Session: C15 Poster: T21B

PREMIER - Impact of new satellite measurements on chemistry-climate model validation

Michaela Hegglin[†]; Brian Kerridge; Jack McConnell; Donal Murtagh; Johannes Orphal; Vincent-Henri Peuch; Martin Riese; Michiel Van Weele
[†] University of Toronto, Canada
Leading author: michaela@atmosp.physics.utoronto.ca

PREMIER (PRocess Exploration through Measurements of Infrared and millimetre-wave Emitted Radiation) is one of the three candidates for ESA's 7th Earth Explorer Core Missions. The mission proposes high temporal and spatial measurements of the atmospheric trace gas distributions in the mid/upper troposphere and lower stratosphere in order to yield unique insight into the chemical, dynamical, and radiative processes controlling them in this height range of particular importance to climate. PREMIER would consist of two limb sounders, one measuring in the infrared (IRLS) with 3D capability, and the other in the millimetre-wave range (MWLS), which would enable observations in the presence of most cirrus clouds. In this contribution we will discuss how PREMIER's measurements would lead to improvements in the validation of chemistry-climate models (CCMs) in the upper troposphere/lower stratosphere. Validation of CCMs in this region has been proven to be difficult, hampered by the low quality of available observations as a result of sampling biases, cloud interferences, or too low vertical and horizontal resolution smearing out the sharp gradients observed in tracer distributions across the tropopause. Our approach uses†synthesized observations of PREMIER and other current limb sounders obtained by subsampling chemical fields of a state-of-the-art CCM according to the different instruments' spatio-temporal sampling patterns. These observations are then used to produce climatologies commonly used as CCM validation diagnostics such as seasonal cycles or vertical profiles, and compared to the corresponding climatologies derived from the full CCM fields. The differences in the climatologies of the subsampled and full fields are solely attributable to sampling biases. Imposition of randomized and systematic errors on each profiles in a second step yields insight into how the climatologies are influenced by these instrument characteristics. The results show PREMIER's ability in improving the explanatory power of CCM validation diagnostics when compared to other instruments.