

3D Global Model Results: The Role of In-Situ Production and Stratospheric Transport on Tropospheric O₃ during Fall 1997

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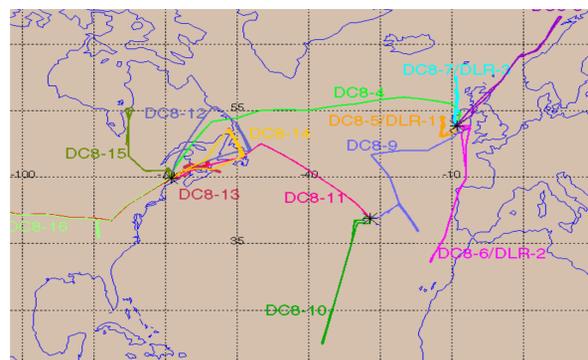
A brief summary of our work.....

- We've developed a global, 3D model, **IMPACT**, that contains **tropospheric and stratospheric** chemistry.
 - **IMPACT** can be "driven" by **assimilated meteorology**.
 - We compare **Fall '97 IMPACT results** to **NASA SONEX (Fall '97) observations** (North Atlantic Ocean).
- What are the roles of the stratosphere and troposphere in controlling tropospheric ozone and other species?

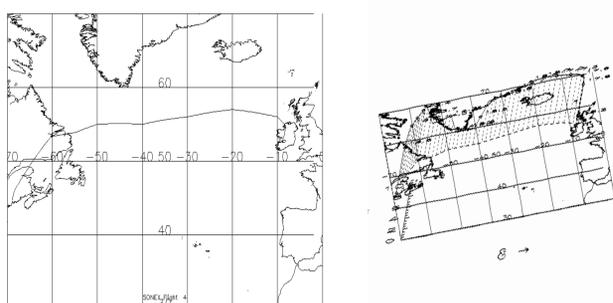
Model Background - IMPACT:

- **Platforms** Massively parallel computers
- **Chemistry** Prognostic **troposphere and stratosphere** SMVGEAR II 29 (CO/CH₄/NO_x/OH/O₃) or 181 species (through C₆)
- **Meteorology** NASA DAO GEOS-STRAT assimilation for 1997 **ADVANTAGE: Direct comparison to observations**
- **Resolution** Data dependent: 2.5° (lon) X 2.5° (lat) X 46 levels
- **Transport** PPM/Semi-Lagrangian (Lin/Rood) advection Implicit vertical diffusion (Walton, met.)
- **Deposition** Dry (Wesely, Jacob, Wang) Wet (Giorgi & Chameides, Balkanski, Koch)
- **Photolysis** Look-up table (clear sky) Pending: (Prather) FAST_J

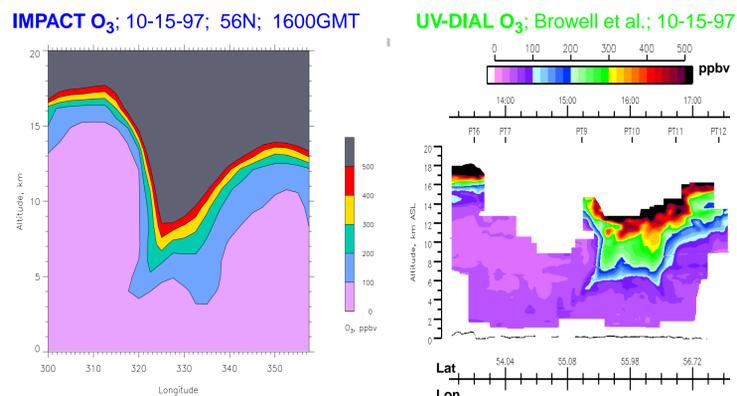
We compare IMPACT results to the NASA/SONEX Fall 1997 campaign



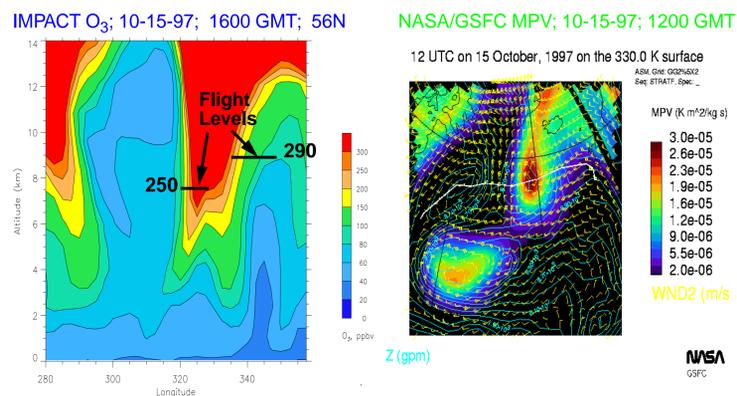
Case #1 - Flight 4; 56°N; 10-15-97



IMPACT predicts stratospheric O₃ influence in the same region as UV-DIAL observations

