

Supplementary material for paper by S. Maksyutov et al “Regional CO<sub>2</sub> flux estimates for 2009–2010 based on GOSAT and ground-based CO<sub>2</sub> observations”

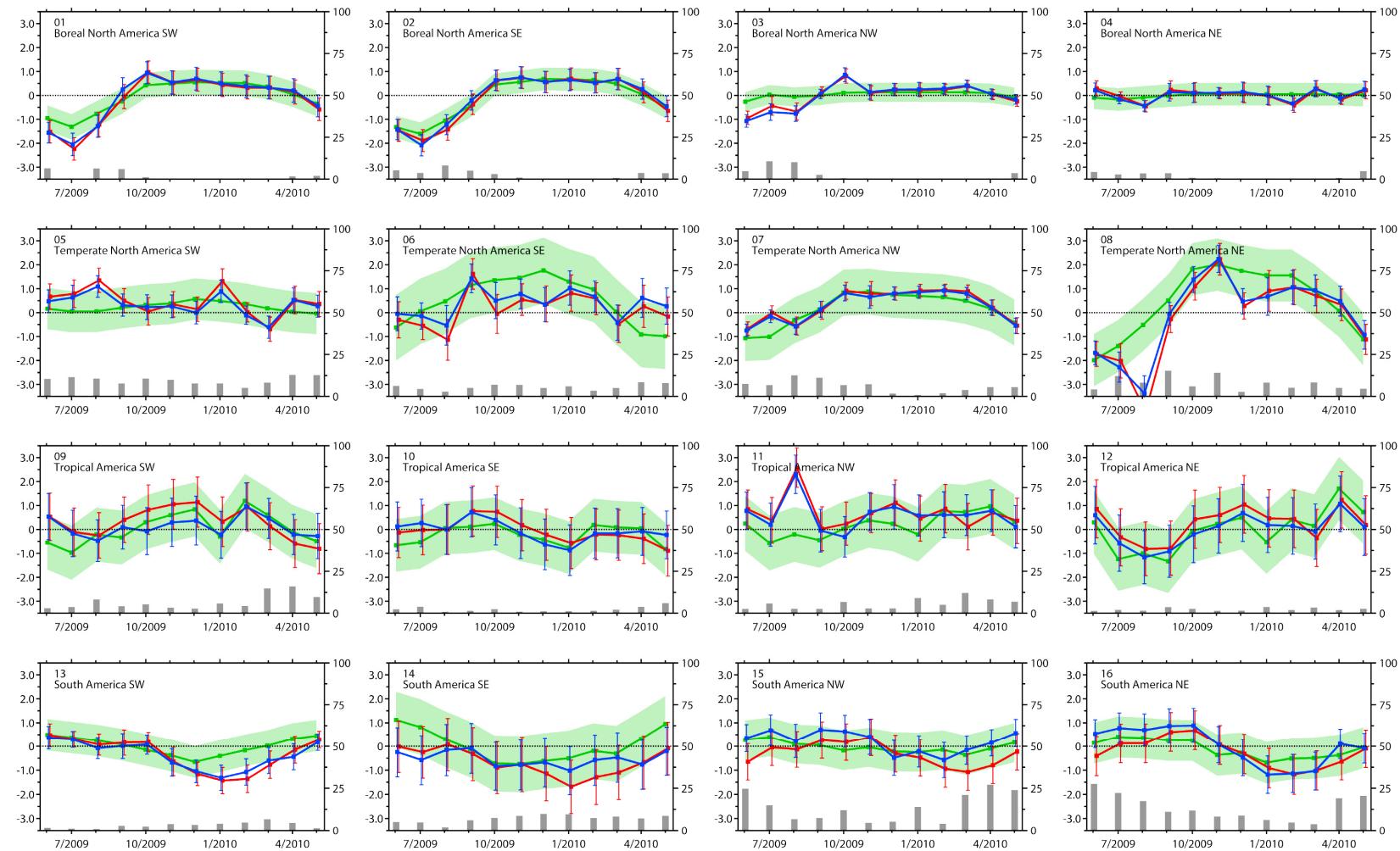


Figure S1. Time series of regionally averaged fluxes (gC/m<sup>2</sup>/day) for June 2009 to May 2010, for quadrants (left to right: SW, SE, NW, NE) in the (top to bottom) boreal North America, temperate North America, Tropical America, and South America subcontinental regions. The graphs show prior fluxes (green lines), estimated fluxes using GV data (red lines), and estimated fluxes using GV and GOSAT data (blue lines). The error bars show flux uncertainties. The gray bars represent the percent reduction in the uncertainty (scale on right side of graphs).

