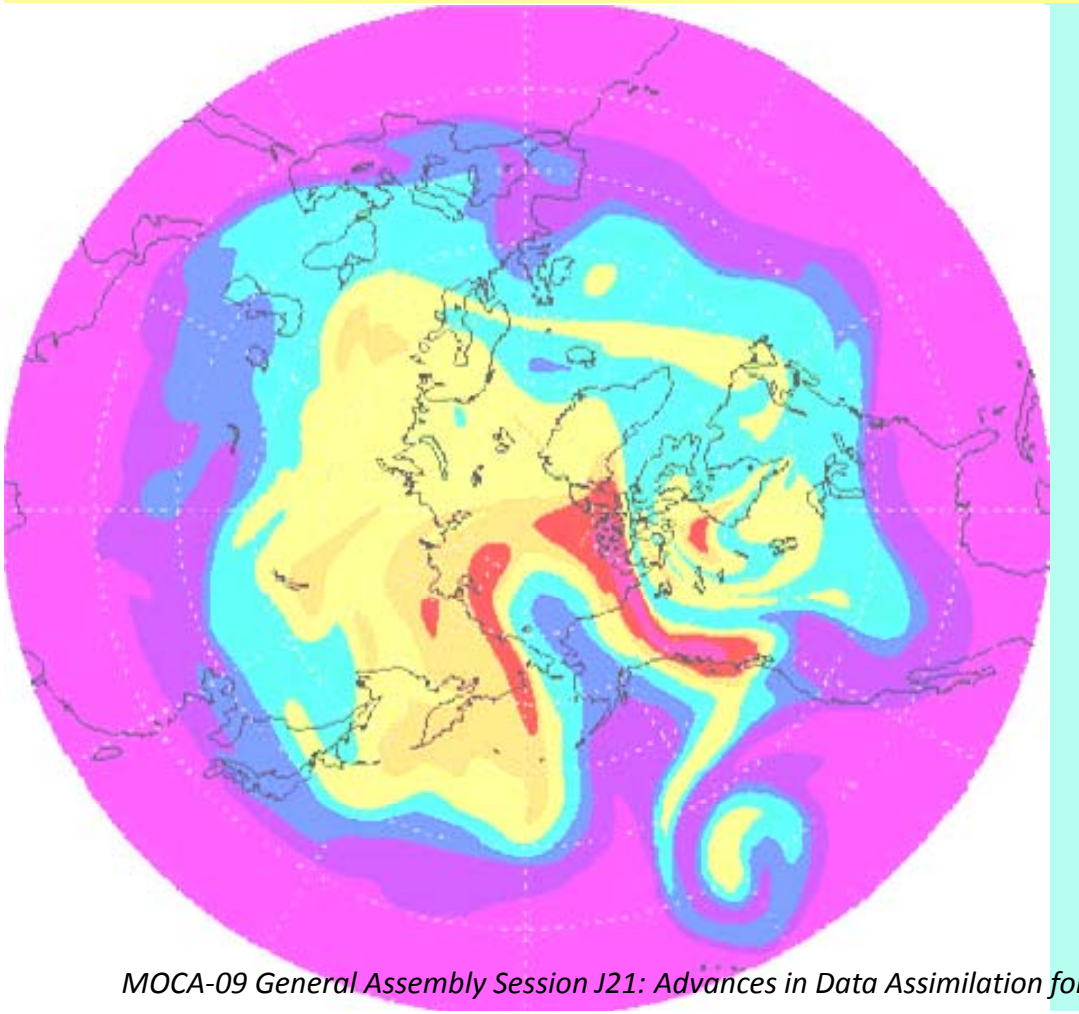
# Spatial and Temporal Resolution of Assimilated Ozone Data



