

Monthly global emissions of anthropogenic CO₂: Atmospheric CO₂ transport calculations based on NASA data assimilation

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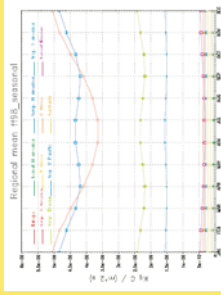
⁴NASA/GSFC

Use a 1st and 2nd harmonic approach dependent on latitude

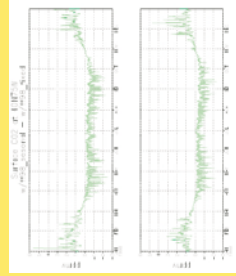
$$\text{flux}(t) = (\text{Annual flux})/12 + 0.01*[A1*\cos(t+\text{shift}) + A2*\cos(2t+\text{shift})]$$

$\phi > 50$: $A1 = [2 - 0.01*(90 - \phi)] * (\text{Annual flux})$; $A2 = 0$
 $35 < \phi < 50$: $A1 = [1.6 - 0.1*(50 - \phi)] * (\text{Annual flux})$
 $A2 = 0.04 * (50 - \phi) * (\text{Annual flux})$
 $15 < \phi < 35$: $A1 = 0$; $A2 = [0.6 - 0.03(35 - \phi)] * (\text{Annual flux})$
 $0 < \phi < 15$: $A1 = 0$; $A2 = 0$

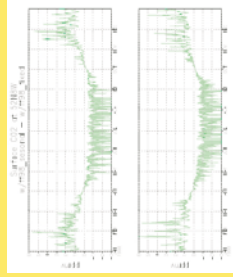
Regional fluxes of anthropogenic CO₂ over the seasonal cycle



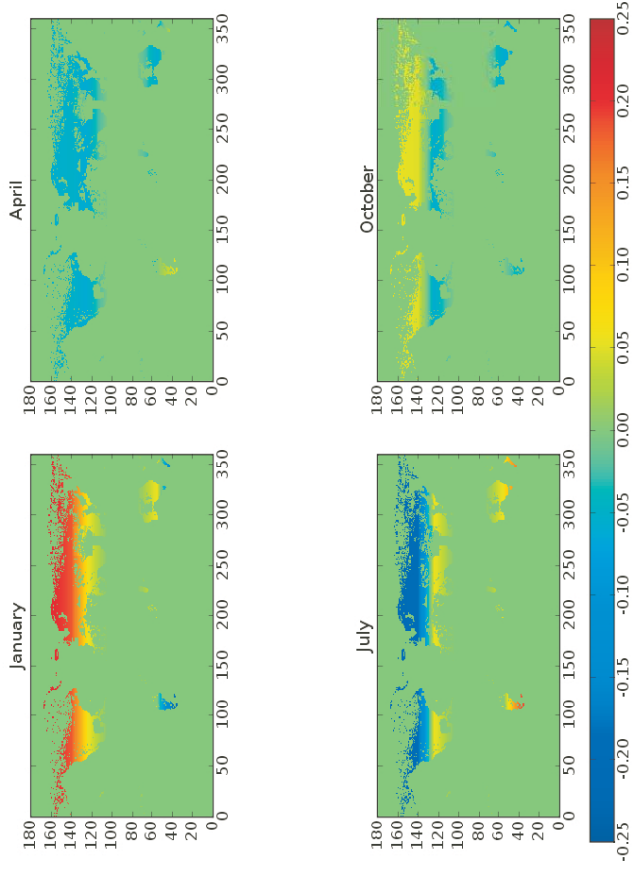
Atmospheric CO₂ concentrations at 40N-75W



Atmospheric CO₂ concentrations at 52N-8W



Monthly anthropogenic CO₂ Fluxes



Conclusions

Anthropogenic CO₂ emissions has significant seasonality and can contribute 1-6 ppm CO₂ to the amplitude of the seasonal cycle of atmospheric CO₂

This harmonic analysis can be applied to any 'annual' anthropogenic CO₂ flux

Implications for atmospheric CO₂ inversions