Dragon 2 Project 5311

Kyrölä, Erkki[1]; Kyrölä, Erkki[1]; Liu, Yi[2]
[1]Finnish Meteorological Institute, FINLAND; [2]Key Laboratory of the Middle Atmosphere and Global Environmental Observation (LAGEO), Institute of Atmospheric Physics, Chinese, CHINA

Exploitation of GOMOS, OSIRIS, OMI and MIPAS measurements for studying the change in the middle atmosphere (EGOMO)

The aim of the Dragon 2 EGOMO project (5311) is to study the natural variation in the middle atmosphere using large satellite data sets and modelling tools. Data are coming from four presently active satellite instruments: GOMOS and MIPAS on ENVISAT, OSIRIS on Odin and OMI on EOS-Aura. We will make use of several middle atmosphere chemistry-transport models: Meso-ROSE, FinROSE, MOZART-3, WACCM, and HAMMONIA.

We have constructed day and night climatologies for O3, NO2 and NO3 using GOMOS and OSIRIS measurements. The same measurements have been used to build up and analyse stratospheric and mesospheric time-series of ozone, NO2 and NO3 for 2001-2010. Using measurements from the SAGE II instruments we have extended the ozone time series to cover 1987-2010. Time series have also been retrieved from Meso-Rose model and compared with time series measured by satellites. All these time series have been analysed by fitting trends, annual and semi-annual harmonics as well as solar and quasi-biennial oscillation (QBO) proxies.

The QBO and semi-annual oscillation (SAO) characteristics of O3, NO2, and NO3 from 2002 to 2008 were analyzed using GOMOS observations. We found that dynamical transport is the principal factor controlling the QBO pattern of O3. The QBO signals of O3 originate in the middle stratosphere and propagate downward along with the anomalies of the vertical residual circulation over the equator. We also analyzed the NO2 anomalies and found that their QBO pattern was deep and stationary in the middle and upper stratosphere over the equator. The interannual anomalies of NO3 displayed an apparent SAO pattern in the tropical upper stratosphere due to different dynamical and chemical effects in different SAO phases.

Extreme events in the atmosphere, such as sudden stratospheric warmings are one of the central studies of the EGOMO project. The response of the middle-atmosphere trace gases during several sudden stratospheric warmings in 2003-2008 is investigated using measurements from GOMOS and MLS. Significant changes in the chemical composition of the middle atmosphere are observed. Changes are not restricted to stratosphere but they extend to mesosphere and lower thermosphere. The experimental spatio-temporal distributions have been compared with the ones of FinROSE chemistry-transport model, which have shown general agreement in the stratosphere.

Other research activities within the project include: studies of gravity wave activity and breaking of during sudden stratospheric warmings (using the GOMOS scintillation measurements), analyses of variability of ozone field (using GOMOS, OMI and ozone sonde data), and studies related to spring-time ozone asymmetry over Antarctica caused by planetary wave activity (using OMI, GOMOS and MLS measurements).