Continuous observations of CO_2, CH_4 and O_3 in the boundary layer of the central Mediterranean basin

Paolo Cristofanelli[1], Alcide Giorgio Disarra[2], Francescopiero Calzolari[1], Maurizio Busetto[1], Salvatore Piacentino[2], Damiano Sferlazzo[2], Tatiana Di Iorio[2], Giandomenico Pace[2], Daniela Meloni[2], Francesco Monteleone[2], Dario Filardo[3] and Paolo Bonasoni[1]

[1] ISAC, National Research Council of Italy, Bologna, Italy, p.cristofanelli@isac.cnr.it

[2] ENEA, Laboratory for Observations and Analyses of Earth and Climate, Italy

[2] IAMC, National Research Council of Italy, Torretta Granitola, Italy

Southern Europe and the Mediterranean basin are recognized as hotspot regions both in terms of climate change and air quality, also representing a major crossroads of different air mass transport processes. In particular, large amounts of anthropogenic pollutants emitted in continental Europe are transported towards the basin. Meteorological conditions such as frequent clear sky and high solar radiation in summer enhance the formation of photochemical ozone (O_3) due to the availability of natural and anthropogenic precursors. In particular, large amounts of anthropogenic pollutants emitted in continental Europe are transported towards the basin where intense photochemical O_3 production occurs. Ricaud et al. (2014) have shown that the meteorology in the Mediterranean basin favors a western basin enriched for instance in methane (CH4) compared to the eastern basin. Widespread open biomass burning further exacerbate air quality and the impact of anthropogenic emissions on the regional climate.

In this work, we will compare and discuss continuous CO_2, CH_4 and O_3 observations carried out in the boundary layer of the central Mediterranean basin at Lampedusa and Capo Granitola (Italy), where two WMO/GAW regional stations are located. Lampedusa (LMP: 35.5182°N, 12.6305°E, 45 m a.s.l.) is a small island located in the hearth of the central Mediterranean Sea. Here CO_2 and CH_4 continuous measurements are carried out together with flask monitoring programmes since 1992 and 1994, respectively. Near-surface O_3 is measured since 2015.Capo Granitola (CGR, 37.66670°N 12.65000°E; 5 m a.s.l.) is located at the southern Sicily coastline facing the Strait of Sicily, at Torretta Granitola (12 km from Mazara del Vallo, 52,000 inhabitants). At this station CO_2 and CH_4 observations are carried out since 2015. Both the measurement sites are equipped with CRDS instrumentation for CO_2 and CH_4 measurements (Picarro G2401), while near-surface O_3 is measured by UV-absorption technique. All the measurements are referred to WMO calibration scales.

The main aim of this work is to compare the variability and average levels of these greenhouse gases over the period for which simultaneous measurements are available. Moreover, we will investigate special events as well as measurement periods representative of the atmospheric background to identify and quantify processes affecting CO_2, CH_4 and O_3 variability in the central Mediterranean basin.

References

P. Ricaud et al., Impact of the Asian monsoon anticyclone on the variability of mid-to-upper tropospheric methane above the Mediterranean Basin, Atmos Chem Phys., 14, 11427-11446. doi:10.5194/acp-14-11427-2014