

Error Characterization of Aura TES Nadir Ozone Retrievals

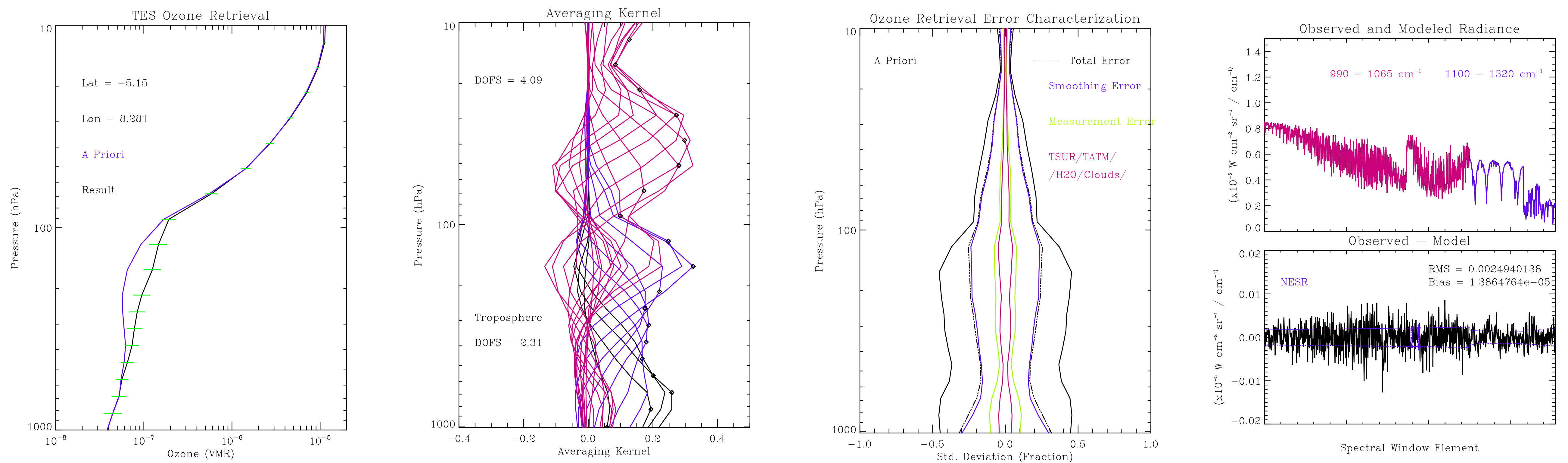


John Worden, Reinhard Beer, Kevin Bowman, Anmarie Eldering, Brendan Fisher, Michael Gunson, Susan S. Kulawik, Michael Lampel, Qinbin Li, Ming Luo, Gregory Osterman, David Rider, and Helen Worden.

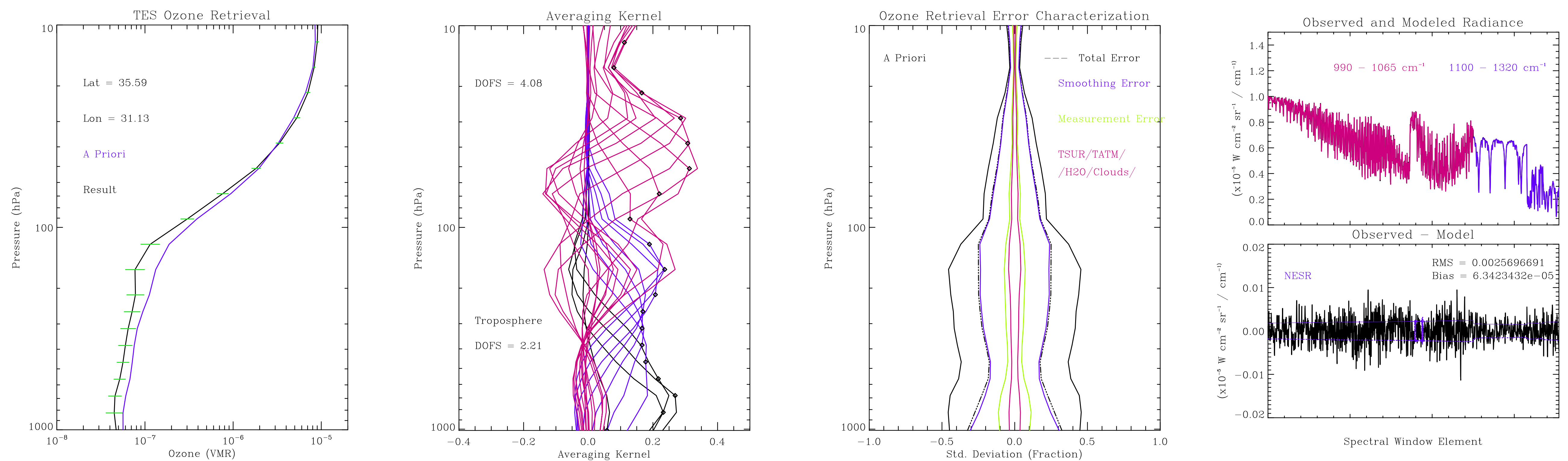
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Abstract: Examples are shown of retrieved ozone profiles at different latitudes and how the errors on those retrievals are characterized. The current strategy for TES retrievals is to jointly retrieve temperature, H₂O, Ozone, Cloud effective optical depth, Cloud pressure, Surface Emissivity (over land), and a set of "Calibration Parameters" using the ozone band 990 cm⁻¹ and 1065 cm⁻¹ and several water lines and "window regions" between 1100 cm⁻¹ and 1320 cm⁻¹. (First Panel) Example of the retrieved ozone, the initial guess (or a priori), and the standard deviation of the error covariance. (Second Panel) The averaging kernel shows how the estimate is affected by the "true" state of ozone and is therefore an indication of the vertical resolution of the retrieval. For example, the trace of the averaging kernel, or degrees-of-freedom of signal (DOFS) is about 2 in the Troposphere for these retrievals implying about a 6 km vertical resolution in the troposphere. (Third Panel) The estimated error covariance is broken into three components (1) Smoothing error which describes the error due to the finite vertical resolution of the retrieval, (2) Measurement error which is the error due to noise, and the cross-state error which describes the effect of jointly retrieving other parameters (e.g., temperature, H₂O, and Clouds) on the retrieval of ozone (Worden et al., JGR, 2004). (Fourth Panel) Observed and modeled radiance and the radiance residuals. Most TES retrievals are able to minimize the observed and modeled radiance residuals down to the measured noise level.