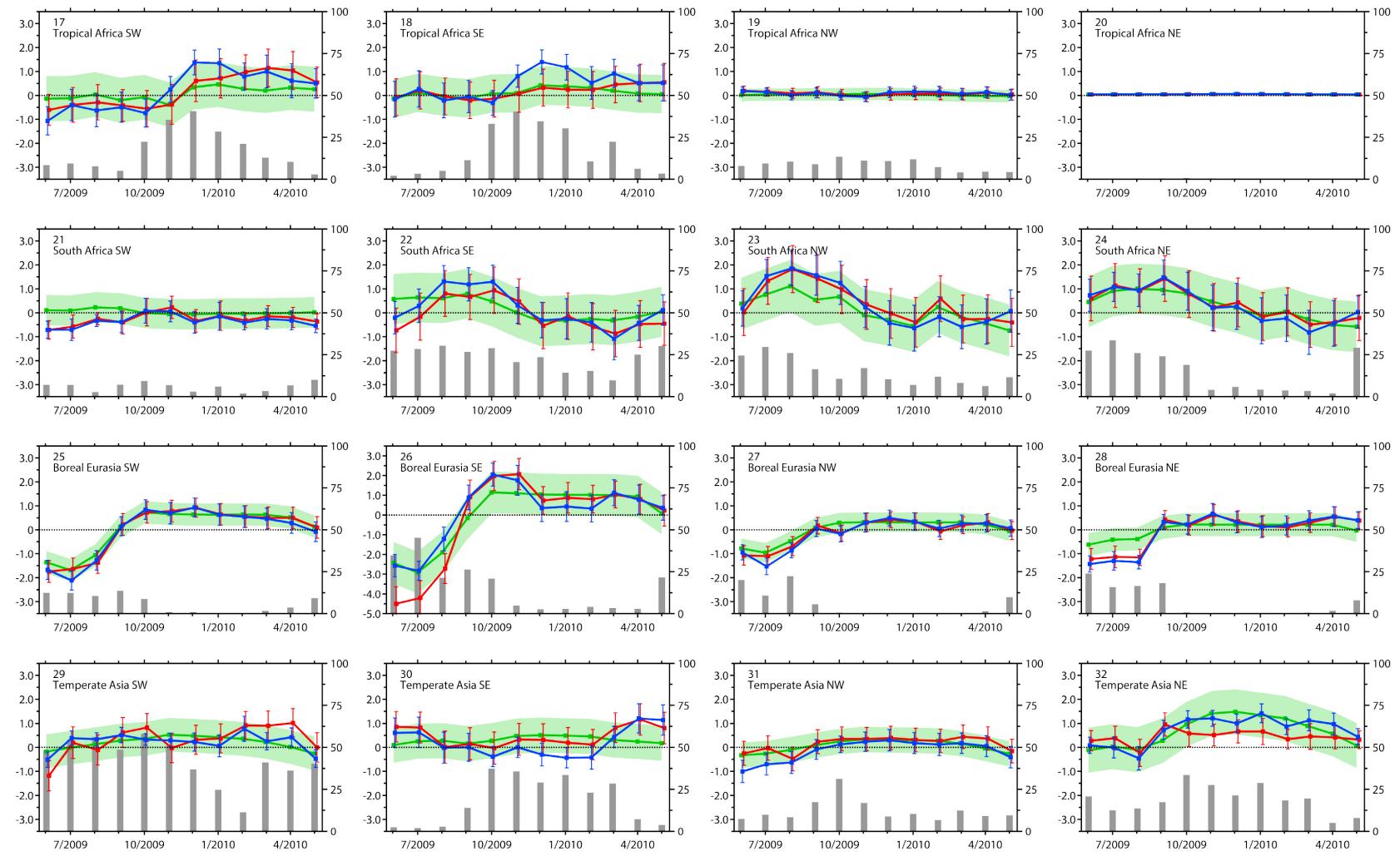


Figure S2. Time series of regionally averaged fluxes ( $\text{gC}/\text{m}^2/\text{day}$ ) for June 2009 to May 2010, for quadrants (left to right: SW, SE, NW, NE) in the (top to bottom) Tropical Africa, South Africa, Boreal Asia, Temperate Asia subcontinental regions. The graphs show prior fluxes (green lines), estimated fluxes using GV data (red lines), and estimated fluxes using GV and GOSAT data (blue lines). The error bars show flux uncertainties. The gray bars represent the percent reduction in the uncertainty (scale on right side of graphs).

