

**Atmospheric CO<sub>2</sub> and chemistry simulations  
employing the NASA GEOS-5 system as  
configured on the ORNL/NCCS Jaguar  
computational platform**

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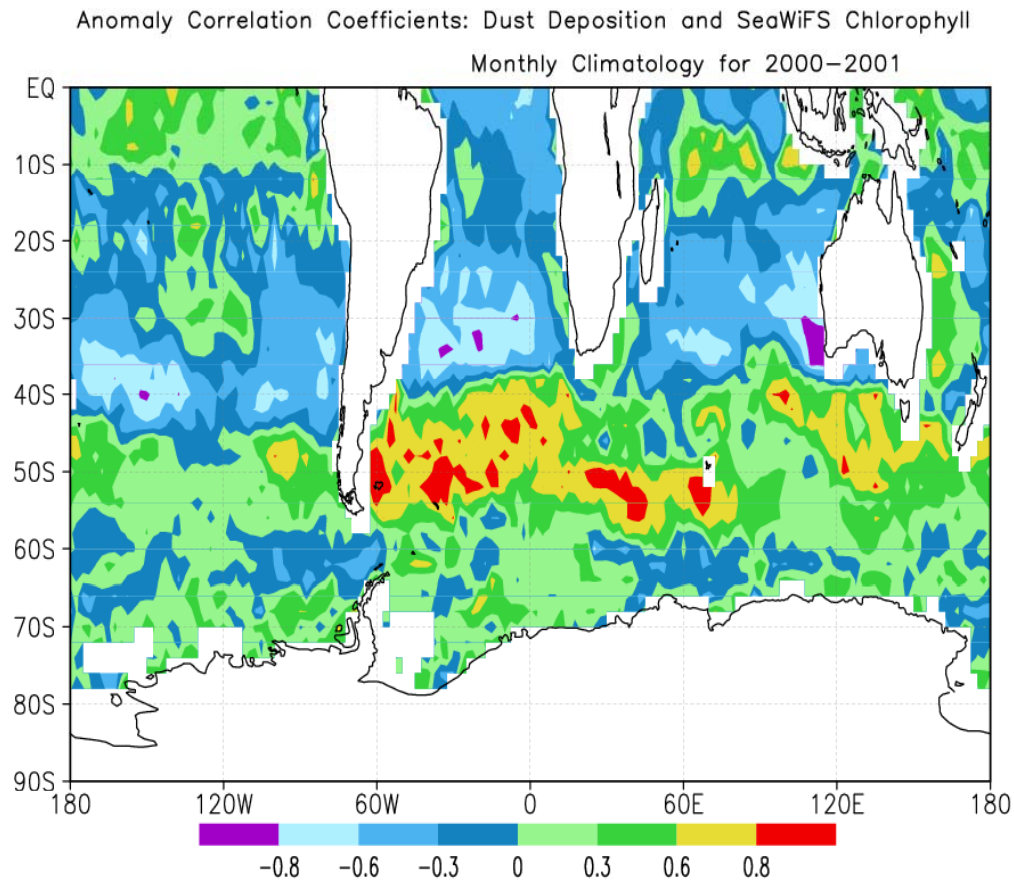
# Outline

- NASA and DOE supported activity to support the NASA GEOS-5 data assimilation system on ORNL/NCCS resources
- Collaborators S. Pawson and E. Neilson (NASA/GSFC)
- Incorporation of CO<sub>2</sub> boundary fluxes into atmospheric climate models
- Visualization of CO<sub>2</sub> in GEOS-5 simulations on Jaguar/NCCS/ORNL
- Global Satellite – Climate Model Merge

