EGU21-1497, updated on 20 Oct 2021
https://doi.org/10.5194/egusphere-egu21-1497
EGU General Assembly 2021

Validation of the capability of WRF-Chem model and CAMS to simulate near surface atmospheric CO_2 mixing ratio for the territory of Saint-Petersburg

Georgy Nerobelov[1], Yury Timofeyev[1], Sergei Smyshlyaev[2], Stefani Foka[1], Ivan Mammarella[3], and Yana Virolainen[1]

[1]Saint-Petersburg State University, The Faculty of Physics, Saint-Petersburg, Russian Federation (akulishe95@mail.ru)
[2]Russian State Hydrometeorological University, Saint-Petersburg, Russian Federation (smyshl@rshu.ru)
[3]Institute for Atmospheric and Earth System Research/ Physics, University of Helsinki, Helsinki, Finland (ivan.mammarella@helsinki.fi)

The growing content of greenhouse gases (GHGs) influences the radiation balance of the planet causing the rise of air temperature in lower atmosphere. This circumstance triggers researchers to create and develop the new methods of estimation of anthropogenic CO_2 emissions. One of such method is top-down estimation which is based on measurements and chemical transport modelling. Since the errors of the top-down approach depend on quality of the modelled data it requires validation by complex observations. In current study we investigated the performance of regional numerical weather prediction and chemistry transport model WRF-Chem and CAMS service in simulating spatio-temporal variation of near surface atmospheric CO_2 mixing ratio in March and April 2019 for the Saint-Petersburg area (Russia). To validate the modelled data, we used local observations obtained on Peterhof (St. Petersburg) station. The analysis demonstrates that WRF-Chem model can adequate simulate the transport of CO_2 in near-surface layer with spatial resolution of 3 km. Average difference and correlation coefficient are in range 0.8-1.6% and 0.55-0.72 respectively. It was found that the WRF-Chem modelled data where biogenic and anthropogenic fluxes were considered fit the observation data worse than the WRF-Chem simulation where only anthropogenic emissions were used. It can be linked to the errors of the biogenic flux calculation. However, to prove that investigations for two contrast periods (in summer and winter) are needed. Despite the rude spatial resolution of the CAMS data (approximately 200x400 km) we found that in general the trend of surface atmospheric CO_2 mixing ratio in March and April 2019 for the Saint-Petersburg area from the CAMS dataset fits the observations.