers transport processes and the relevant chemical transformations. The horizontal grid size used in this study is 925 m in East-West direction and 750 m in North-South direction. 25 vertical layers are used up to the top of the model domain which is at 8000 m above sea level. Only emissions by ships were taken into account. EMEP (http://webdab.emep.int) data was used.

Results

• A strong wind shear occurred on July 25, 1998 (Fig. 3). Stable stratification prevails at the sea during the whole day.
• The islands of Malta are modifying the airflow. This leads to increased turbulence.
• Ozone that is produced at higher elevations over the sea is mixed downward by this increased turbulence over Malta.
• The emissions along the ship route increase the ozone concentration by more than 20 ppb.
• We need more detailed information about the exact location of the ship routes.

References