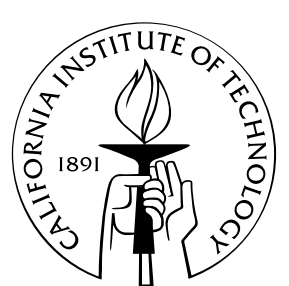
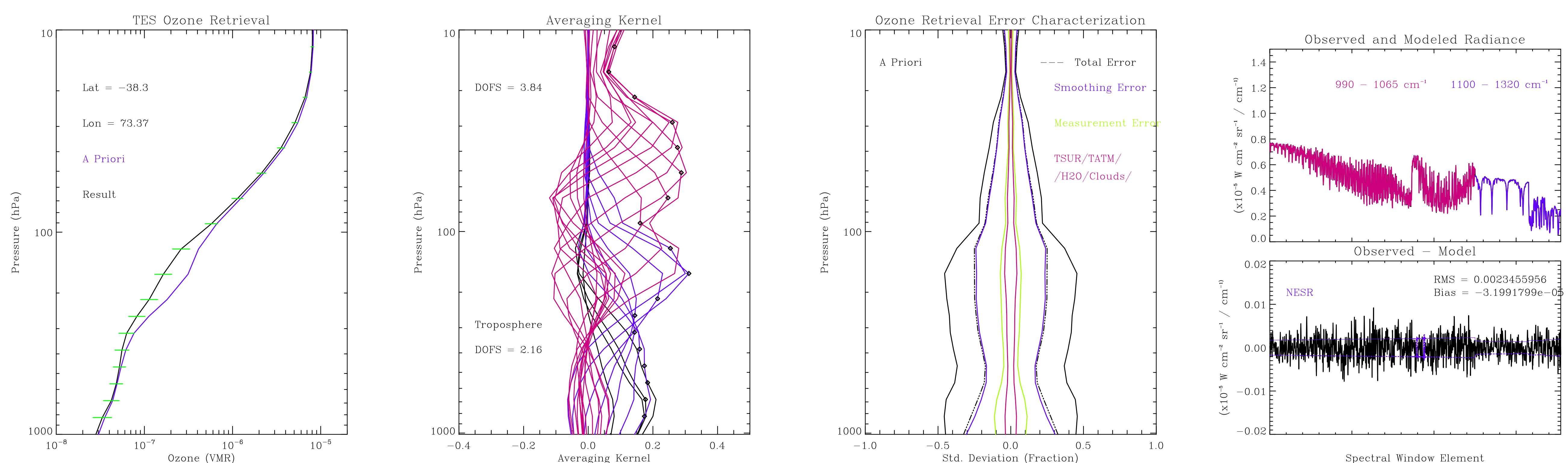
Error Characterization for TES Tropical Ozone Retrieval

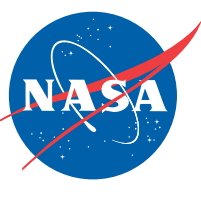


Error Characterization for TES North Mid-latitude Ozone Retrieval



Error Characterization for TES South Mid-latitude Ozone Retrieval





Characterization of Aura TES Global Survey Nadir Ozone Retrievals for Sept. 20, 2004



