



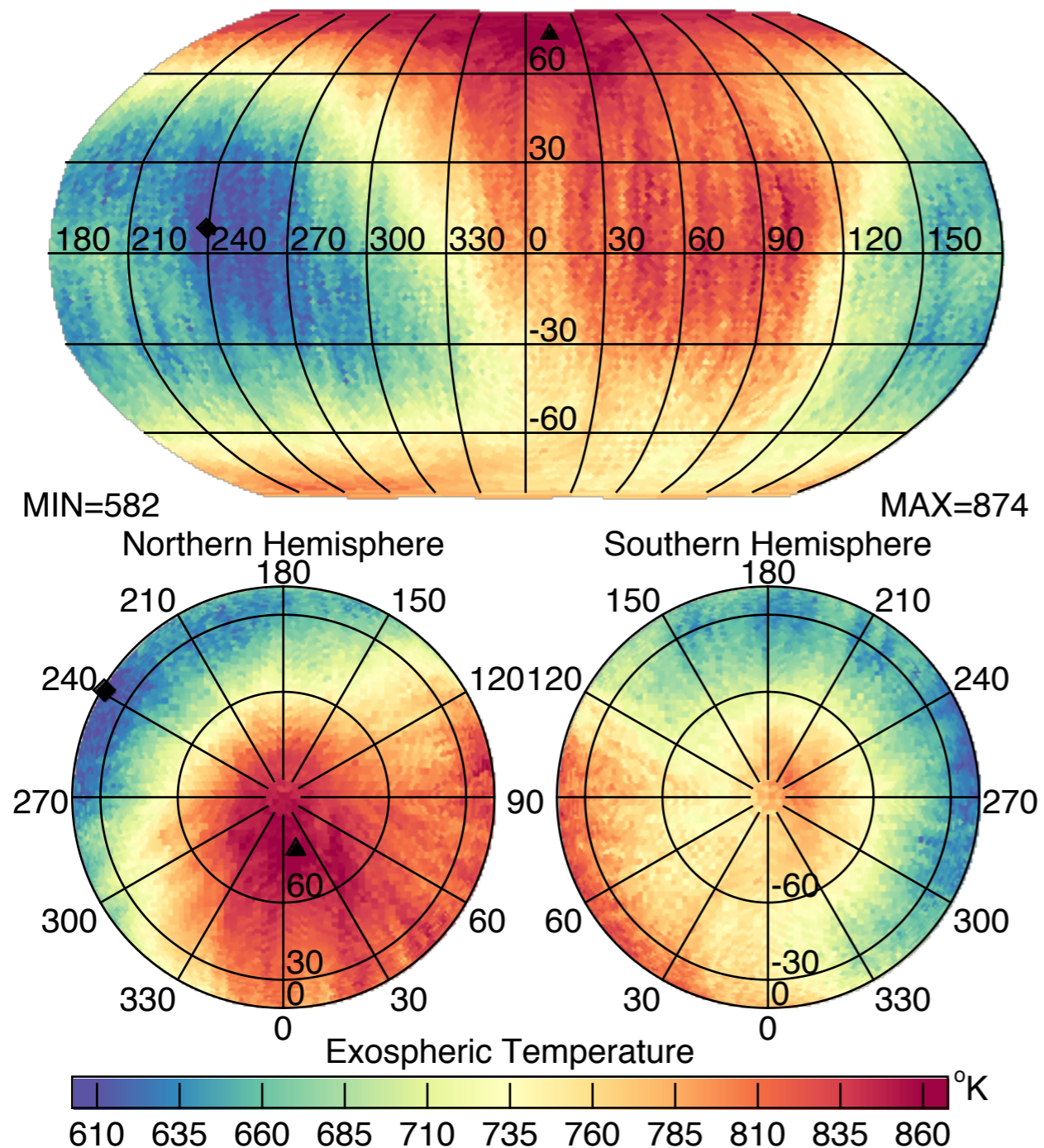
Strong correlations between oxygen in
thermosphere, SABER measurements of CO₂
emissions, and the annual/semiannual
variations

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provided by Eric Sutton, Martin Mlynczak,
Linda Hunt, and the NRLMSISE-00 Developers

Objective was to map exospheric temperatures from neutral density measurements:

A problem was that neutral densities from CHAMP and GRACE did not seem to agree with each other as well as desired, and which dataset needed adjustment was not clear.