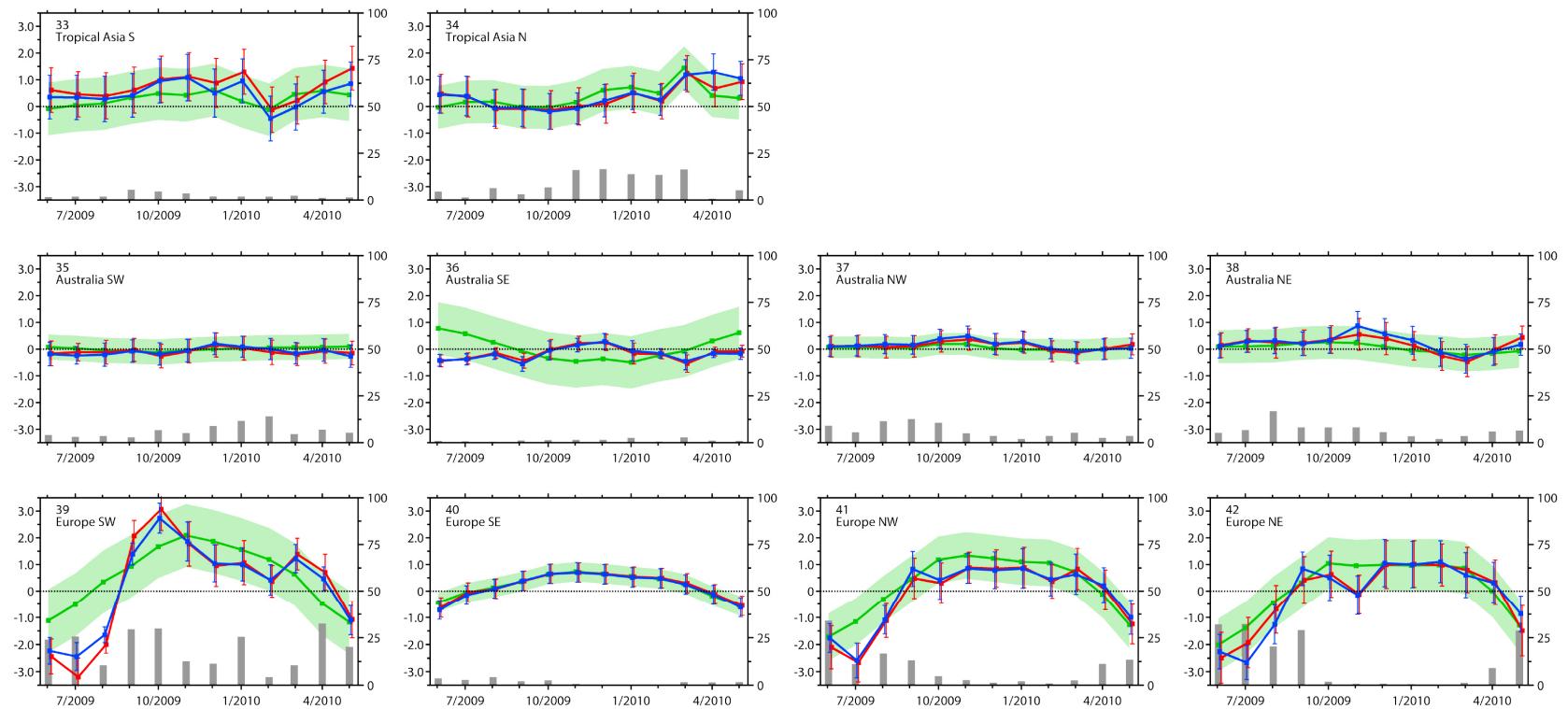


Figure S3. Flux time series for June 2009-May 2010, for Tropical Asia, Australasia and Europe Time series of regionally averaged fluxes (gC/m<sup>2</sup>/day) for June 2009 to May 2010, for sub-region pair (North and South) of Tropical Asia (top left), and quadrants (left to right: SW, SE, NW, NE) in the Australasia(middle) and Europe(bottom) subcontinental regions. The graphs show prior fluxes (green lines), estimated fluxes using GV data (red lines), and estimated fluxes using GV and GOSAT data (blue lines). The error bars show flux uncertainties. The gray bars represent the percent reduction in the uncertainty (scale on right side of graphs).