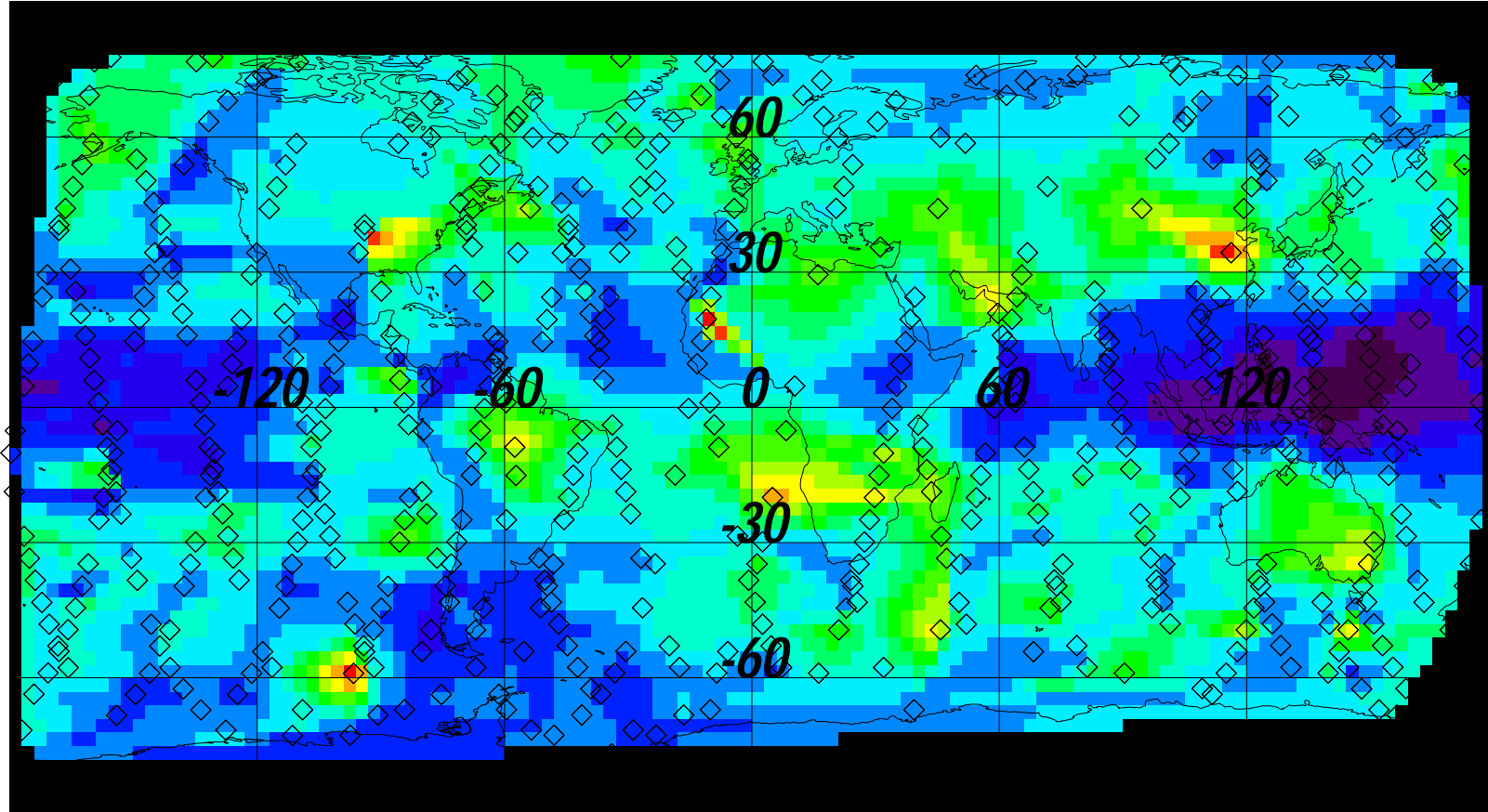
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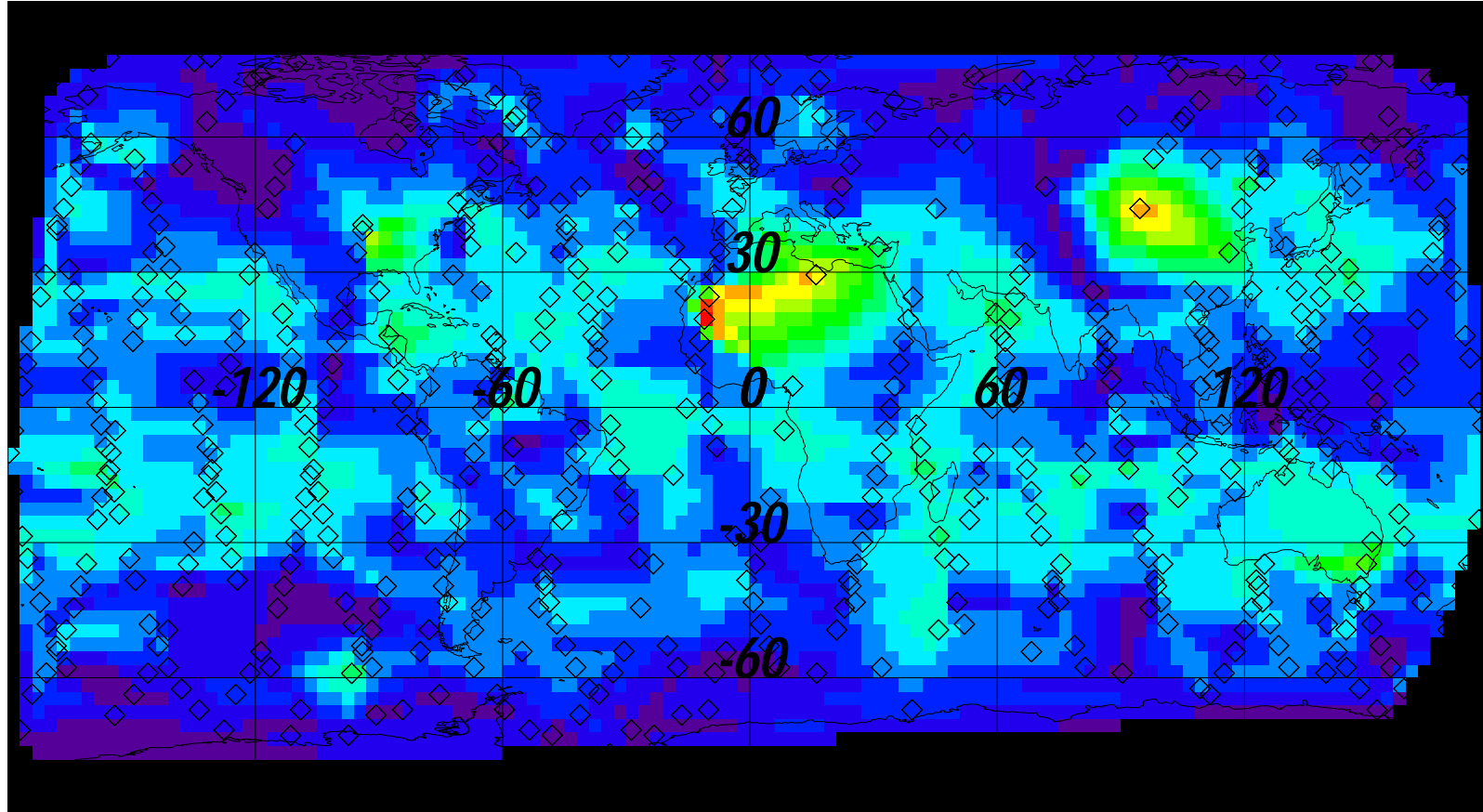
Abstract: Results are shown for the first TES global survey taken on Sept 20, 2004. Integrated column amounts are shown for the lower troposphere, upper troposphere, and stratosphere to demonstrate the vertical resolution of TES retrievals. These quantities are interpolated to the whole globe (3 x 3 degree grid) using linear interpolation. Pollution from bio-mass burning in Africa and South America as well as fossil fuel pollution from the Southern U.S. and East Asia are readily apparent in the lower troposphere. Pollution lofted in the upper troposphere and possible tropopause folding associated with large storm systems is seen in the upper troposphere. The Stratospheric ozone column is shown in the bottom panel. The degrees-of-freedom of signal (DOFS) for the corresponding region as well as the fractional error for the column are also shown. The DOFS are an indication of the vertical resolution for the specified pressure range. For example, 1 degree of freedom indicates about a 6 km vertical resolution for these ozone retrievals. Both the vertical resolution and errors are a function of temperature, cloud conditions, and ozone concentrations.

