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Identification of tropospheric emissions sources from satellite observations: Synergistic use of HCHO, NO_2, and SO_2 trace gas measurements

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We present case studies for combined HCHO, NO_2, and SO_2 satellite observations, derived from GOME and SCIAMACHY measurements. Satellite observations of the different trace gases are a well suited tool for the identification of tropospheric emission sources on a global scale.

The satellite HCHO observations provide information concerning the localization of biomass burning (intense source of HCHO). Other HCHO sources can be biogenic isoprene emissions and fossil fuel combustion. The NO_2 data are strongly correlated with human activities, but also with sources due to biomass burning, lightening or soil emissions. The SO_2 observations allow principally the identification of volcano emissions, also coal burning (coupled with anthropogenic activities) and possibly from biomass burning.

The principal biomass burning areas can be observed in the Amazon basin region and in central Africa. Other high HCHO emissions can be correlated with climatic events like the El Nino in 1997, which induced dry conditions in Indonesia causing many forest fires. Tree isoprene emissions could also contribute to high HCHO concentrations especially in southwest United States, northern part of the Amazon basin, and in the African tropical rain forest region. Biomass burning are also an important tropospheric source for NO_2 emissions and can be compared with the HCHO emissions to discriminate the influence of the vegetation type on the tropospheric emissions of both trace gases during biomass burning: the change in the vegetation type can be followed with the change in the observed column densities of HCHO and NO_2. The comparison between HCHO and NO_2 could also allow to estimate the part of the HCHO due to

tree isoprene emissions in biomass burning areas, against the HCHO due the biomass burning itself. This discrimination can be completed by comparing with an third trace gas, SO_2. In this way it is possible to identify and discriminate emission by volcanoes, industry and traffic, biomass burning and trees.