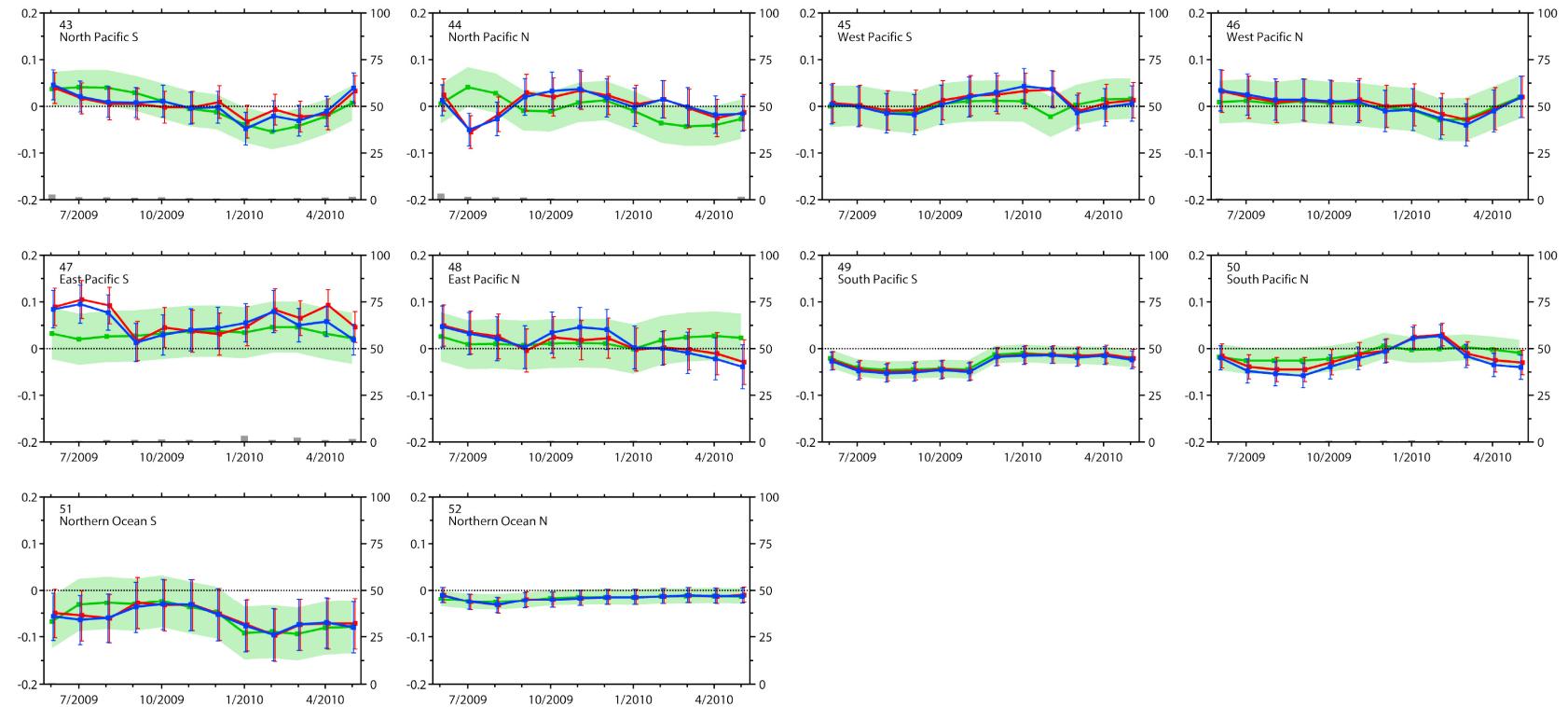


Figure S4. Time series of regionally averaged fluxes ( $\text{gC}/\text{m}^2/\text{day}$ ) for June 2009 to May 2010, for sub-regions (North and South) pairs of North Pacific Ocean (top left), West Pacific (top right), East Northern Ocean (middle left), South Pacific Ocean (middle right), Northern Ocean (bottom left) oceanic regions. The graphs show prior fluxes (green lines), estimated fluxes using GV data (red lines), and estimated fluxes using GV and GOSAT data (blue lines). The error bars show flux uncertainties. The gray bars represent the percent reduction in the uncertainty (scale on right side of graphs).