Characterization of Retrieved TES Lower Tropospheric Ozone (Sept. 20, 2004)

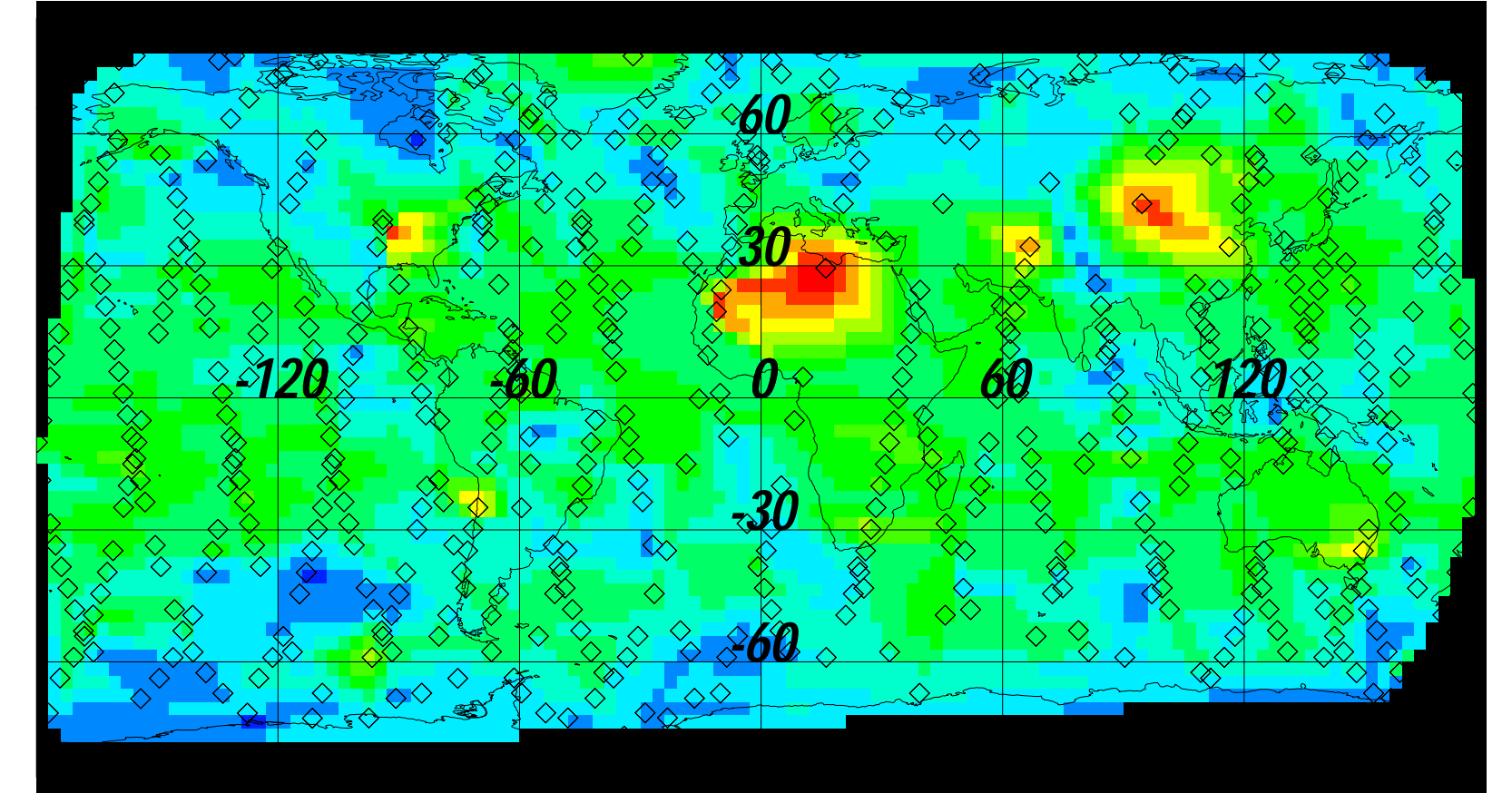
TES Lower Tropospheric Ozone (Surface - 500 hPa)