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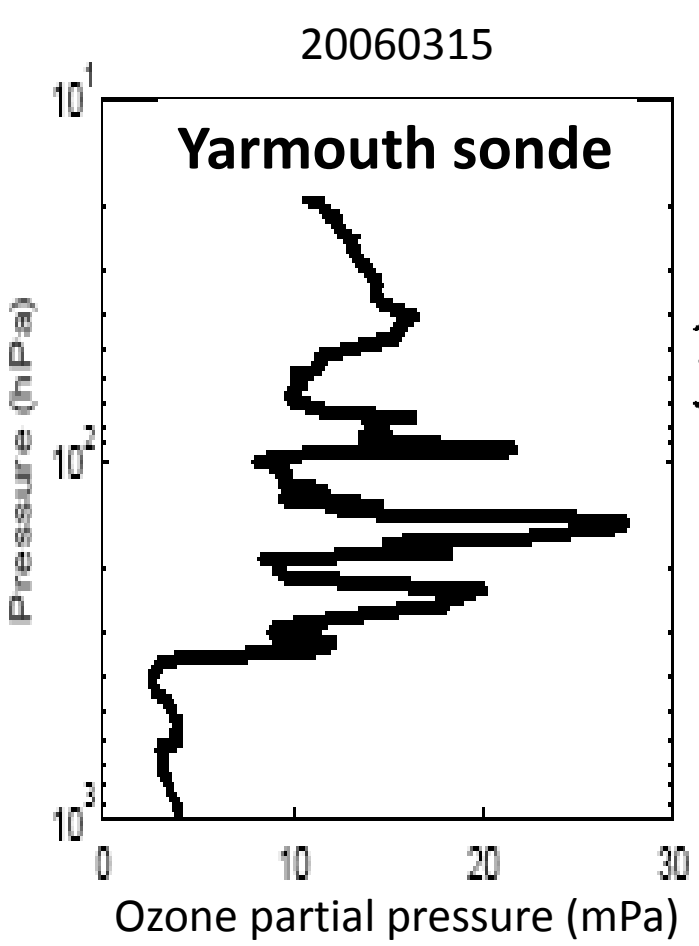
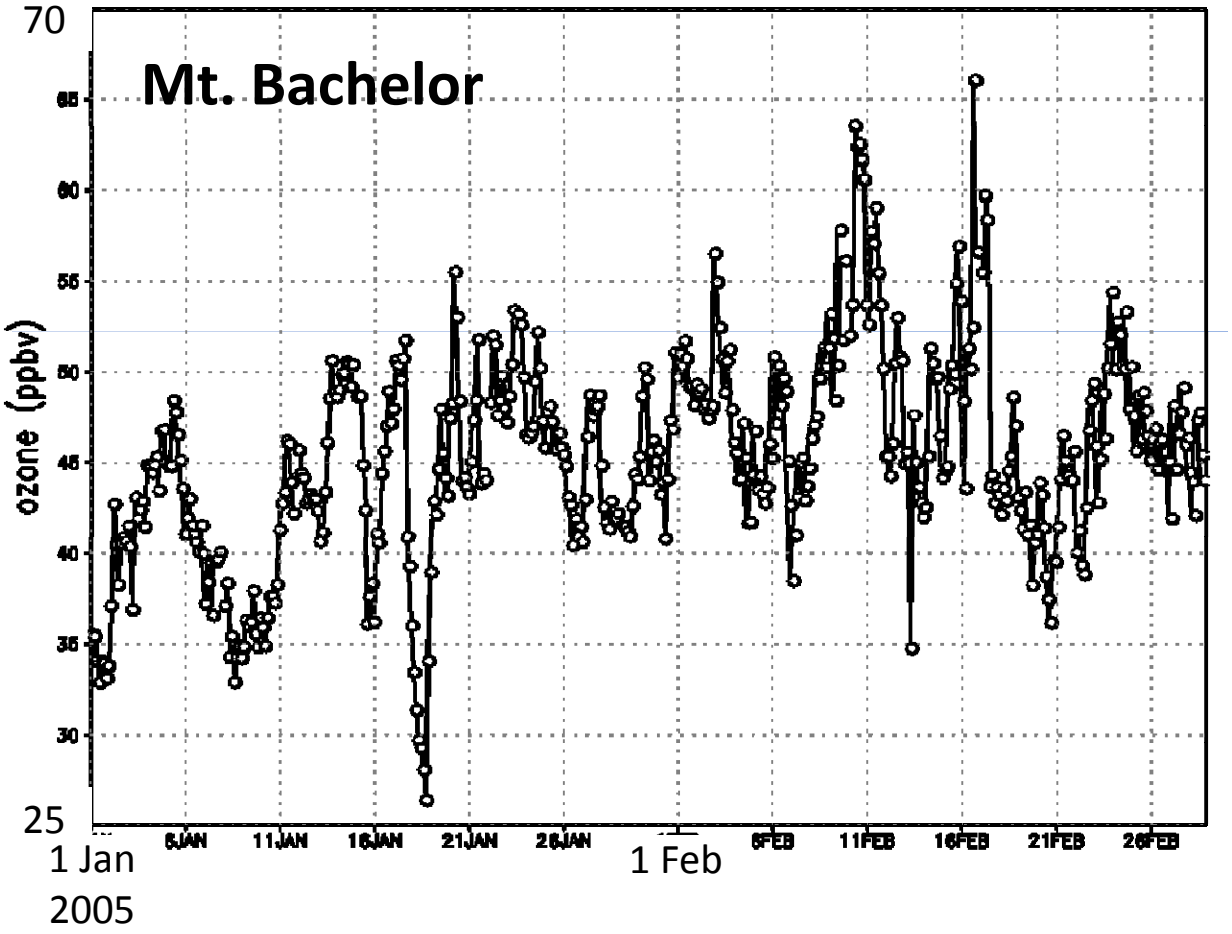
# Ozone assimilation system

- Goddard Earth Observing System, Version 4 (**GEOS-4**) global general circulation model:
  - 1°×1.25°
  - 55 levels
  - ozone archived every 3h
- Ozone Monitoring Instrument (**OMI**) cloud-free total ozone columns
- Microwave Limb Sounder (**MLS**) profiles for pressure <216 hPa

