Fig. S1. Same as Figure 1, but for January 2009 to highlight seasonal variability. For other months and years, see full benchmark results at https://issuu.com/jennyfisher_uow/stacks .
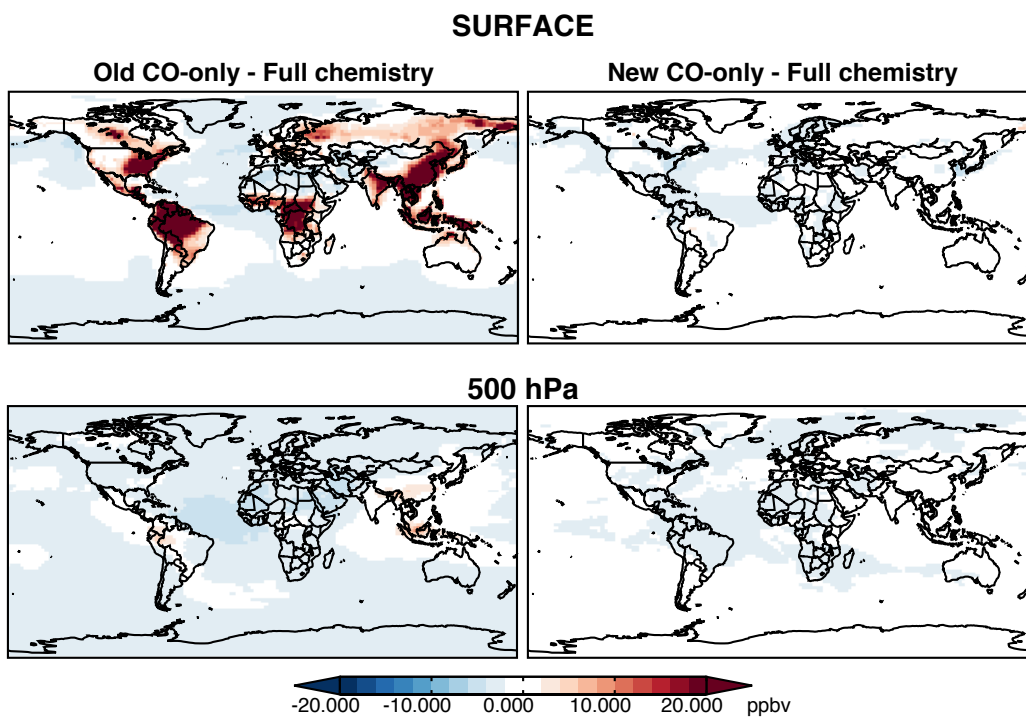
Fig. S2. Same as Figure 1, but for July 2010 to highlight interannual variability. For other months and years, see full benchmark results at https://issuu.com/jennyfisher_uow/stacks .
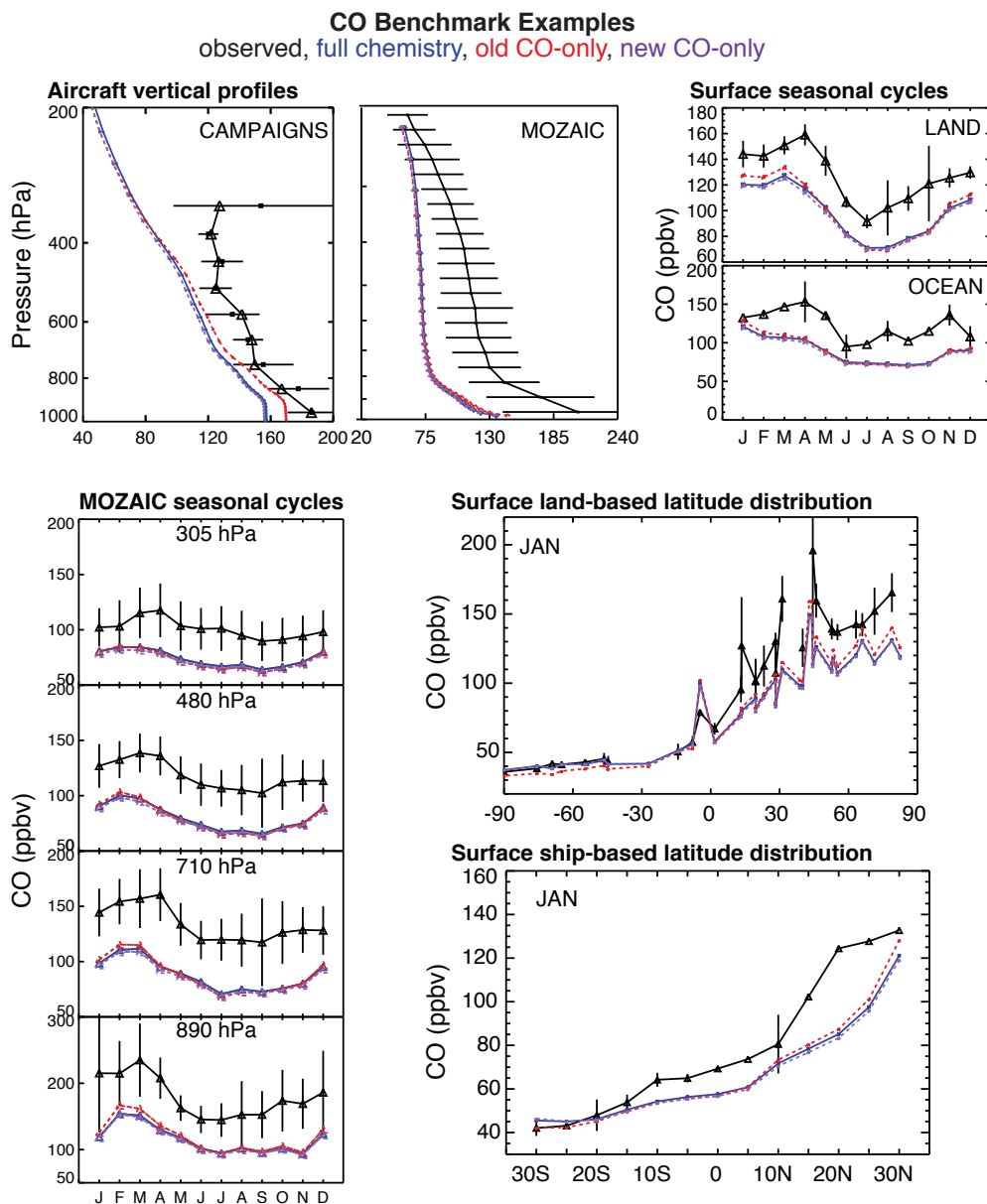
Fig. S3. Representative examples of the plot types produced by the GEOS-Chem CO benchmark evaluation. Plot types include: aircraft vertical profiles (top left), both from short-term campaigns and from MOZAIC data separated by seasons; aircraft seasonal cycles (bottom left) from MOZAIC data separated by altitude; surface seasonal cycles (top right) from NOAA GMD land and ocean sites; and surface latitude distributions (bottom right) from a subset of land-based and ship-based NOAA GMD sites. For the full set of benchmark plots, see https://issuu.com/jennyfisher_uow/stacks .

CO vertical profiles
observed, full chemistry, old CO-only, new CO-only
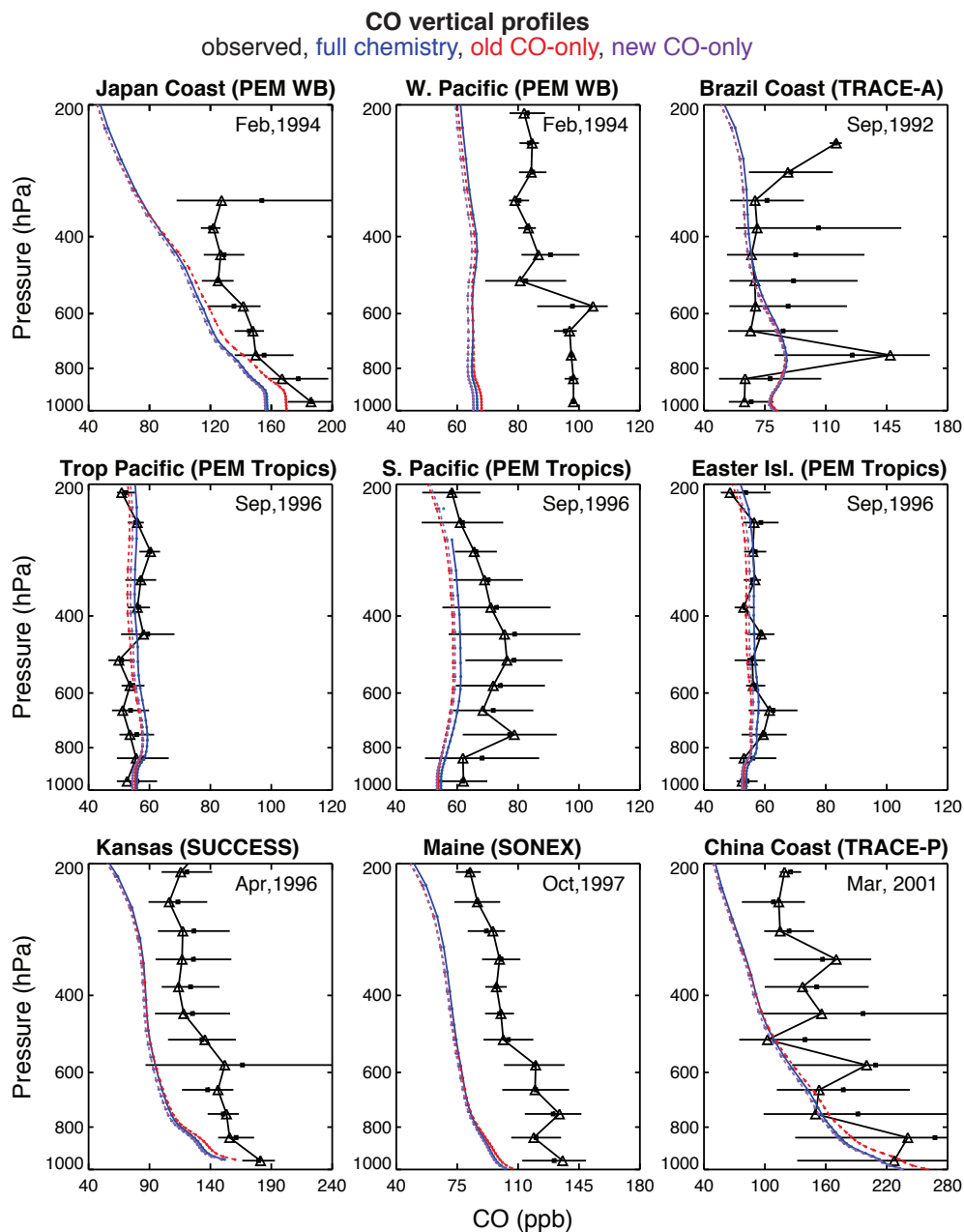