TES Vertical Resolution (DOFS) (Surface - 500 hPa)

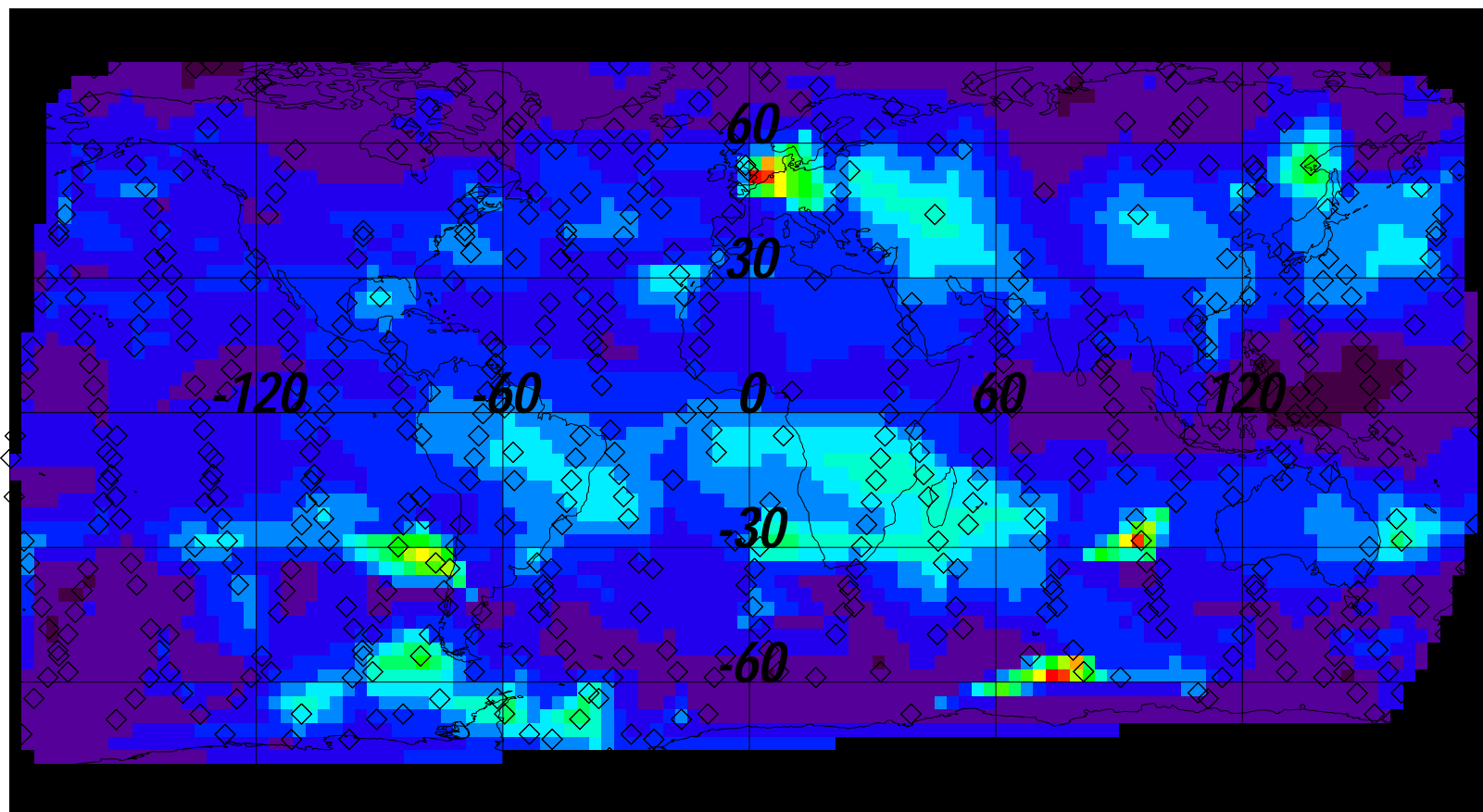


Fractional Error (Surface - 500 hPa)