*Stajner et al. (JGR 2008)*

# Spatial and temporal variability of ozone captured by insitu data

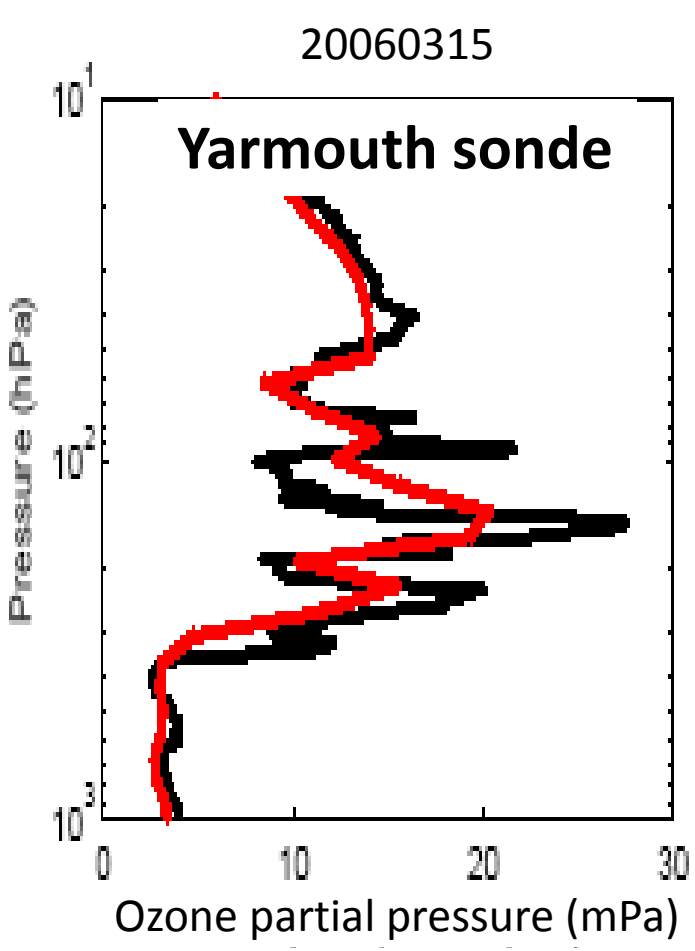


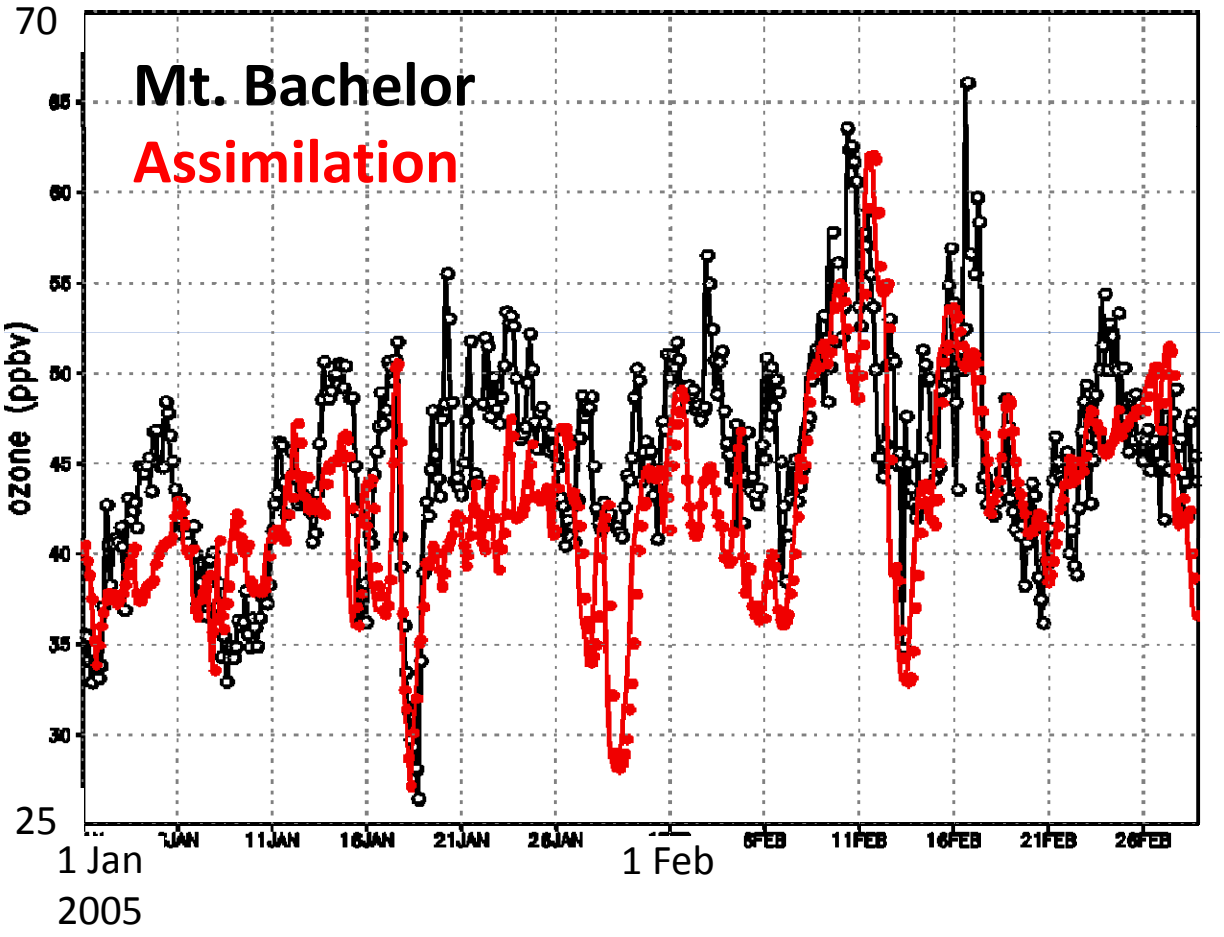




IONS-06: intensive sonde campaign over North America

- Isolated volcanic peak in Oregon, ~2.7 km altitude

# Comparison of assimilated ozone and insitu data




