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Trends in formaldehyde columns over the Amazon rainforest, as observed from space with SCIAMACHY, OMI and GOME-2 spectrometers.

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Atmospheric formaldehyde (H2CO) is a central carbonyl compound of tropospheric chemistry. It is produced by the oxidation of a large variety of volatile organic compounds (VOCs), from biogenic, pyrogenic or anthropogenic emission sources. Tropical vegetation, in particular the Amazon forest that represents over half of the planet's remaining rainforests, emit a wide range of highly reactive biogenic volatile organic compounds (BVOCs). Those play a critical role in atmospheric chemistry and climate, by changing the oxidation capacity of the atmosphere and thus the lifetimes of other key trace gases such as CO and CH4, and by producing organic aerosols.
Satellite observations of H2CO, bringing information at the global scale and over decades, are essential to trace and understand the nature and the spatio-temporal evolution of VOC emissions. We have been developing algorithms to retrieve formaldehyde columns from satellite nadir UV spectral measurements, and we have processed the full level-1 datasets of GOME/ERS-2, SCIAMACHY/ENVISAT, GOME-2/METOPA&B and OMI/AURA (De Smedt et al., 2008; 2012; 2015). Resulting H2CO products are openly distributed via the TEMIS website (http://h2co.aeronomie.be).
In this work, we use the morning and afternoon H2CO columns between 2004 and 2014, respectively composed by the SCIAMACHY and GOME2 A&B datasets, and from the OMI observations, to study the diurnal, seasonal and long-term variations of H2CO over the Amazon rainforest. The highest H2CO columns worldwide are observed, with morning columns markedly higher than early afternoon. Very large variations between the dry and the wet seasons occur each year. Importantly, in some areas of the forest, mainly in the Rondonia Brazilian State, we observe a net decrease of the H2CO columns. We find very high correlation coefficients between the satellite H2CO columns and the reported deforestation fires that have significantly decreased in Rondonia since 2004 [INPE].