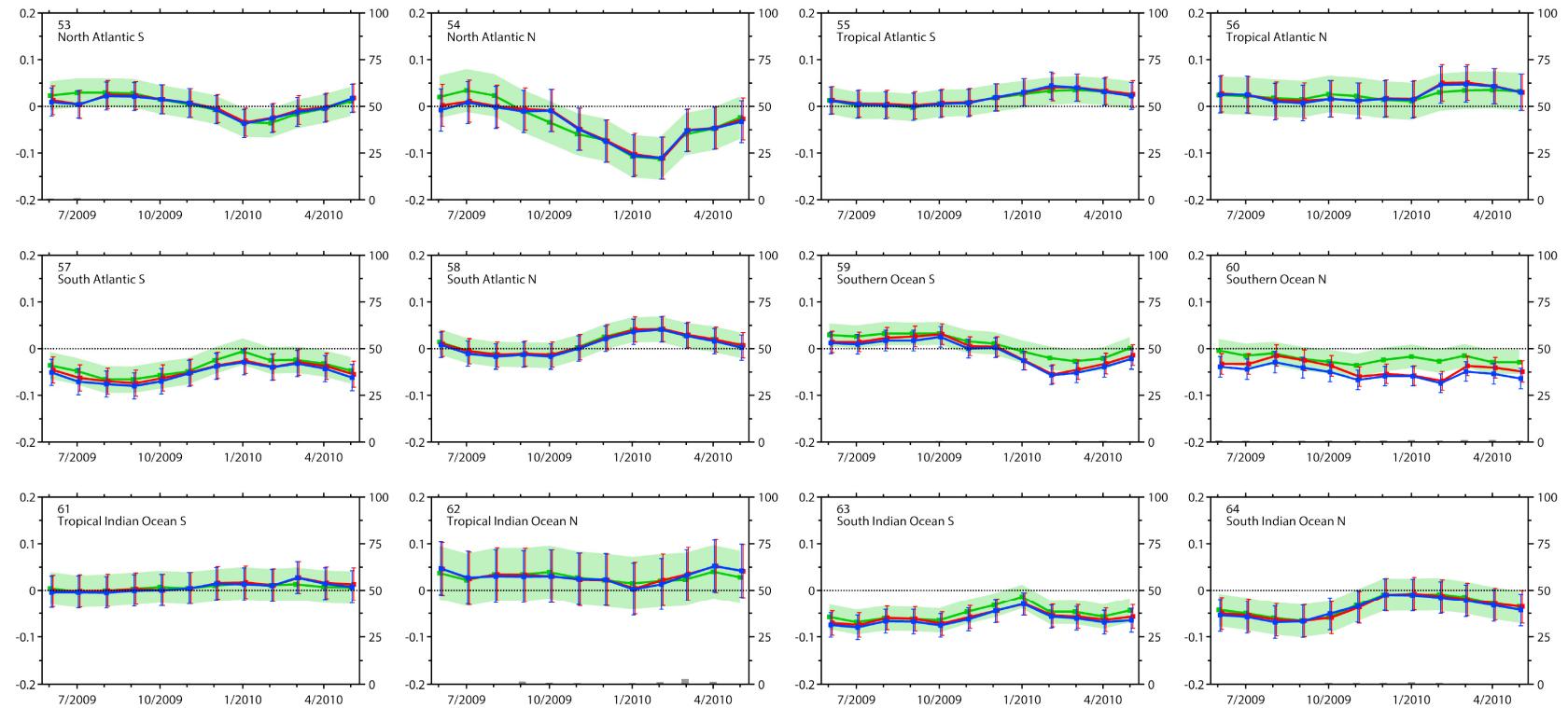


Figure S5. Flux time series for June 2009- May 2010, for Atlantic Ocean, Southern Ocean, Indian Ocean. Time series of regionally averaged fluxes ( $\text{gC/m}^2/\text{day}$ ) for June 2009 to May 2010, for sub-regions (North and South) of North Atlantic Ocean (top left), Tropical Atlantic Ocean (top right), South Atlantic Ocean (middle left), Southern Ocean (middle right), Tropical Indian Ocean(bottom left), South Indian Ocean (bottom right) oceanic regions. The graphs show prior fluxes (green lines), estimated fluxes using GV data (red lines), and estimated fluxes using GV and GOSAT data (blue lines). The error bars show flux uncertainties. The gray bars represent the percent reduction in the uncertainty (scale on right side of graphs).