Good agreement at larger spatial scales and longer temporal scales

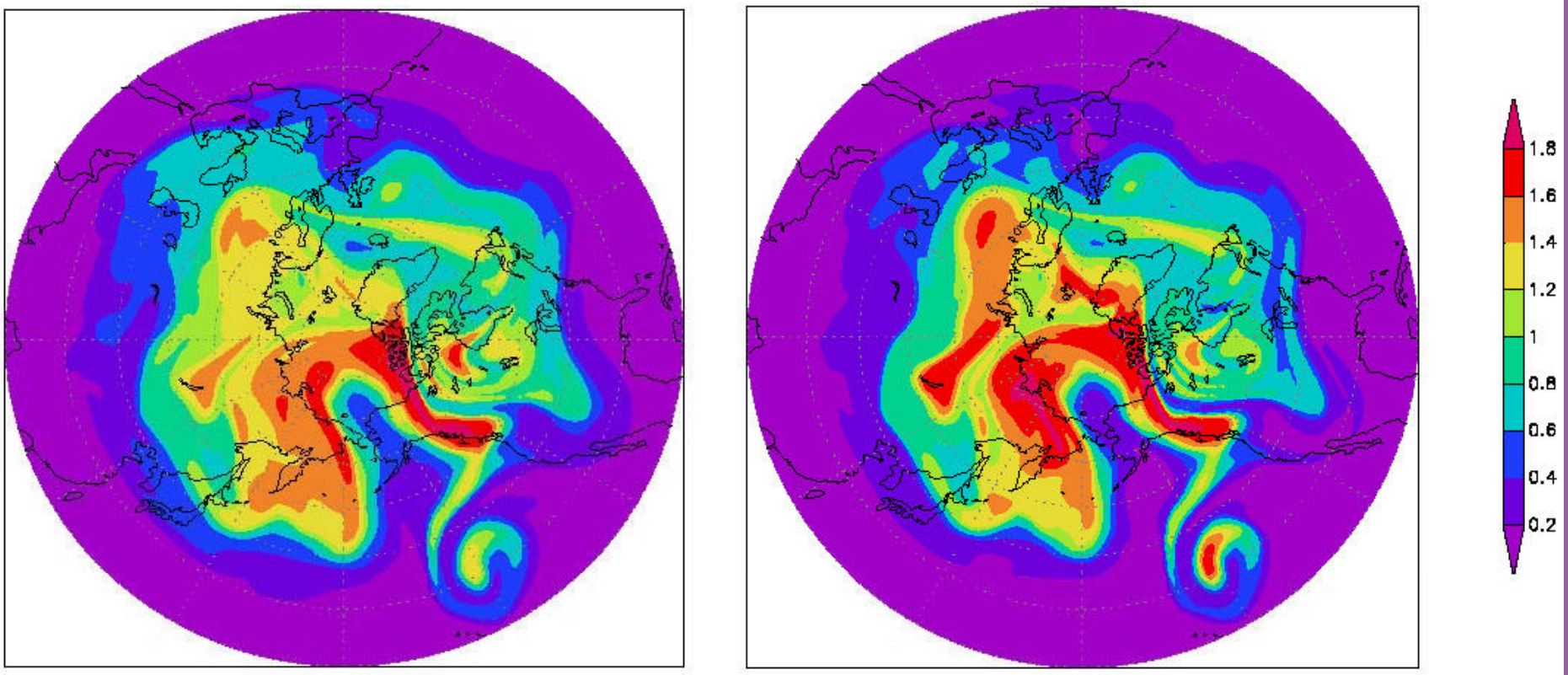
# Questions:

1. How do assimilation and model compare with insitu data?
2. Does assimilation of observations excessively smooth fine scales?
3. Does assimilation improve comparison with insitu data at larger spatial/longer temporal scales?

