On the use of IAGOS 20-years database for evaluating and analysing chemistry-climate simulations

Yann Cohen (1,2), Virginie Marécal (1), Béatrice Josse (1), and Valérie Thouret (2)

(1) Centre National de Recherches Météorologiques, Université de Toulouse, Météo-France, CNRS, Toulouse, France, (2) Laboratoire d'Aérologie, Université de Toulouse, CNRS, UPS, Toulouse, France

Chemistry-transport models (CTMs) and chemistry-climate models (CCMs) are essential tools for understanding the atmospheric composition, for providing information where measurements are lacking, and for predicting air composition future evolution. In the framework of the CCMI (Chemistry-Climate Model Initiative) intercomparison project, the REF-C1SD global simulation generated by each of the 20 CCMs/CTMs aims to model as realistically as possible the tropospheric and stratospheric compositions in recent climate years (1980 – 2010). The ability of these simulations to reproduce atmospheric composition has to be evaluated, using observation data sets as reference tools, in the troposphere, in the stratosphere and in the UTLS (upper troposphere – lower stratosphere), the latter being a key region, regarding both the ozone radiative forcing and stratosphere – troposphere exchanges. Specific to this region, the whole IAGOS (In-service Aircraft for a Global Observing System) cruise dataset (Aug. 1994 – Dec. 2016) from commercial aircrafts has not yet been used for the comparison with any long-term simulation. Their high spatial and temporal resolutions contrasting with the models coarse vertical resolutions and the monthly resolution of their outputs has required the development of a new method for mapping the IAGOS data onto the models grid, in order to generate a monthly-averaged field from observations directly comparable with the modelled chemical fields. This method has only been applied yet to the REF-C1SD simulation of MOCAGE CTM (CNRM, Meteo-France).

In this presentation, we explain the details of the method developed. Then, we compare IAGOS dataset mapped on MOCAGE grid on a monthly basis to MOCAGE REF-C1SD outputs. We found a good agreement between the simulation and the observations for ozone (O_3) and carbon monoxide (CO) climatology maps and for vertical profiles in the UTLS above 8 regions in the northern-hemisphere mid-latitudes well sampled in IAGOS database. We also compare and analyse the mean seasonal cycles in the upper troposphere and the lower stratosphere. We found a good agreement regarding the O_3 cycles in the lower stratosphere and regarding the CO cycles in the upper troposphere.

This evaluation work based on the new method proposed here could be extended to evaluate the REF-C1SD simulations from the CCM-I models other than MOCAGE. This tool can also be regarded as a potential new IAGOS product.