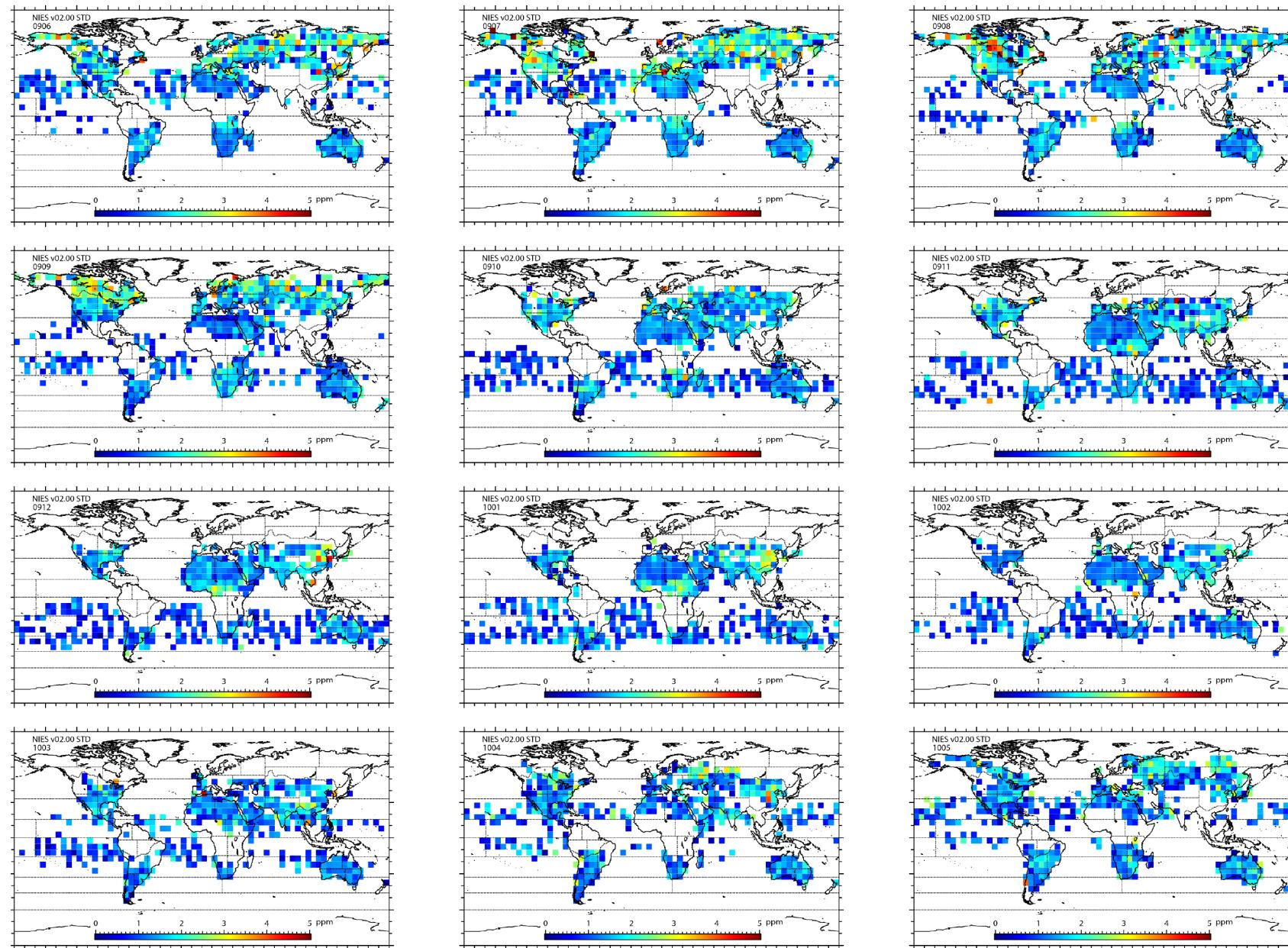


Figure A. Standard deviations of the GOSAT retrievals for each 5x5 degree box by month.

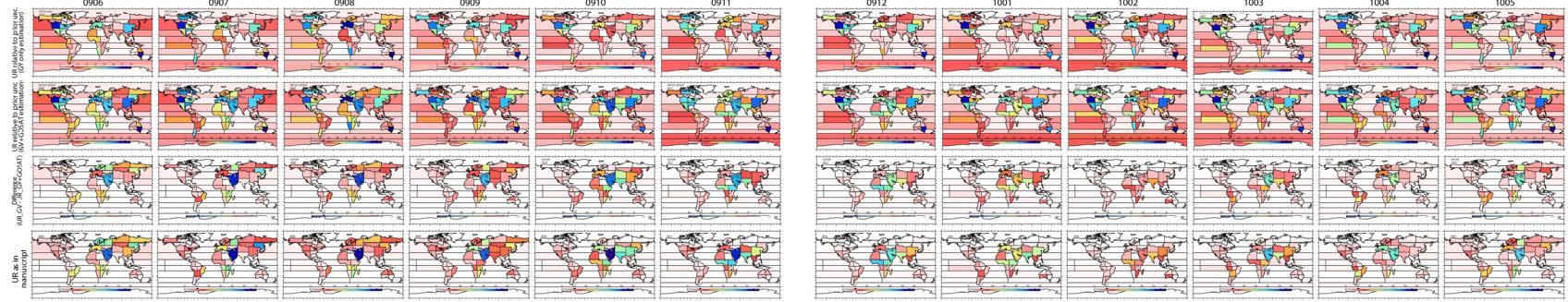


Figure B. Flux uncertainty reduction rate (UR) for each month. Top row: relative to prior with GV only; second row: relative to prior with GV and GOSAT; third row: difference  $UR(GV \text{ only}) - UR(GV+GOSAT)$ ; bottom row: UR as in manuscript.