# Spatial resolution

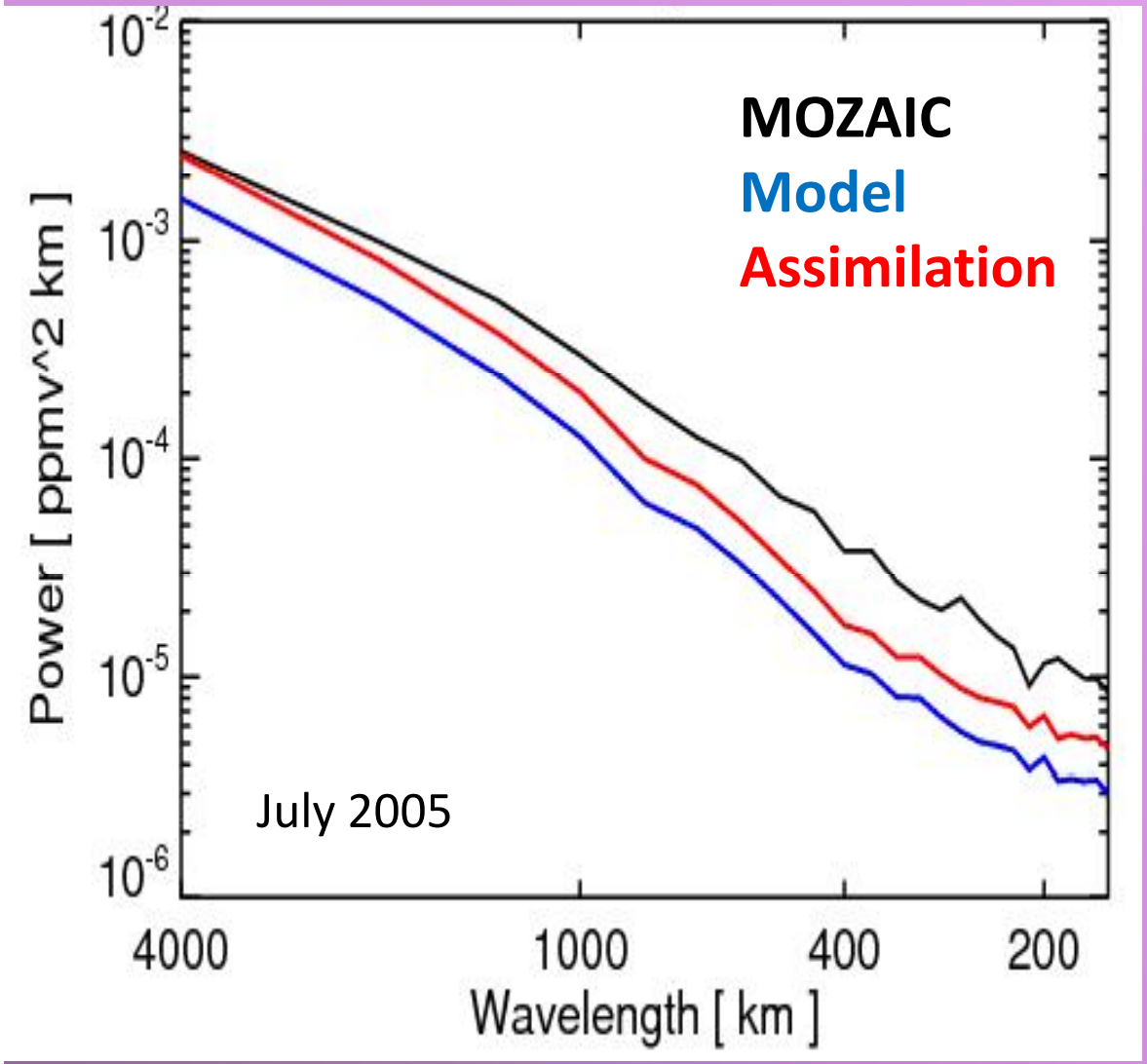
# Assimilation vs model

Ozone mixing ratio (ppmv) at 118.25 hPa on March 16th 2005, 6 UT



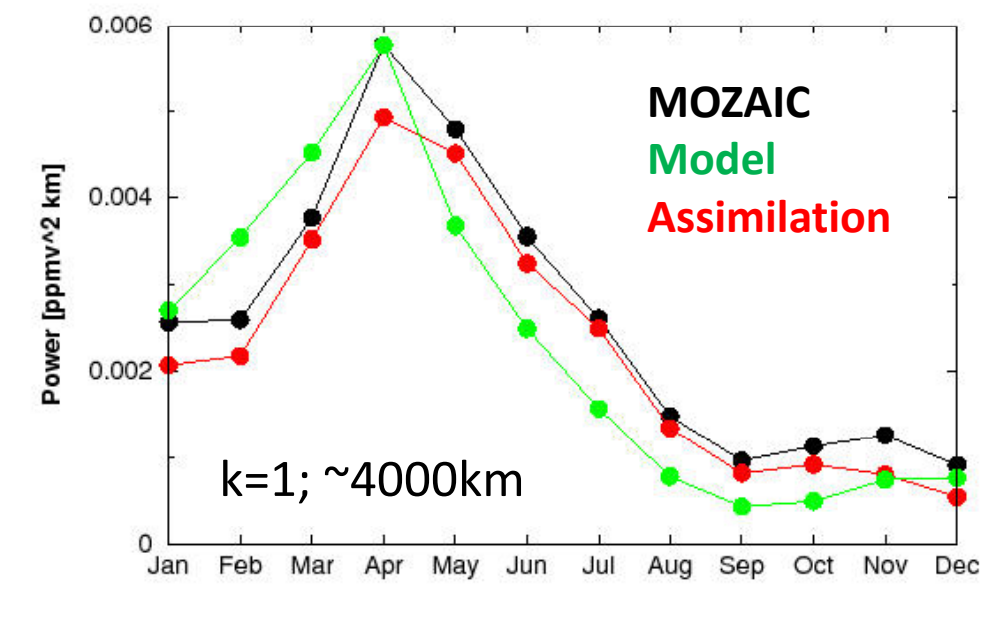

- Mean ozone reduced in assimilation
- Variability (filament structure) similar

# Ozone power spectra




- MOZAIC aircraft data in the UTLS have more power at **shorter** wavelengths than model or assimilation
- Model and assimilation have similar **slope** → no indication of smoothing at shorter wavelengths in the assimilation
- At **longer** wavelengths the assimilation agrees with MOZAIC better than the model

