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Atmospheric Chemistry and Physics Discussions

Interactive comment on "CO_2 flux history 1982-2001 inferred from atmospheric data using a global inversion of atmospheric transport" *by* C. Rödenbeck et al.

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General comments

The paper by Rodenbeck et al. presents probably the most up-to-date inversion of interannual CO2 surface fluxes using atmospheric measurements. Compared with previous studies of the same type (mainly Rayner et al. 1999 and Bousquet et al. 2000), this paper provides an update of the inverted period (until end 2001) but, most important, addresses a large number of limitations of thesestudies : Use interannual atmospheric transport to calculate response functions Sample model outputs according to data (see comment below) Evaluate a Şmodel errorŤ Solves at pixel resolution with correlations to avoid aggregation error (Kaminski et al. paper)

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Discussion Paper

On a general basis, I only have two main criticisms on the paper. First, I wonder why you use such a little number of atmospheric measurements in your inversions, even for the late 1990s period where more than 90 sites are available. So far, I can see two main reasons : 1. You only use NOAA/CMDL network because you can get raw data to do the model selection. Raw data are available on request for all main laboratories measuring CO2 (CSIRO, LSCE, Ĕ), except maybe the Japenese data that are hard to obtainĔ For instance using Crozet Island instead of Amsterdam island is not good as the position of the measurement on CRZ is not as optimal as in AMS. 2. You want to avoid network calibration issues. Calibration issues are critical but you can include at least part of it in the observation error using Şround RobinŤ calibration values. 3. You think that some continental sites can be hardly reproduced by a global coarse atmospheric model. This is a good reason as inversion would then analyses model/data differences in terms of surface fluxes instead of atmospheric model error. However, this only removes few sites that are hard to model like in polluted areas or at the top of mountains. Moreover, why using BAL that is very hard to model and not SCH that is one of the longest timeseries over Europe ?

Your idea of making ŞwindowsŤ in time to invert fluxes with a constant number of sites is good, but why not including all possible sites (except maybe those of point 3 above) for the last period ? In a such underconstrained problem as estimating CO2 fluxes, not using all available atmospheric measurements seems hard to justify to me.

My second concern is a form one. I do not like the interpolated maps in the figures as it hides the real resolution of the model behind. TM3 has a horizontal resolution of 4x5° and even if you make great progress by solving the fluxes for each model pixel, it is still not a point optimisation. I understand that it produces nice maps but I suggest at least to note in each legend of the considered figures that maps are interpolated and that the model resolution is 4x5°.

Specific comments

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Interactive Comment

Section 2 : page 3 : What is an Śobvious outlierŠ ?

Section 2.1 : Concept : End of the section : Can you give order of magnitude of the matrices ?

Section 2.2.3 : Concentration uncertainty The trick to represent model representation error is nice. But, please give a range of data uncertainties, like min/max and associated stations.

Section 3.1 : Time variation of fluxes - North America/Eurasia partition. An other reason why North america temperate and Eurasia temperate differ might also be the lack of stations over Eurasia. Did you check the error anti-correlation between these two regions ? - It seems to me that the interannual variability of ocean fluxes was a larger in Rayner et al 99 than in Bousquet et al 2000 ?

Section 4.1 : The station set Again your choice to use only homogeneous records over time is reasonable but why not using more site in the late 1990s ? The presentation of figure 5 is very nice but you should adapt the scales to the fluxes you plot. Either you prefer that all regions have the same scales to compare more easily (but it makes hard to read ocean fluxes). Better would be to change the vertical scale of your plot depending on the region you plot. Also the complete run with 42 sites over the whole period is not readable. Please dark a little the grey color used.

Section 4.9 : time scale Do you apply any additional constrain on the time variation of seasonal fluxes to avoid ŞwigglesŤ (unrealistic fluctuations with time) in the inverted fluxes at pixel resolution? If not arenŠt your gross monthly fluxes very noisy ? What is so the influence of this noise on your monthly mean aggregated over large regions ?

Section 5.3 : 8 & 22 regions breakdown EIC & South Pacific sink. Can you find any oceanographic measurements that could indicate a strong ocean sink in this region ?

Interactive comment on Atmos. Chem. Phys. Discuss., 3, 2575, 2003.