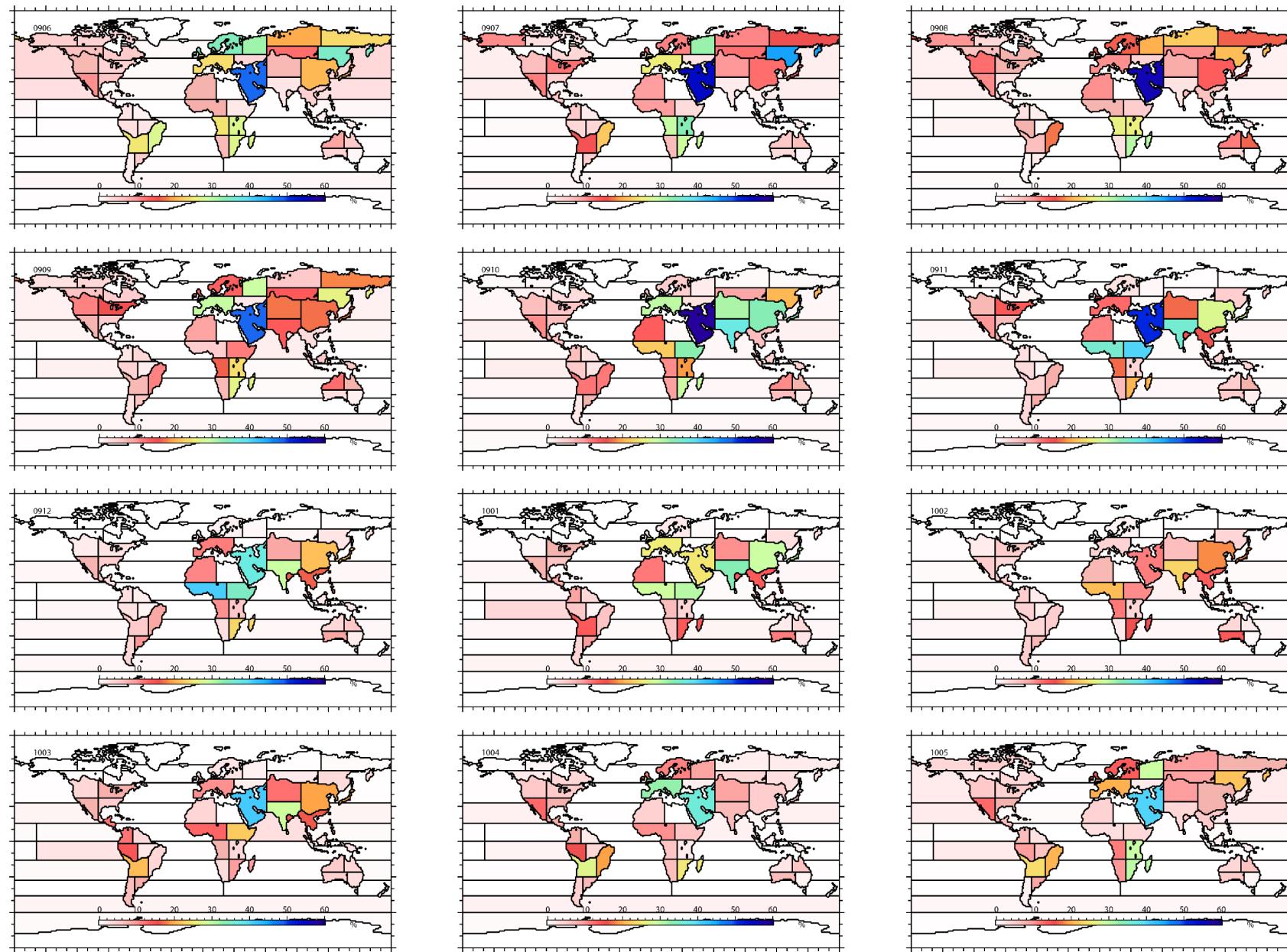


Figure C. Map of uncertainty reduction rate by month.