# Coupling Climate Models with NASA Satellite Data

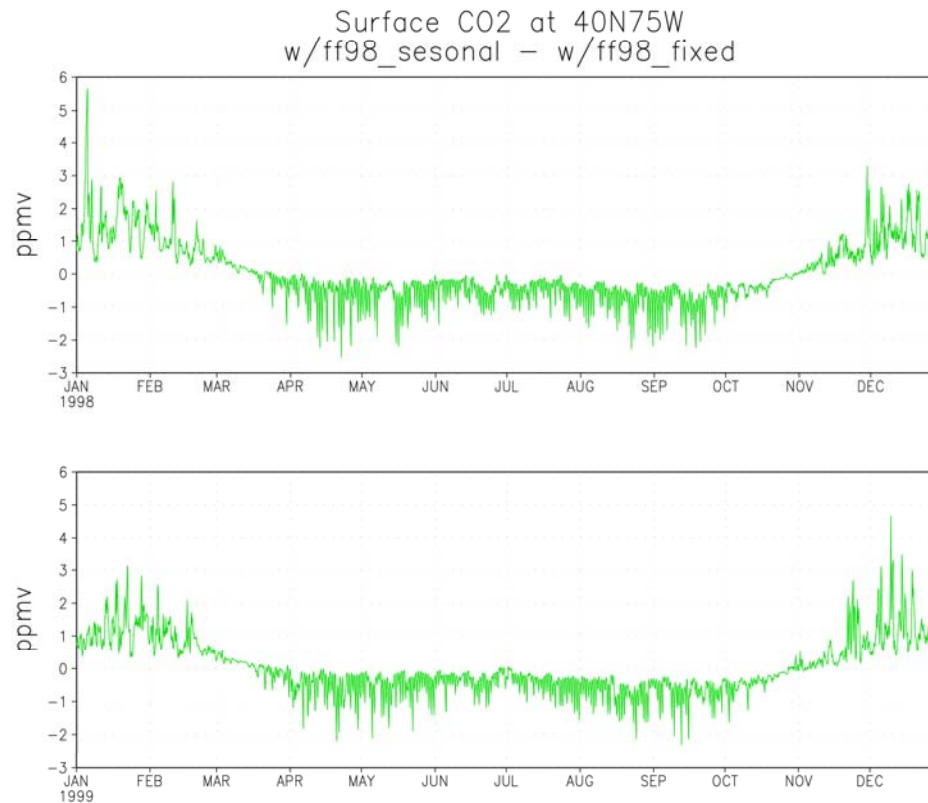
- Global Atmospheric Dust Simulation Based on NASA climate model
- Coupled for statistical analysis with SeaWifs ocean color

