Direct Effects of EPP on the Middle and Lower Atmosphere
(8 oral, 7 poster,
also Model/Measurement Workshop)

HEPPA Workshop

Boulder, CO

Oct. 6-8, 2009

Summary of topics covered

- Particle input
  - Medium and high energy electrons (EISCAT measurements)
  - Use MLS OH measurements for:
    - Electron flux (200-300 keV)
    - Proton flux (>10 MeV)
- Energy deposition (Ion rate) computation
- Particle production of H, OH, HNO_2, HNO_3
- New observations
  - Temperature, NO, OH, etc. from OSIRIS
  - H_2O_2, $BrONO_2$ from MIPAS

Summary of topics covered

- Modeling studies
  - HCl decrease during SPEs (HALOE)
  - Mesospheric Ozone response 2004-5 (GOMOS)
  - Proton & electron (together) impact on constituents (Ozone & HNO_3, MIPAS)
  - Electron impact (Ozone & NOx, MIPAS)
  - Extremely large SPE (Carrington event) influence

What are the outstanding issues?

- Medium and high energy electron impact
- Energy deposition computation
  - Intercomparison needed?
- Model predictions of HNO_3 too low
  - Ion chemistry, look-up table production needed (also, include NOx loss)?
- Incorrect model predictions of N_2O_5, $ClONO_2$, ClO…. [HOCl reasonable?]
- Realistic transport (winds, waves, diffusion) in models

From HEPPA-1 Outstanding Issues May 2008

Medium and high energy electrons
- Precipitating fluxes
- Temporal distribution
- Spatial distribution

EPP-caused temperature effect – SABER
- Increase, decrease
- Altitude dependence
- Changes in dynamics (e.g., radar winds)

EPP-caused constituent changes
- HNO3 – model-measurement differences
- N2O5
- CO
- HCl
- N2O, H2O, ClONO2
- HOx (esp. wrt HNO3 and diurnal variations)

Other
- South Atlantic Anomaly
- Ozone changes (Arctic) in lower stratosphere
- Surface temperature signature from EPP
- Transport