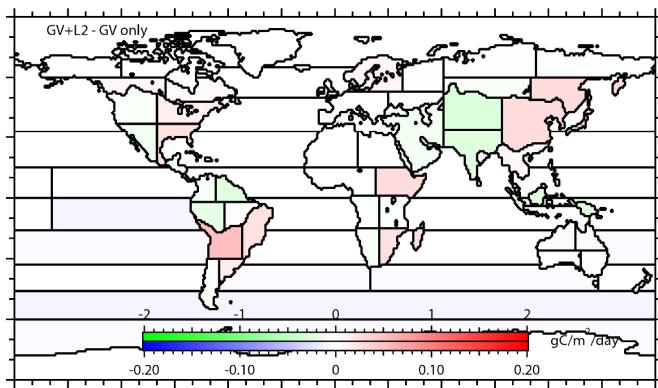
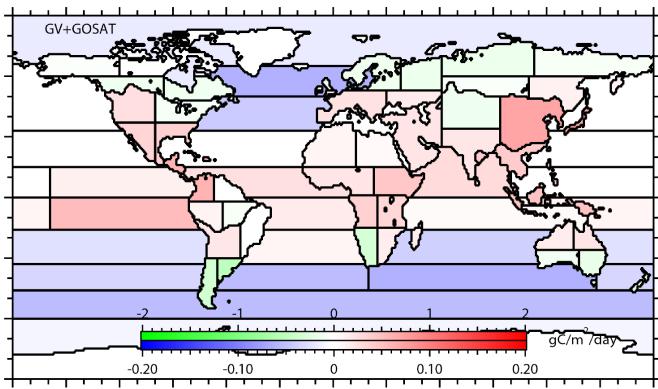
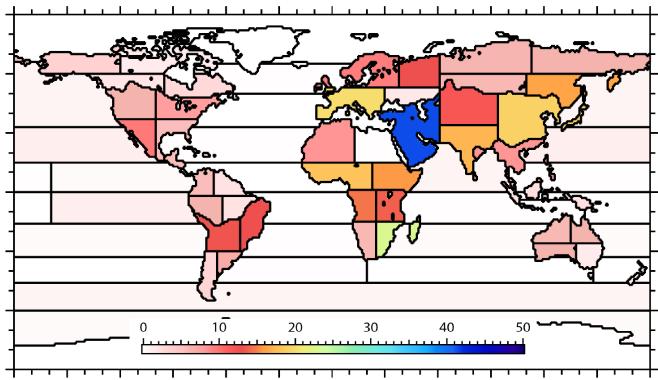


Figure D. Annual average: uncertainty reduction (top), posterior flux for GV+GOSAT (middle), flux difference (GV+GOSAT) – (GV only)

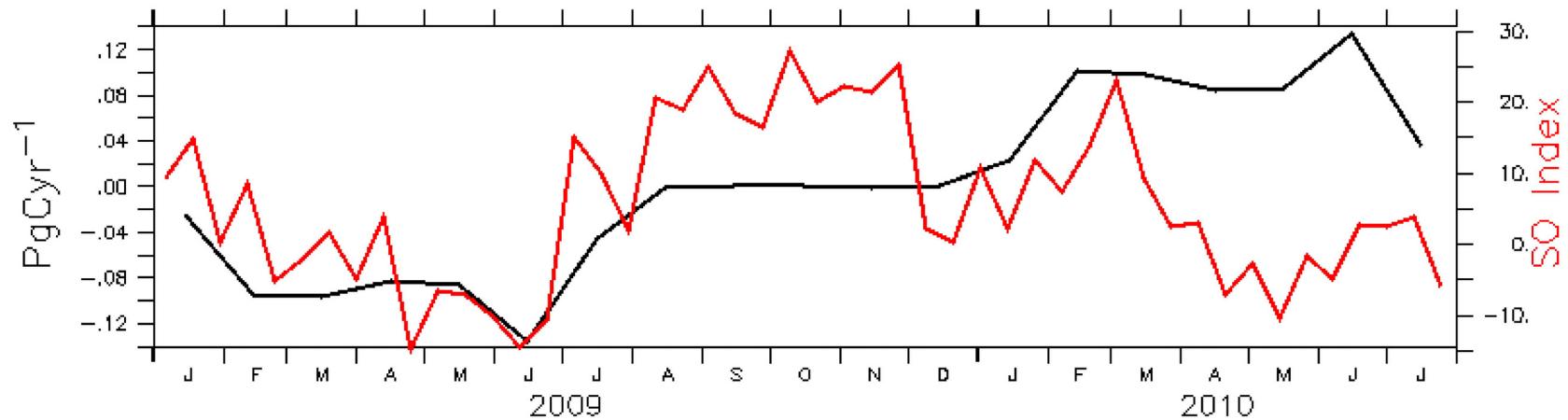


Figure E. Ocean CO<sub>2</sub> flux anomaly integrated over a box of (S10-N10, E150-E250) in red, SO (Southern Oscillation) index in black