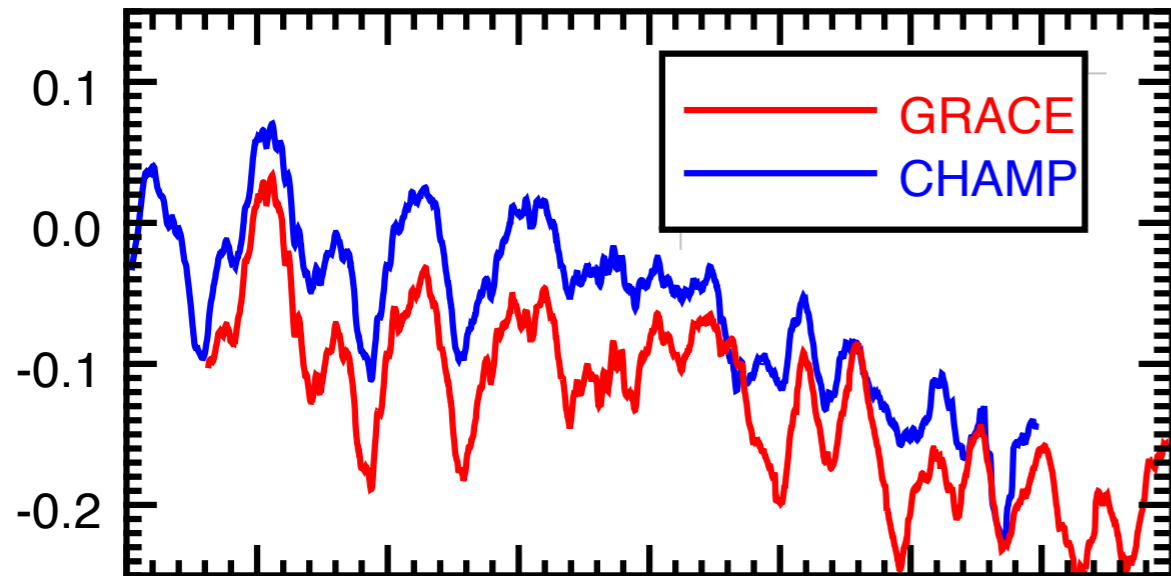


NRL personnel had suggested a comparison with the NRLMSISE-00 model.

ALL density values compared with MSIS. Log of ratios are shown, after smoothing with 60-day running average.

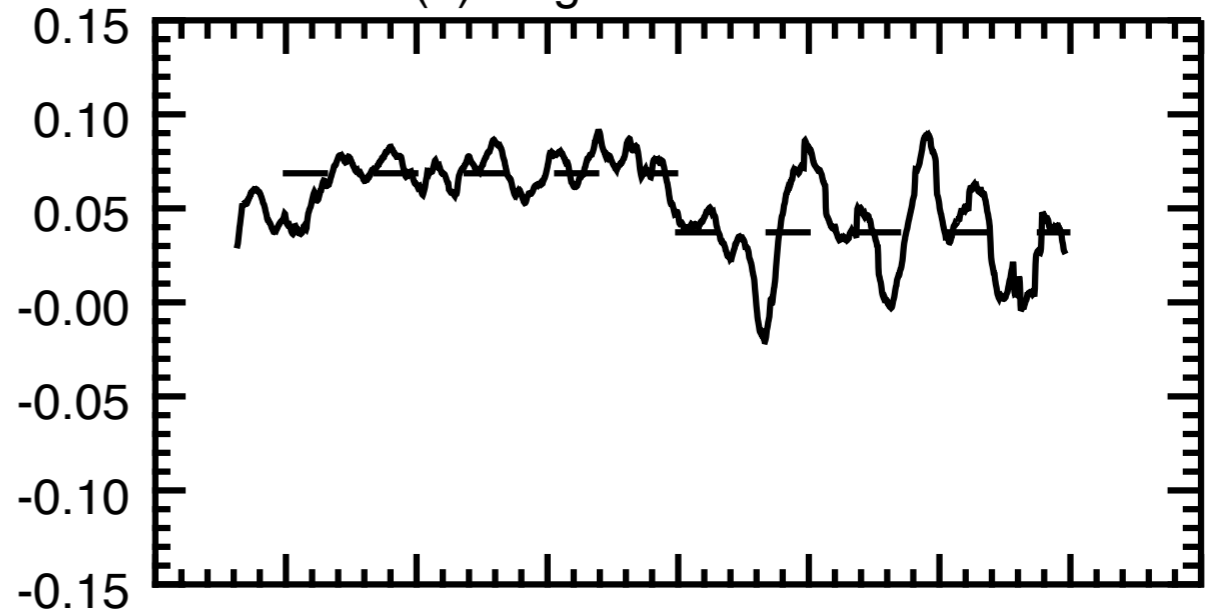
$\text{LOG}_{10}(\rho_{\text{Sat}} / \rho_{\text{MSIS}})$