# Erickson et al., Geophys. Res. Lett., 2003



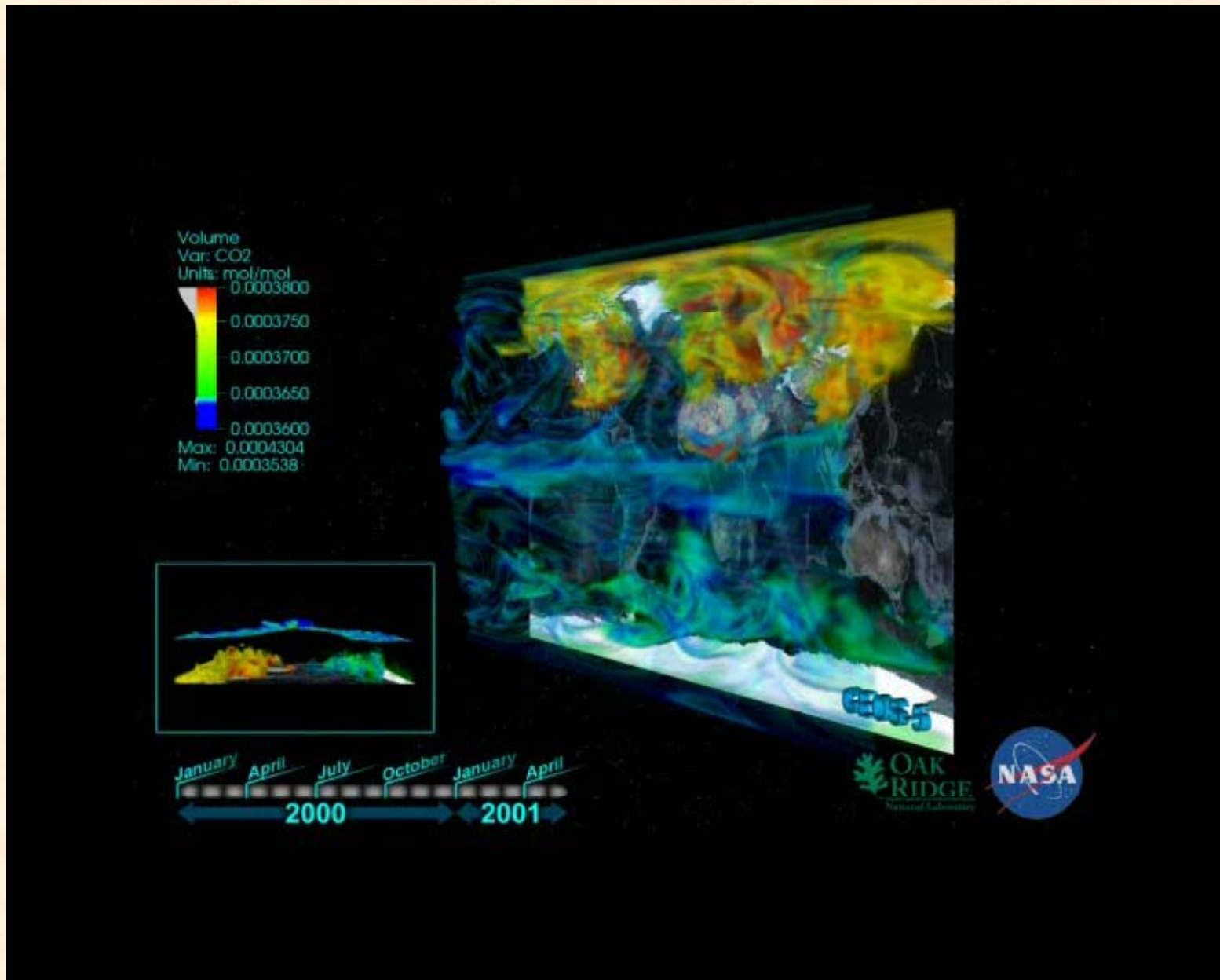
# CO<sub>2</sub> boundary fluxes coupled with NASA GEOS-5 modeling framework

## Monthly resolved anthropogenic CO<sub>2</sub> fluxes



The difference between the atmospheric CO<sub>2</sub> concentrations computed with an annual mean CO<sub>2</sub> flux and the monthly resolved fluxes computed as above for a location at 40N, 75W and at 52N, 8W. Note the seasonality of the deviations from the general trend of concentrations.

Erickson, D. J., III, R. T. Mills, J. Gregg, T. J. Blasing, F. M. Hoffman, R. J. Andres, M. Devries, Z. Zhu, and S. R. Kawa (2008), "An estimate of monthly global emissions of anthropogenic CO<sub>2</sub>: Impact on the seasonal cycle of atmospheric CO<sub>2</sub>", *J. Geophys. Res.*, 113, G01023, doi:10.1029/2007JG000435, (2008).



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# HPC and Climate Model Challenge Areas

- **High Resolution in Space and Time**
- **Fully coupled carbon-chemistry (Biogeochemistry) – Time Scales of Nano-seconds to Hundreds of Years (15 orders of magnitude)**
- **Assimilation of data streams from satellite to constrain global and regional budgets of CO<sub>2</sub> and other chemical species**
- **High end statistical methods, extreme events, inserted into climate models**
- **Fully coupled Earth System Models (ESM) – Definition is evolving.....**



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