Geophysical Research Abstracts
Vol. 19, EGU2017-5600, 2017
EGU General Assembly 2017

Effect of climate change and CO_2 inhibition on isoprene emissions in Europe calculated using the ALARO-0 regional climate model

Maite Bauwens (1), Jean-François Müller (1), Trisevgeni Stavrakou (1), Lesley De Cruz (2), Bert Van Schaeybroeck (2), Piet Termonia (2), Rozemien De Troch (2), Julie Berckmans (2), and Rafiq Hamdi (2)

(1) Royal Belgian Institute for Space Aeronomy, Brussels, Belgium (maite.bauwens@aeronomie.be), (2) Royal Meteorological Institute, Brussels, Belgium

Isoprene is the dominant biogenic hydrocarbon emitted in the atmosphere, with global annual emissions estimated at ca. 400-600 Tg (Guenther et al. 2006). It plays a key role in the atmospheric composition because of its influence on tropospheric ozone formation in polluted environments and its contribution to particulate matter. Its emissions depend on the type and abundance of plants, and are modulated by meteorological parameters. Climate changes therefore affect the spatiotemporal and interannual variation of these emissions. In this study we estimate the isoprene fluxes emitted by vegetation in past and future climate over the European (EURO-CORDEX) domain using the MEGAN-MOHYCAN model (Müller et al. 2008, Stavrakou et al. 2014).We first calculate isoprene emissions over 1979-2012 based on the ECMWF ERA-Interim reanalysis data, we compare with available isoprene flux measurements, and we investigate the sensitivity to solar radiation changes observed at European stations. The interannual variability and emission trends on regional and country level are derived and discussed.
Next, we perform simulations using the output of the ALARO-0 regional climate model (Giot et al., 2015) forced by the RCP2.6, RCP4.5 and RCP8.5 scenarios over 2071-2099, and compare with the historical emissions over 1976-2005 derived by the same model. Furthermore, we incorporate the inhibition of isoprene emissions to the enhanced CO_2 levels of the climate projections through two different parameterizations. The future climate scenarios result in higher isoprene emissions over the European domain increased by 6%, 33% and 82% for the RCP2.6, RCP4.5 and RCP8.5 scenario respectively. However, the CO_2 inhibition effect results in an overall decrease of isoprene emissions relative to the standard future simulation, even though this decrease is strongly sensitive to the parameterization used. The different CO_2 inhibition simulations in this study show that future isoprene emission are between 11% lower and 26% higher than the present isoprene emissions over Europe.

Giot, O. et al.: Validation of the ALARO-0 model within the EURO-CORDEX framework, Geosci. Model Dev. Discuss., 8, 8387-8409, 2015.
Guenther, A. et al.: Estimates of global terrestrial isoprene emissions using MEGAN (Model of Emissions of Gases and Aerosols from Nature), Atmos. Chem. Phys., 6, 3181-3210, 2006.
Müller, J.-F. et al.: Global isoprene emissions estimated using MEGAN, ECMWF analyses and a detailed canopy environmental model, Atmos. Chem. Phys., 8, 1329-1341, 2008
Stavrakou, T. et al.: Isoprene emissions over Asia 1979-2012 : impact of climate and land use changes, Atmos. Chem. Phys., 14, 4587-4605, 2014.