

#### **4.114 Processes driving the chemical variability over the Mediterranean basin: results from the GLAM campaign as compared to chemical-transport models and analysis.**

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Abstract:

The objective of the GLAM (Gradient in Longitude of Atmospheric constituents above the Mediterranean Basin) airborne campaign was to evaluate the summer impact of the Asian Monsoon Anticyclone onto the Mediterranean Basin (Ricaud et al., 2014, ACP). Performed during 6-10 August 2014, tropospheric pollutants, greenhouse gases and aerosols over the Mediterranean Basin were densely sampled along W-E transects at 5 and 9 km altitudes, with additionally vertical profiles (0-12 km) in the vicinity of Menorca, Lampedusa, Heraklion and Larnaca airports (Ricaud et al., 2018, BAMS). Considering the O<sub>3</sub>, CO, CH<sub>4</sub>, CO<sub>2</sub> and H<sub>2</sub>O measurements sampled between 3°E (Menorca, Spain) and 33°E (Cyprus), the W-E gradient is atypical when compared to the climatology. Fine structures echoed consistently between species are interpreted as signatures of biomass burning, stratospheric intrusions and ozone depleted air masses with a remote maritime origin. We compared GLAM results against the Copernicus Atmosphere Monitoring Service (CAMS) models, the Météo-France MOCAGE chemistry transport model models, and the NASA Modern-Era Retrospective analysis for Research and Applications version 2 (MERRA-2). The results with the evaluated biases are provided. Nevertheless, GLAM some anomalies are not echoed in the models/analysis and the tested MOCAGE downscaling

does not reduce bias significantly. The origin of the GLAM chemical species are determined using backward trajectories from Hybrid Single-Particle Lagrangian Integrated Trajectory model (HYSPLIT). These trajectories combined to chemical-transport model or analysis results are allowing to trace a chemical history of air masses.

The variability of the tropospheric chemical composition observed during GLAM is driven by the long-range transport (from Asia, from Africa through the North Atlantic and from North America), the downward motion of subsiding air aloft and a stratospheric intrusion, in which strong subsidence mechanisms interplay (Dayan et al., 2017, ACP) leading to an unexpected chemical W-E gradient.