(a) Original Data Values

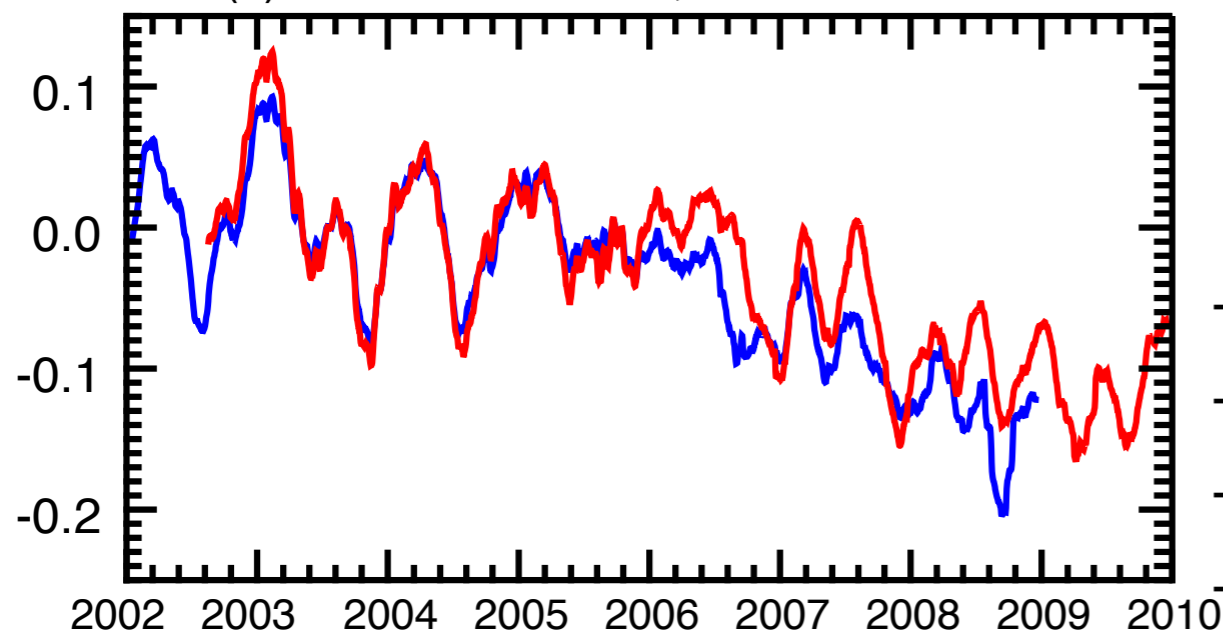


$\text{LOG}_{10}(\text{Ratio})$ Difference, CHAMP - GRACE

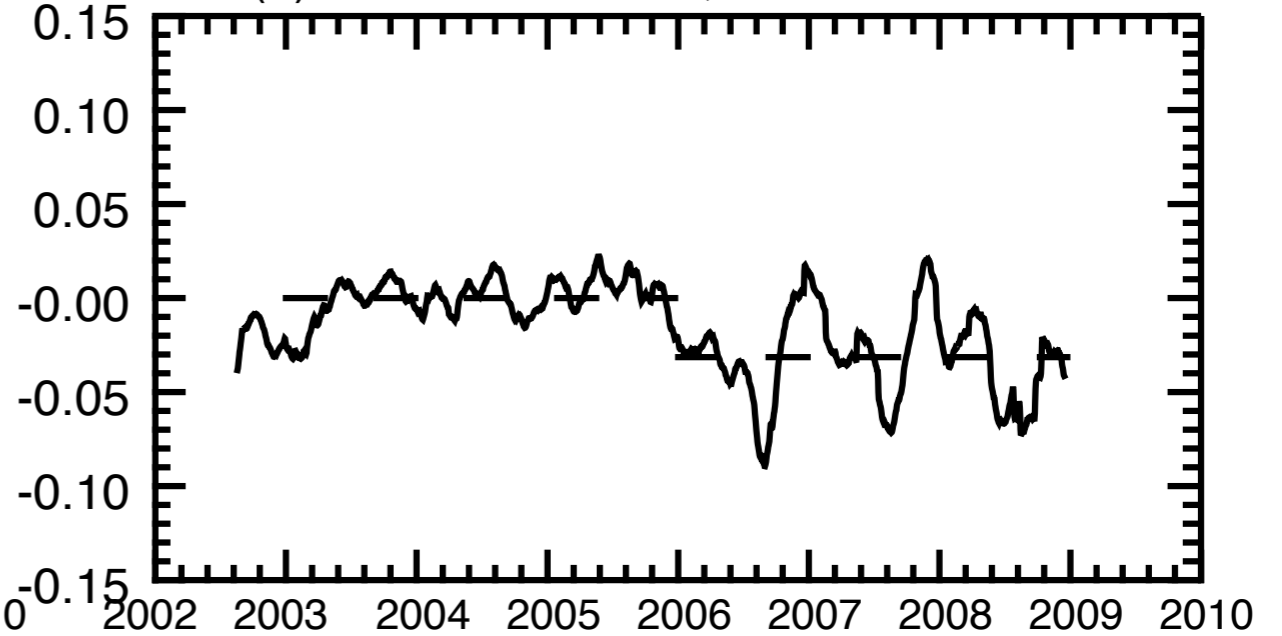