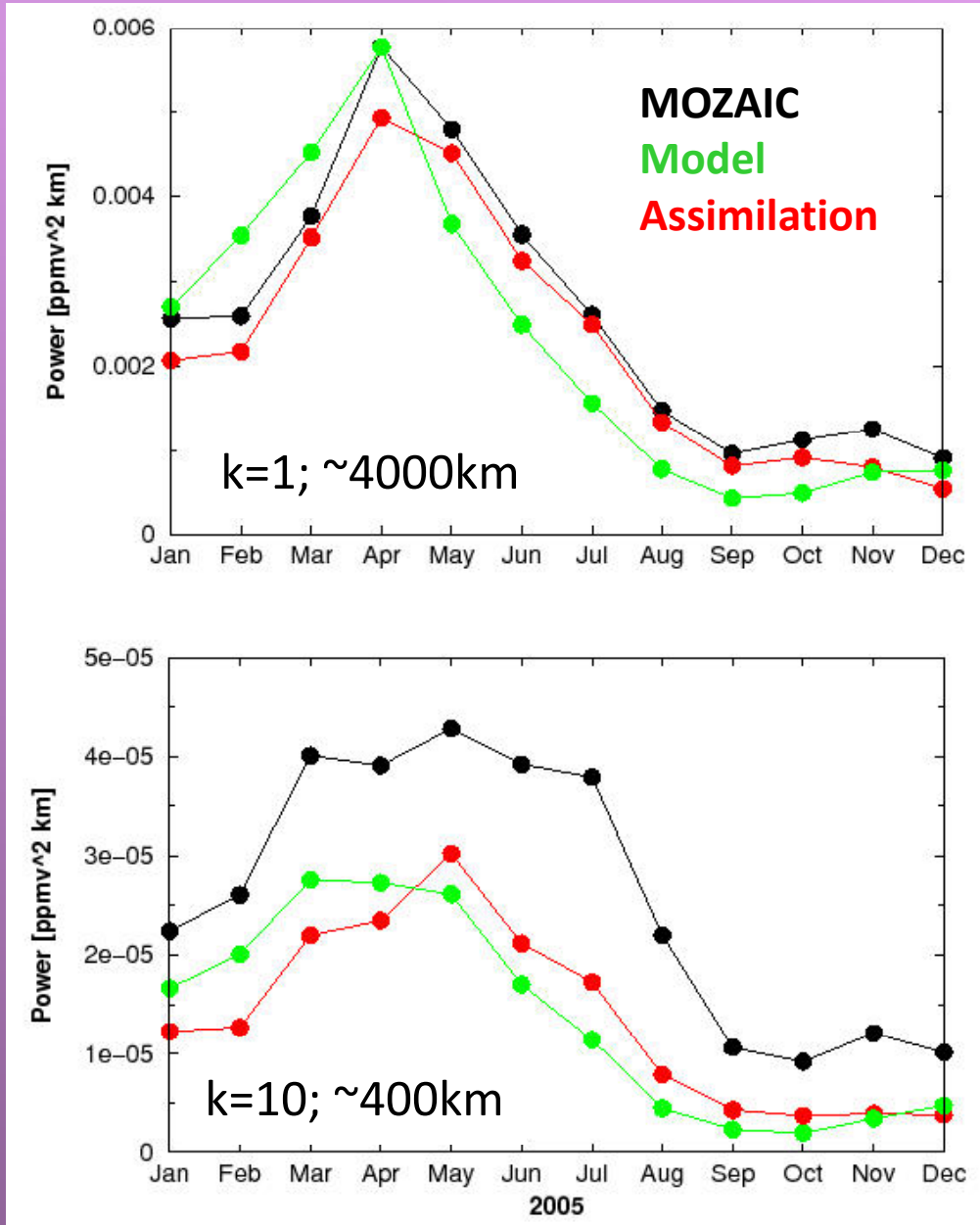
# Power at different scales




Annual cycle in 2005:

- At **large scales** assimilation agrees better with MOZAIC during Feb.-Mar. & May-Nov.