Fig. S4. Same as Figure 5, but for additional aircraft data available in the GEOS-Chem benchmark. Additional campaigns and regions can be seen at https://issuu.com/jennyfisher_uow/stacks .
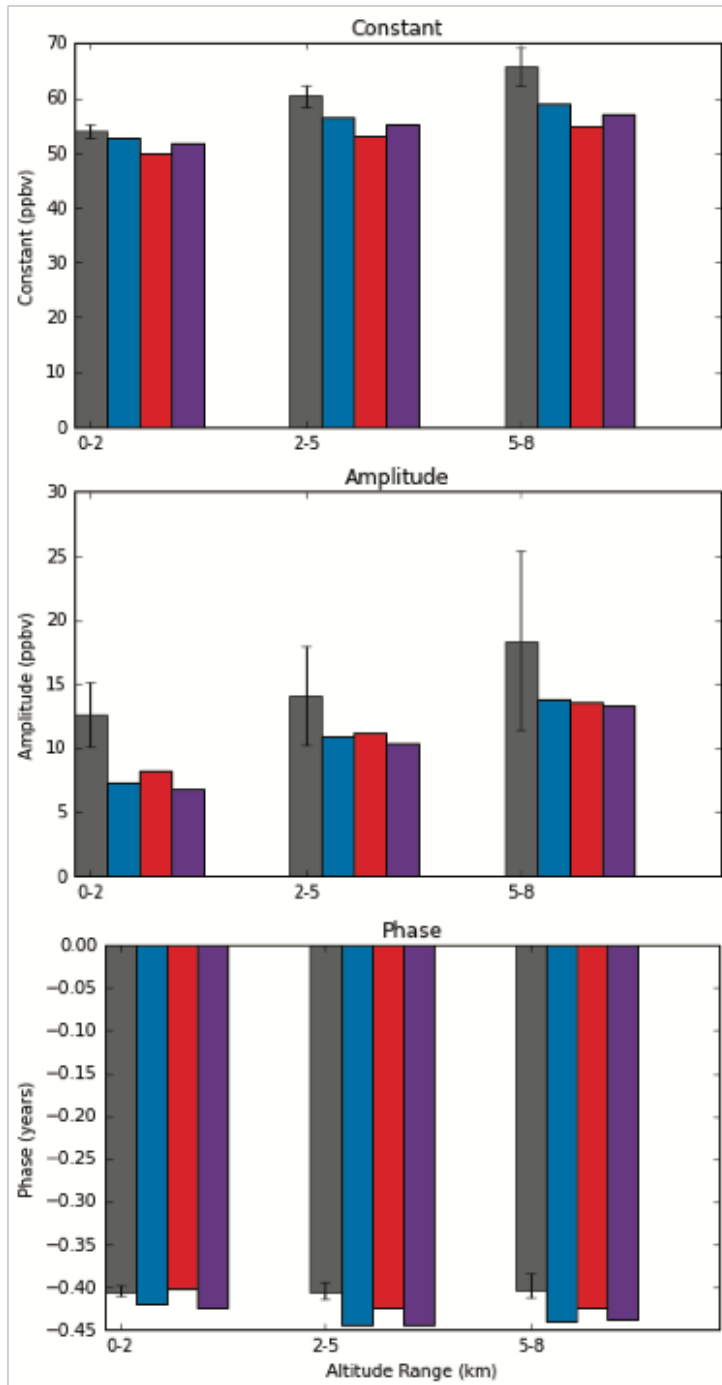
Fig. S5. Parameters for a single harmonic fit describing the shape of the seasonal cycle of carbon monoxide in the remote southern hemisphere (in/around Cape Grim, Australia) in different altitude bins. Grey bars represent the fit to the observations (including 95% confidence intervals) and coloured bars represent the GEOS-Chem full chemistry (blue), original CO-only (red) and updated CO-only (purple) simulations. For full details of the method and motivation of the fit, see Fisher et al. (2015).