(b) Original Data Values



(c) CHAMP * 1.0529, GRACE * 1.2333



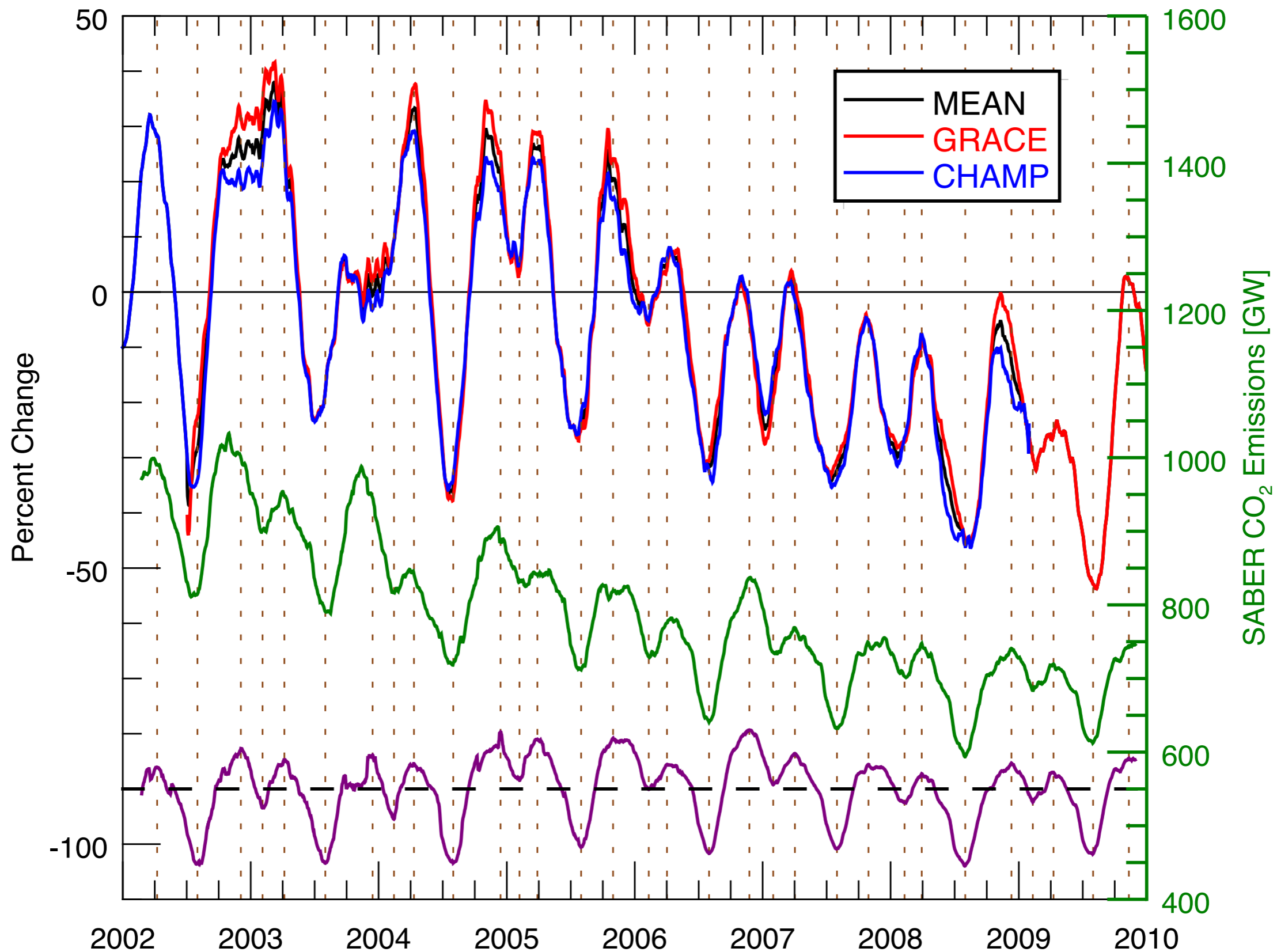
(d) CHAMP * 1.0529, GRACE * 1.2333



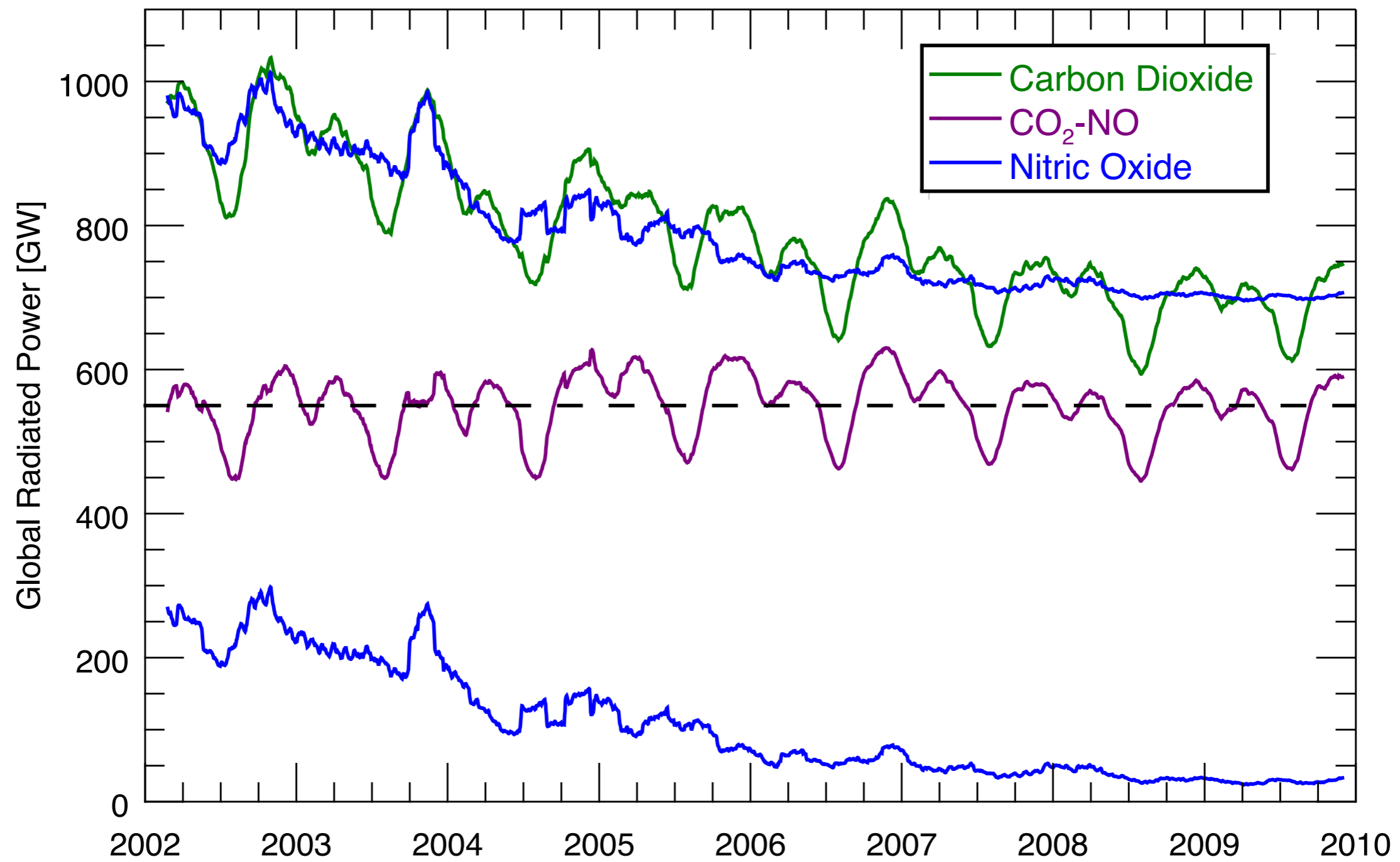
First adjustment improves comparison for 2002 thru 2005. There remain problems, as MSIS is not handling the AO/SAO very well, nor the low solar cycle.