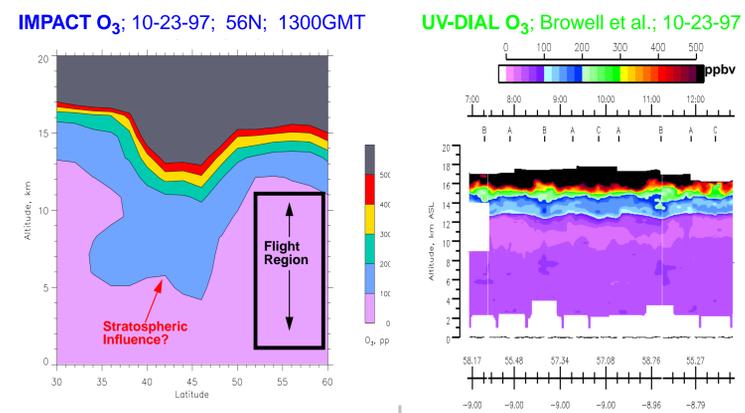


This region experiences high levels of potential vorticity, indicative of stratospheric influence

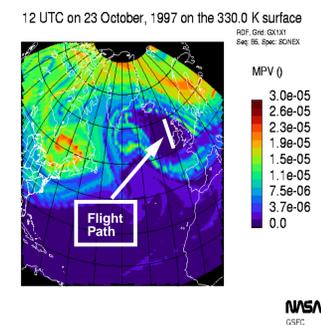


Case #3 - Flight 7; ~10°W; 10-23-97

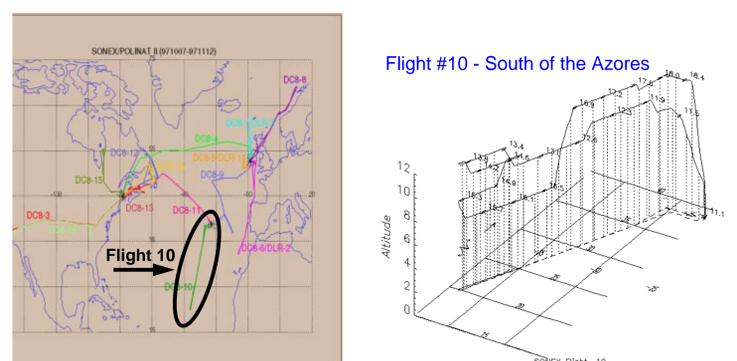
Both **IMPACT** and observations show air of more "tropospheric quality". The [O₃] < 100 ppbv for entire flight path. However, **IMPACT** predicts a stratospheric influence south of the observations.



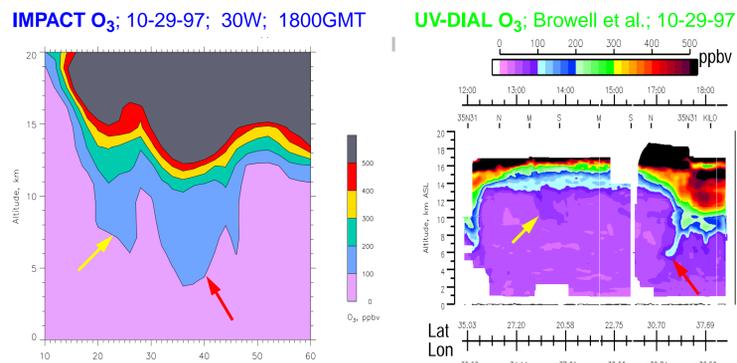
Flight #7 experienced very low levels of potential vorticity



Case #2 - Flight 10; 30-35°W; 10-29-97



Both IMPACT and observations show stratospheric influence near 30-40°N



Conclusions and Future Work:

- Our global, three dimensional model, **IMPACT** has **tropospheric and stratospheric** chemistry and is "driven" by **assimilated meteorology**.
- **IMPACT** results can be compared directly to observations.
- **IMPACT** can help quantify and assess: What are the current and predicted future roles of the stratosphere and troposphere in controlling tropospheric ozone and other species?
- **Current updates underway:**

Quantity in-situ production and stratospheric transport
 Simulate additional time periods/sampling campaigns - (Observations/collaborations welcome!)
 Higher order NMHCS, isoprene, terpenes
 Heterogeneous chemistry

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