4.021 The impact of climate variability on volatile organic compounds emissions assessed using spaceborne formaldehyde data from SCIAMACHY and OMI.

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Abstract:

Biogenic hydrocarbon emissions (BVOC) respond to temperature, solar radiation, leaf area index and other factors. Isoprene is the principal contributor to BVOC emissions and accounts for about half of the estimated global total emissions, whereas monoterpenes are also significant over boreal ecosystems. Due to their large emissions, their major role in the tropospheric ozone and aerosol formation, BVOCs are highly relevant to both air quality and climate. Whereas the short-term response of BVOC emissions to meteorological drivers is fairly well simulated by current emission models, it is yet unclear whether models can faithfully predict their response to climate change, given the scarcity of long observation records of BVOC fluxes. The objective of this study is to cast light on the interannual variability and trends of observed HCHO columns during the growing season, when BVOC emissions are dominant, and interpret them in terms of climate and emissions variability.
We use the MEGAN-MOHYCAN model driven by the ECMWF ERA-interim meteorology to calculate global BVOC fluxes (Muller et al. 2008, Stavrakou et al. 2014) over 2003-2015, satellite HCHO observations from SCIAMACHY (2003-2011) and OMI (2005-2015) (De Smedt et al. 2008, 2017) and the IMAGESv2 global model (Bauwens et al. 2016). We focus on mid- and high-latitude regions in summertime, as well as tropical regions during the wet season. We find generally a very strong temporal correlation (>0.8) between modelled and observed HCHO columns over temperate and boreal ecosystems and positive calculated BVOC emission trends associated to warming climate which are well corroborated by the observations. We show that 1) HCHO interannual variability is primarily driven by climate through its impacts on photochemistry, vegetation fire occurrence, and above all, biogenic emissions, and the HCHO record validates the interannual variability of biogenic emissions calculated by the MEGAN model in regions dominated by biogenic sources.