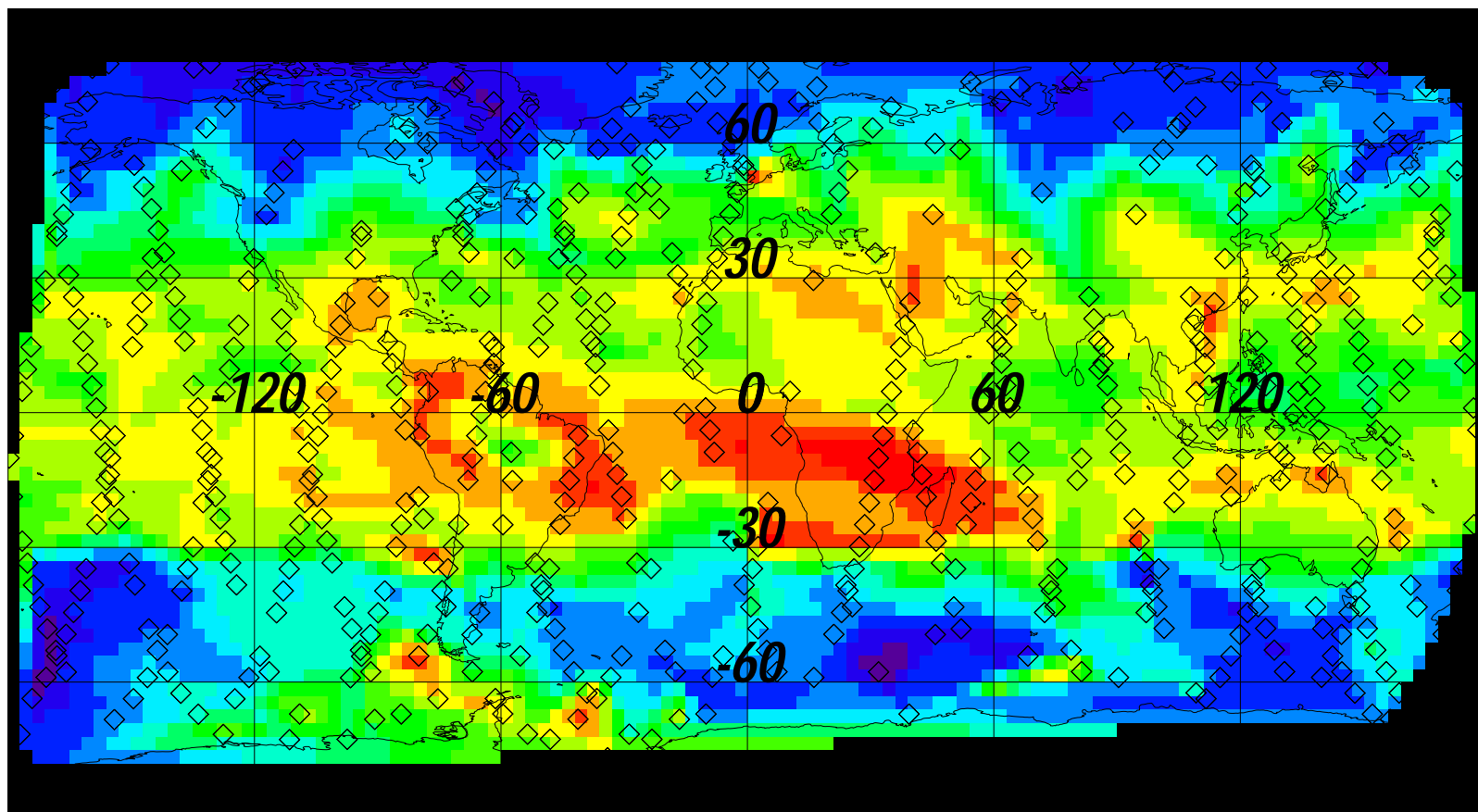


Characterization of Retrieved TES Upper Tropospheric Ozone (Sept. 20, 2004)

