EMS Annual Meeting Abstracts
Vol. 13, EMS2016-771, 2016
16th EMS / 11th ECAC

Coastal ozone in sea breeze circulation: episode analysis by mean of aircraft measurements and mesoscale modelling in Naples

Sandro Finardi (1), Daniele Gasbarra (2), Giuseppe Calori (1), Alessio D'Allura (1), Beniamino Gioli (3), Giuseppe Agrillo (2), Pantaleone Carlucci (2), Luca Shindler (2), and Vincenzo Magliulo (2)

(1) ARIANET Srl, Milano, Italy, (2) CNR/ISAFOM, Ercolano, Italy, (3) CNR/IBIMET, Firenze, Italy

Persistent high pressure ridges of African origin affect the Mediterranean basin during summertime causing heat waves and favouring the occurrence of ozone episodes. The weak synoptic forcing favours the development of sea breeze circulation that influences ozone production and transport giving rise to complex recirculation patterns.

Airborne observations have been performed during an ozone episode occurred on 15-16 July 2015 over the coastal region of Naples, which is one of the largest and densest conurbations in the Mediterranean basin, accounting over 3 million inhabitants. Measurements were performed at an average height of 150 m a.g.l. along a square track enclosing Naples, its gulf, and the Vesuvius. The SkyArrow/ERA aircraft provided vertical profiles at the square track vertexes up to a height of 1500 m a.s.l. Measurements are compared with high resolution meteorological and air quality model simulations to investigate local circulation and pollutants dynamics.

The main atmospheric flow features are correctly reproduced by WRF. Differences between modelled and measured winds are observed during the morning transition period and in the wake of Vesuvius. Observed and modelled ozone concentrations show general coherence, with higher spatial detail provided by airborne measurements. Sea breeze and local emissions give rise to production of ozone inland of Naples, causing high concentrations over the region located between the coast and the Apennine chain. Ozone is then injected in the upper boundary layer and transported towards the sea by the wind rotation occurring above 500 m a.s.l. causing a complex vertical layering of concentration, with maximum measured values between 500 and 800 m. The vertically growing ozone concentration profile is also contributed by the decrease of the boundary layer depth occurring when the breeze front reaches the inland area carrying NO_x from the densely populated coast and favouring titration effect near the surface.