Estimate of the Global Carbon Monoxide Budget Derived From MOPITT Data


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Introduction
Carbon monoxide (CO) influences the oxidizing capacity of the troposphere as the major sink of the OH radical. Thus it is very important to have an accurate estimate of the atmospheric CO budget. It is well known that CO concentrations are higher in the northern hemisphere than in the southern hemisphere (fig.1 A). However, another important source of CO is biomass burning, much of which takes place in the southern tropics. Figure 1 B) also shows that Indonesia is another very significant source. Many of these fires are fueled by peat that smoulders and has a high carbon content.

Method
- Losses were calculated for the reaction with OH: \[ L = k_1 \cdot [OH] \cdot [CO], \]
  where \( k_1 = 5.6 \times 10^{-13} \) (1 + 0.6 \( \cdot \) Patm). (DeMore et al. 1997)
- Reference profiles of OH and air density were used from the model of Anderson et al. (1986)
- The total loss was estimated by integrating the loss rate over the month
- Net change in CO amount was calculated between successive months.
- The sum of the net change and the losses within one month equals the change of the CO budget. It is very important to have an accurate estimate of the CO budget.
- Monthly values were used to give the annual budget.

References

Estimate of global budget

Source (CO) = Net Change (CO) + OH Losses (CO)

Emissions in Indonesia 2002
- Region: 10°N to 25°S and 75°W to 141°W (see also fig. 2).
- CO emissions to transport to be small.
- CO columns and vmr into 6-day bins.
- Only grid cells exceeding threshold are populated.
- Area' coincides with the box.
- Smaller CO emissions will underestimate the plume size.
- Further increasing the threshold (D) will underestimate the CO variations.

Emission estimates:

- Emissions in Indonesia 2002:
  - "Emissions of 1990 - 2230 Tg/year (with OH as primary sink)
  - Near the lower end of earlier budget estimates
  - Inclusion of ground deposition as additional sink would increase emissions to values quite similar to an earlier estimate.

Estimated CO emissions in Indonesia (2002):
- 66 Tg CO between August 1 and December 5.
- This is about half of the emissions estimated for the fires in 1997.

Conclusion
- Emissions of 1990 - 2230 Tg/year (with OH as primary sink)
- Near the lower end of earlier budget estimates
- Inclusion of ground deposition as additional sink would increase emissions to values quite similar to an earlier estimate.

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