# Power at different scales



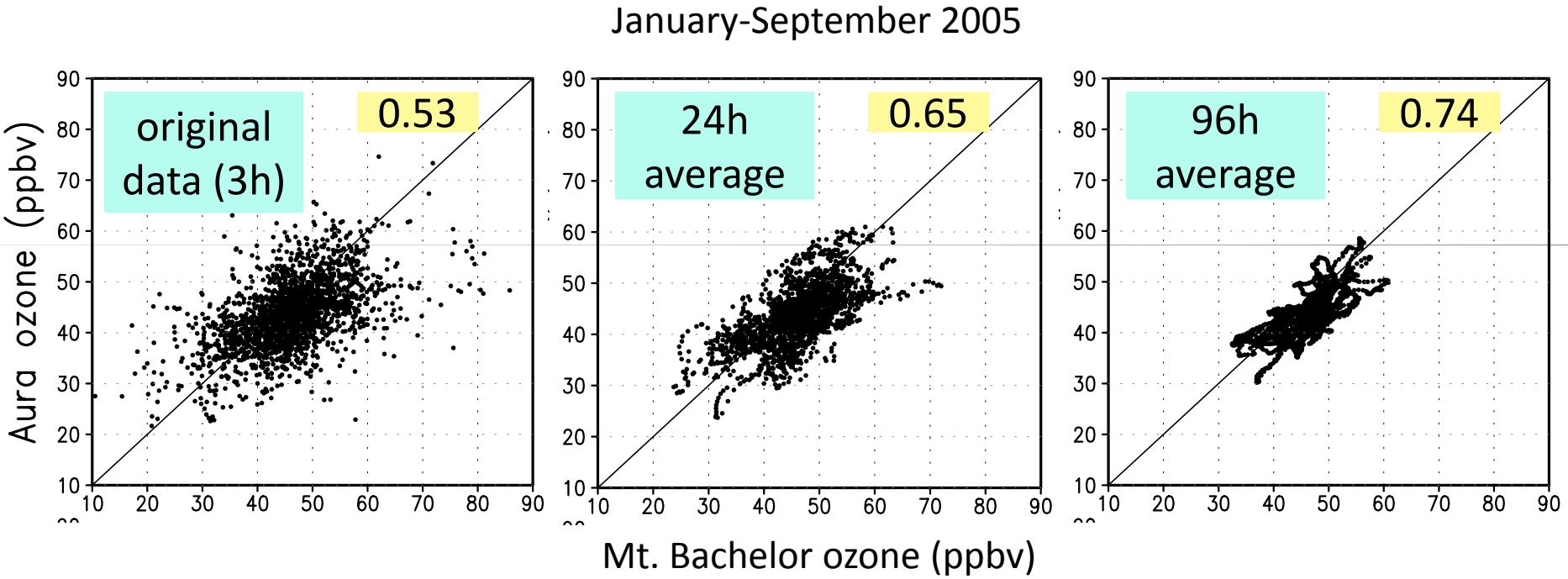

Annual cycle in 2005:

- At **large scales** assimilation agrees better with MOZAIC during Feb.-Mar. & May-Nov.
- Changes in power between the assimilation and the model at **smaller scales** are similar to changes in power at large scales