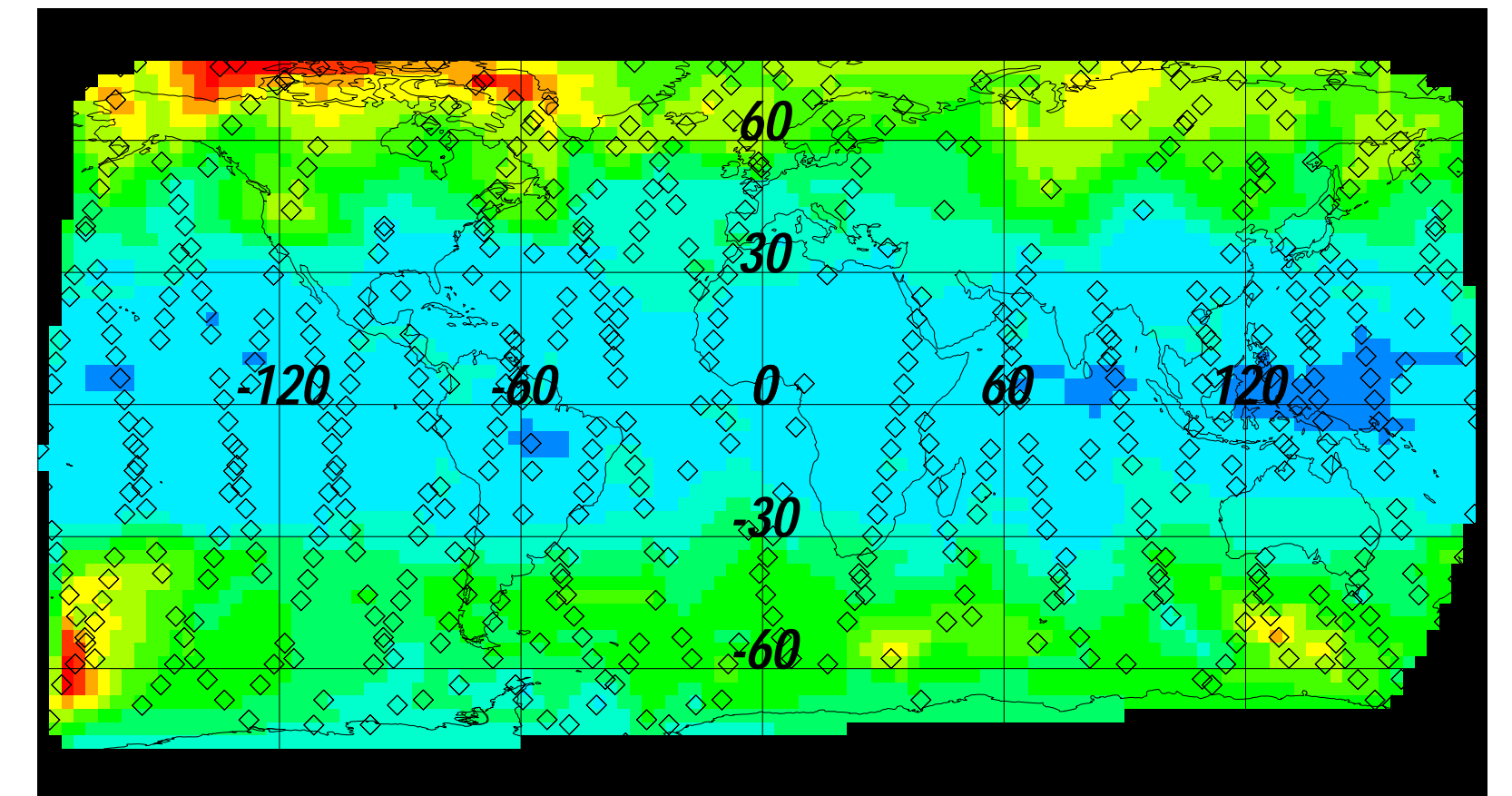
TES Upper Tropospheric Ozone (500 hPa - Tropopause)



TES Vertical Resolution (DOFS) (500 hPa - Tropopause)

