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Interactive comment on "Retrieval of CO from SCIAMACHY onboard ENVISAT: detection of strongly polluted areas and seasonal patterns in global CO abundances" *by* C. Frankenberg et al.

Anonymous Referee #1

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General comments The paper addresses retrievals of carbon monoxide from SCIAMACHY. Carbon monoxide is an important trace constituent of great interest, and SCIAMACHY is an important asset to the atmospheric science community. These CO measurements in the near infrared are extremely challenging. The MOPITT instrument on EOS Terra also carries a near infrared channel, but the instrument performance did not support high quality retrievals. The paper describes efforts to retrieve near infrared CO using a DOAS based retrieval and the SCIAMACHY instrument channels. As such, it is both new and important. The paper presents results of their most recent efforts to accommodate instrument operational effects (ice on the detectors) as well as the re-

trieval improvements. The work supports the conclusion that SCIAMACHY can detect areas of elevated CO.

Specific comments The paper does a good job of describing SCIAMACHY and the retrieval work to date, with a good reference list to keep the focus on the CO retrieval results. Section 2.1 describes realistic but significant challenges to the near-infrared retrieval of trace gases.

It would be helpful to add a reference to the optimization of the fitting window (section 2.3) if available; the paper necessarily states the selected fitting window, but provides no description of the optimization.

Section 2.4, entitled “Aims” actually describes the approach to treatment of clouds. The authors include cloud “contaminated” pixels and use a graphical mapping approach to present the results. The graphical approach tends to exhibit data for cloud-free pixels wherever such are available (because the total column abundance is greater), and to not distinguish between cloud-free and cloudy data. Thus, interpretation of Figure 3 is somewhat ambiguous. The representation of cloudy data is a challenge to the entire research community.

Given the “Aim” described as detecting geographic patterns and temporal variations on a bi-monthly time scale, the paper provides adequate evidence of bimonthly maxima of CO across the planet. Further, the linkage of maxima in CO to fire counts is useful. While the linkage of elevated CO to southern hemisphere biomass burning was first determined by MAPS, and the annual pattern was first determined by MOPITT, this paper presents additional data that corroborates the earlier findings, and lends credence to the reported techniques. Detection and studies of boreal fires are increasingly important from a scientific standpoint due to climate changes which make them more intense and frequent, and the increased loading of the already polluted northern hemisphere atmosphere. Good science can be done with such SCIAMACHY observations in the future.

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While the paper's title appropriately refers to a capability for detection of strongly polluted areas and patterns, line 10 of Section 3 claims "low column abundances can be measured by SCIAMACHY". This statement would be more accurate if it claimed column abundances can be "detected", as in the title. To claim measurement, the paper should compare the numerical values from SCIAMACHY to surface observations as well as to other, well-validated satellite observations (e.g., MOPITT). Section 2.3 line 13 indicates that the column abundance statistical error for the reported retrievals of SCIAMCHY CO is "below 30%". Such errors are acceptable when presenting patterns and maxima, but need improvements before reporting quantitative data. The calibration and instrument interpretation efforts described at the end of the conclusions are encouraged, and should result in data which are more quantitative, rather than the mostly qualitative results reported here.

Under Conclusions, line 14 states that SCIAMCHY is able to detect CO globally "with sufficient accuracy". This statement should be made more accurate and informative. The authors can clearly state that "SCIAMCHY is able to detect CO globally with sufficient accuracy to detect maxima and seasonal patterns." Or, the statement might substitute the numeric value and avoid vague adjectives by stating "SCIAMCHY is able to detect CO globally with a column averaged accuracy of 30%", although this is less supported by the discussion in the paper itself.

Finally, the paper is a step along the process to produce a global CO data set that reflects the variations in the boundary layer as well as the long range transport of CO. While it is not the final step, the authors provide a meaningful, informative contribution to understanding the complexities of spaceborne instrument performance and retrieval difficulties. The paper should be published.

Technical changes For the busy reader who is not immersed in SCIAMACHY, it would be helpful to add the wavelength range of Channel 8 to the first reference to Channel 8. The authors have already provided the specific sub-region of Channel 8 used in this retrieval.

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Interactive Comment

Interactive comment on Atmos. Chem. Phys. Discuss., 4, 8425, 2004.