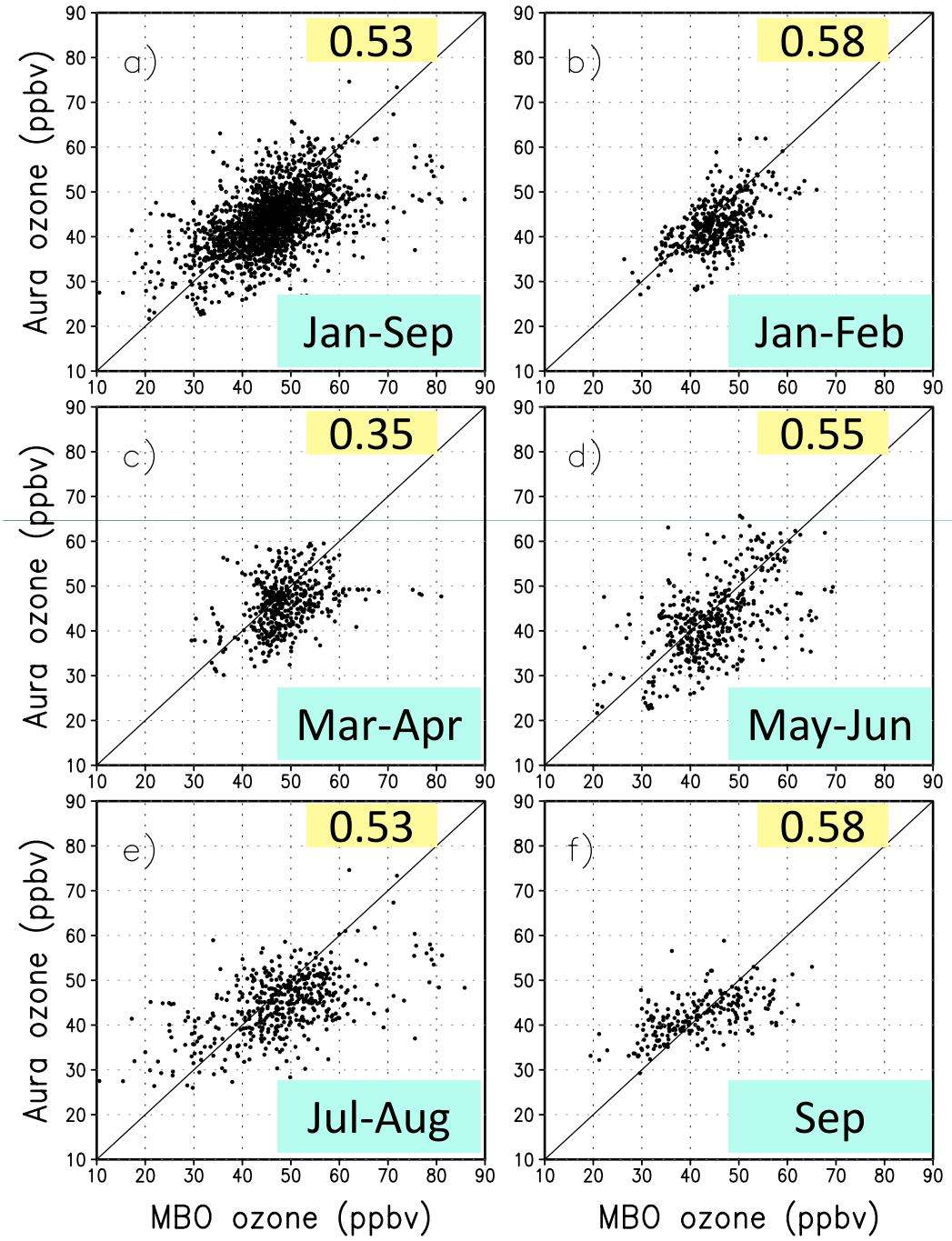
# Temporal resolution

# Impact of temporal averaging

## on Mt. Bachelor comparisons

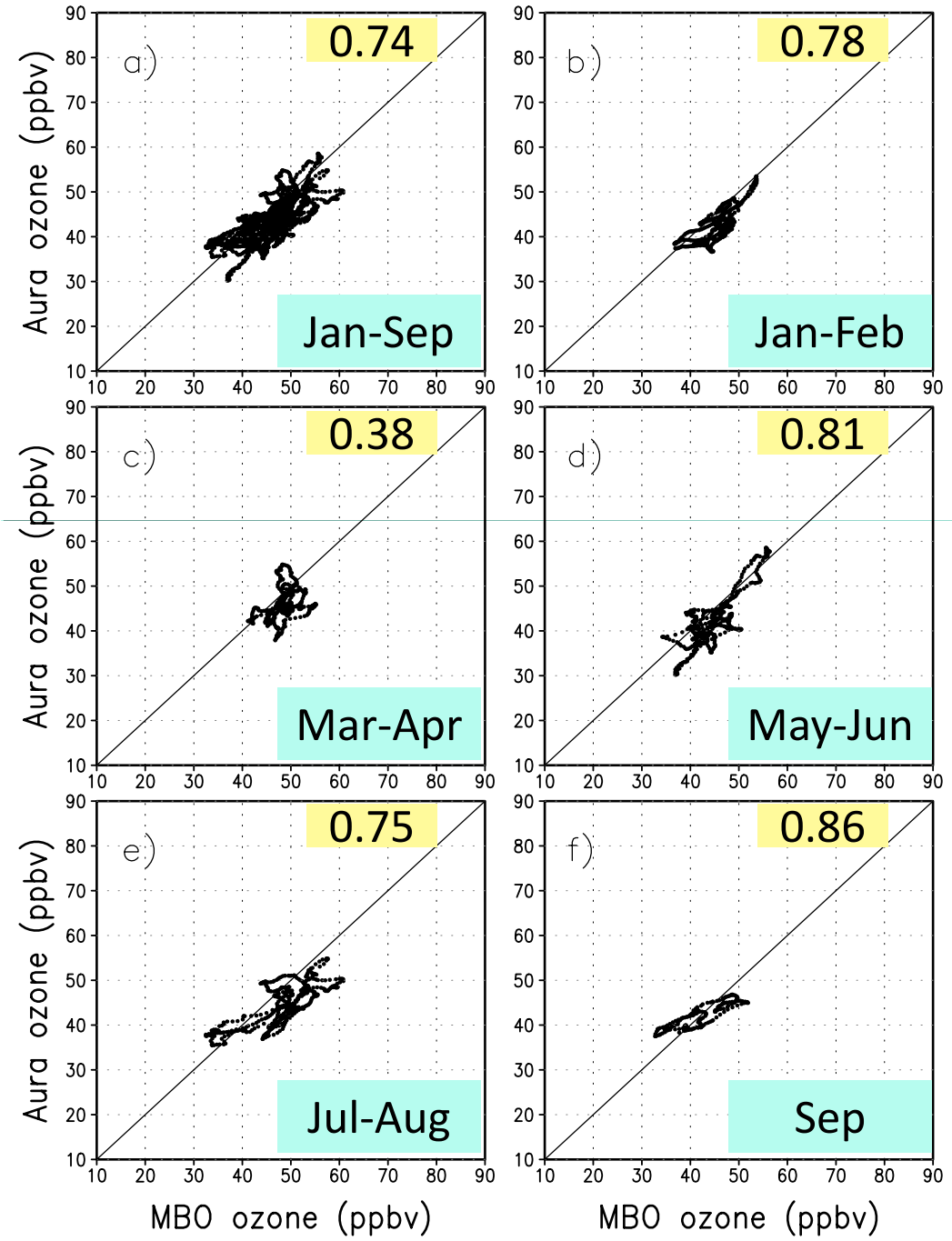



- Temporal averaging **reduces scatter** and **increases correlation** between Aura assimilation and independent Mt. Bachelor measurements




# Mt. Bachelor vs assimilated ozone

- Comparison of original data for year 2005 at **3-hourly** resolution
- Correlation up to 0.58




# Mt. Bachelor vs assimilated ozone

- Comparison of **4-day** (96h) **running means** for year 2005
- Reduced scatter
- Correlation up to 0.86
- Correlations larger by 0.03 to 0.28

# Summary

In assimilation of Aura ozone data into GEOS-4:

- Model is driving small scales (power and resolution)
- Assimilation is correcting large scales
- Assimilation is not excessively smoothing small scales
- Temporal averaging substantially increases correlation between assimilation and Mt. Bachelor data

Thank you