Adjusted oxygen, with AO/SAO flags in MSIS turned "off":

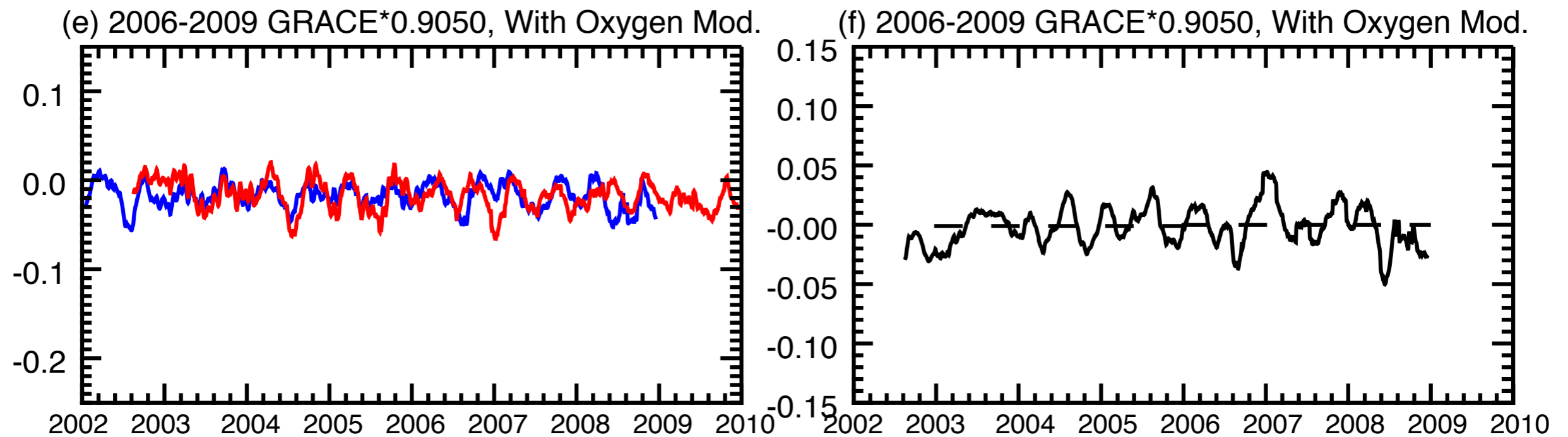
Changes In NRLMSISE-00 Oxygen Needed To Match Density Data