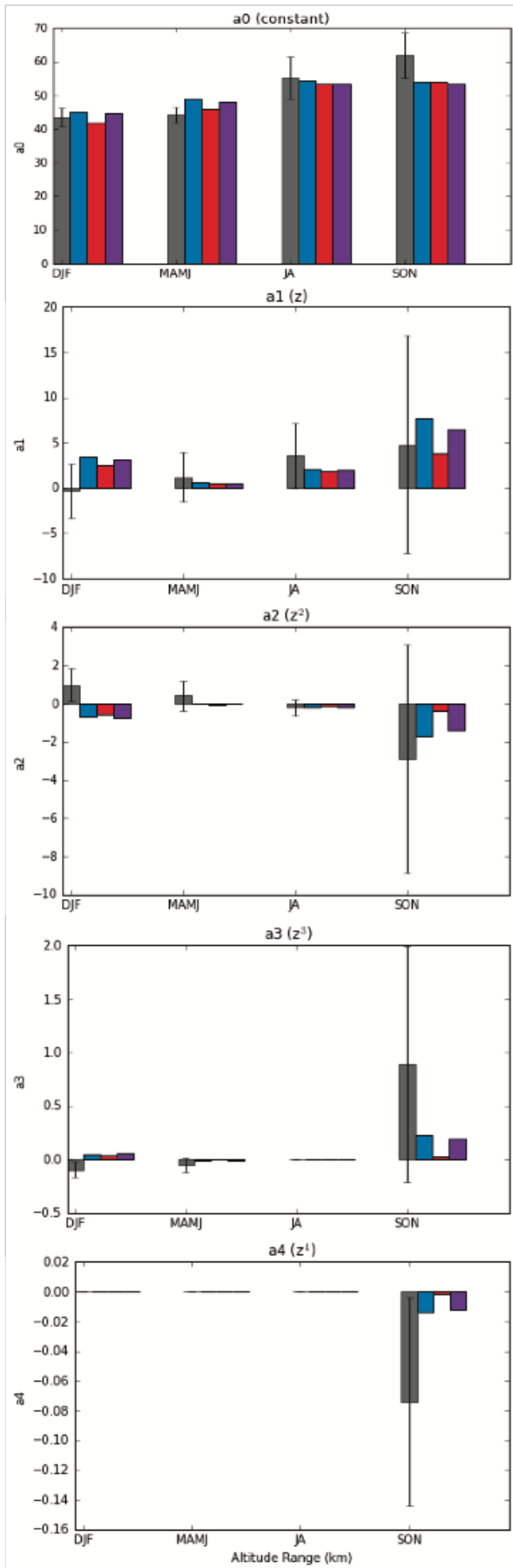
Fig. S6. Polynomial terms representing the shape of the vertical profile of carbon monoxide in the remote southern hemisphere (in/around Cape Grim, Australia) in different seasons. Grey bars represent the fit to the observations (including 95% confidence intervals) and coloured bars represent the GEOS-Chem full chemistry (blue), original CO-only (red) and updated CO-only (purple) simulations. For full details of the method and motivation of the fit, see Fisher et al. (2015).