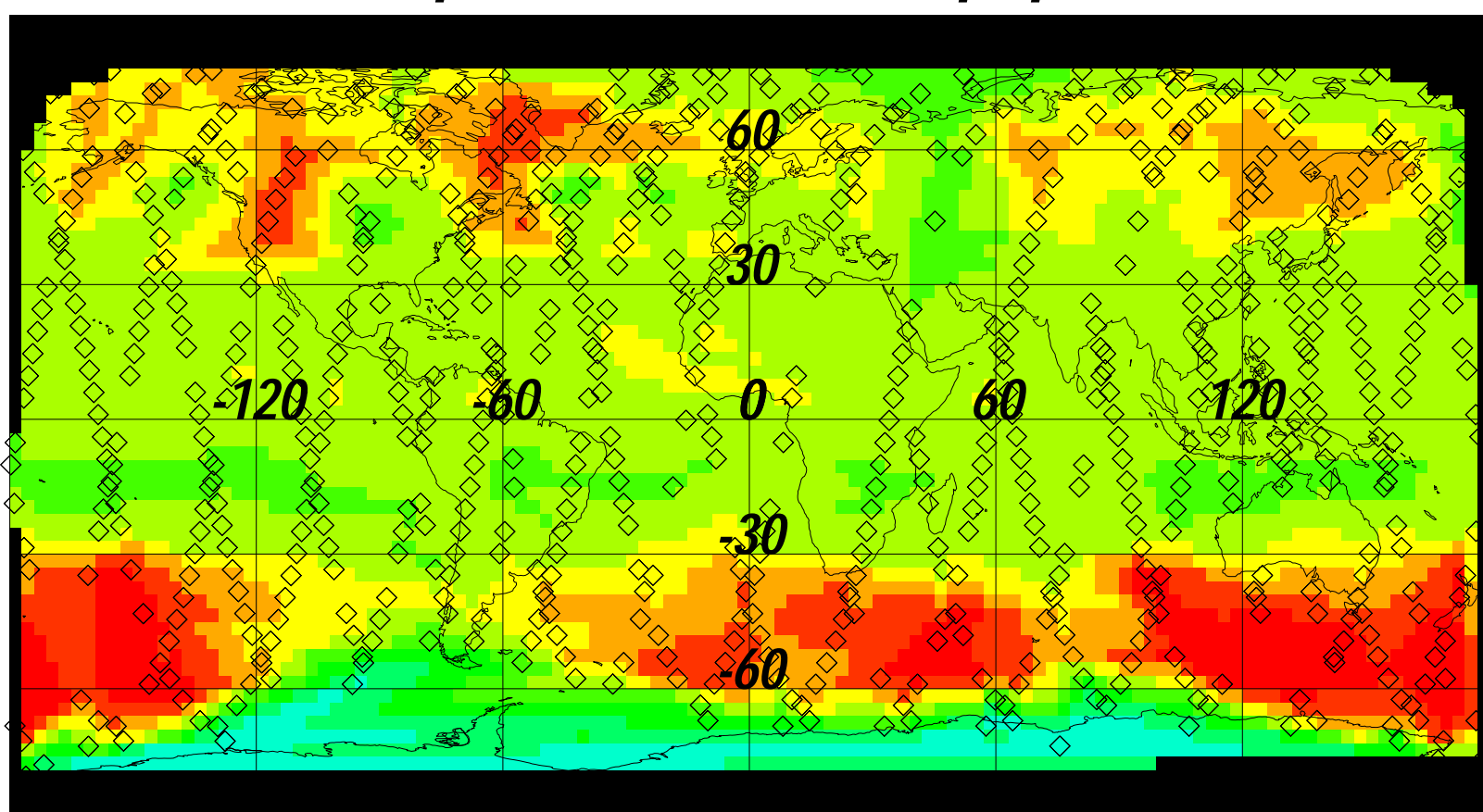


Fractional Error (500 hPa - Tropopause)

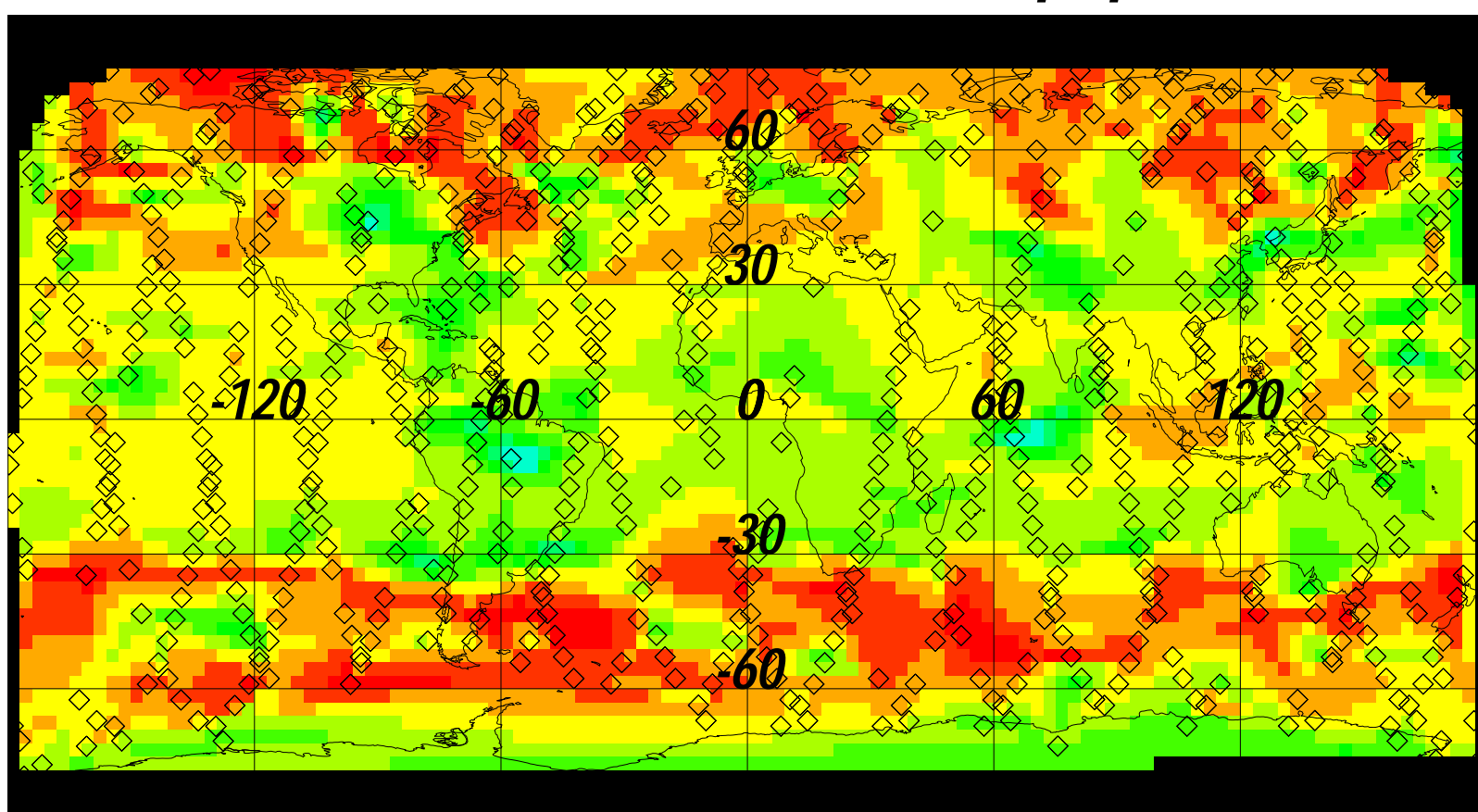


Characterization of Retrieved TES Stratospheric Ozone (Sept. 20, 2004)

TES Stratospheric Ozone (Tropopause - TOA)



TES Vertical Resolution (DOFS) (Tropopause - TOA)



Fractional Error (Tropopause - TOA)