Global NO and CO₂ Radiated Power From SABER, 60-Day Sliding Average

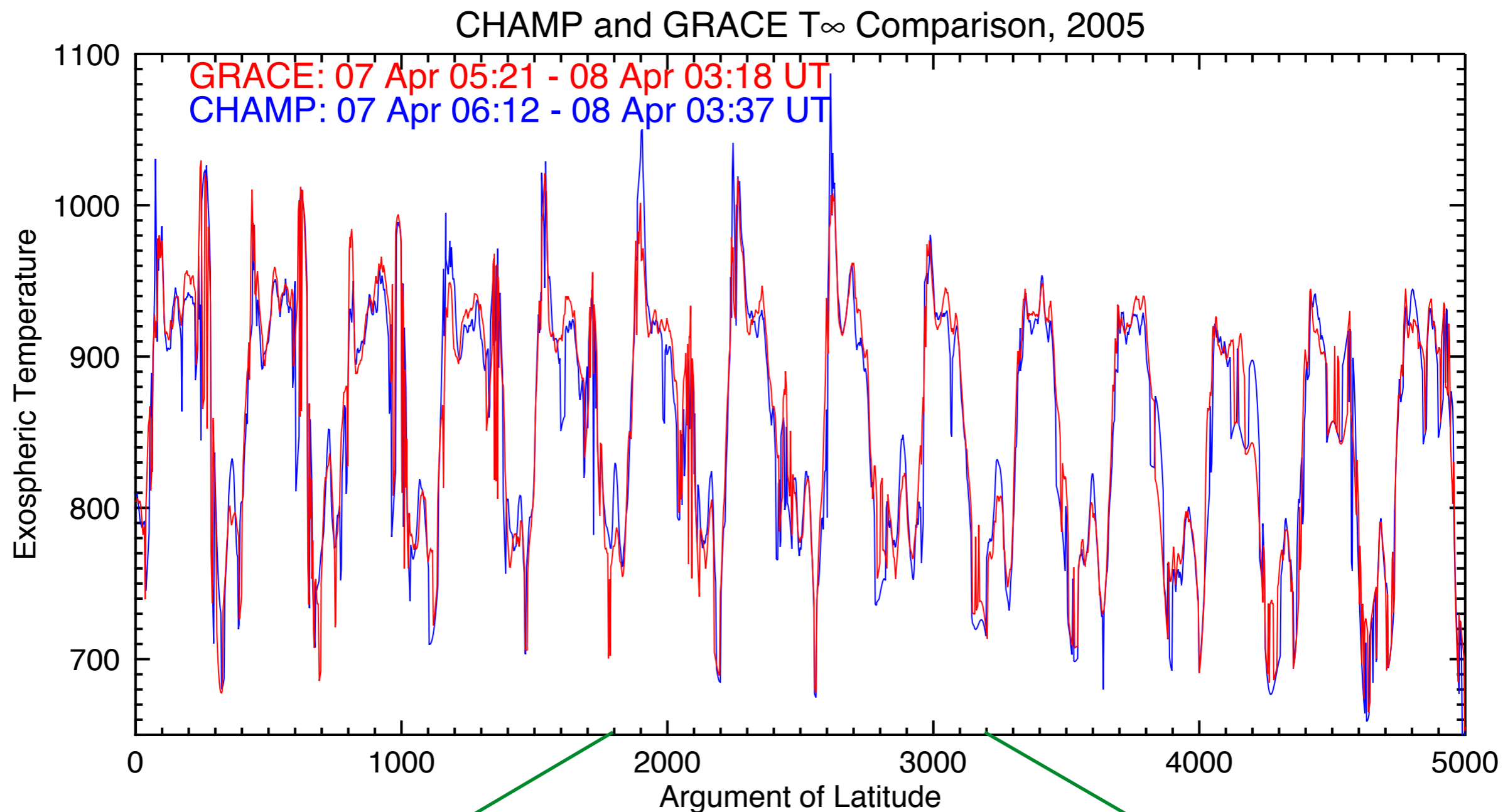


Comparison with oxygen adjustments, using prior results and with MSIS AO/SAO flags still turned off. A second adjustment to the GRACE densities is applied for 2006 onward:



These adjustments were satisfactory enough to do the mapping (for now, as in principle more could be done). The oscillations that remain may perhaps be due to the “winter Helium bulge.”

The exospheric temperatures derived from CHAMP and GRACE neutral densities now agree very well, as shown with this close conjunction



The exospheric temperatures derived from CHAMP and GRACE neutral densities now agree very well, as shown with this close conjunction

