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Performance of upcoming CO2 monitoring satellites in the new high-resolution inverse model CTDAS-WRF

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Efforts to reduce greenhouse gas (ghg) emissions require support by independent monitoring. The inverse modeling emission quantification approach, based on measurements of atmospheric ghg mixing ratios, promises objective ghg flux estimates consistent across country borders. Yet, ghg flux quantification on national scales and below is impeded both by the sparsity of atmospheric data and uncertainties in atmospheric ghg transport modeling. To overcome these challenges, the EU supports two concept studies for ghg monitoring satellites via the H2020 projects CHE (CO2M satellite) and SCARBO. Both systems aim at vast coverage and high accuracy and precision. Within these projects, we developed a variant of the CarbonTracker Europe inverse model (van der Laan-Luijkx et al., 2017) that uses WRF-GHG (Beck et al., 2011) to model atmospheric transport (CTDAS-WRF). In this presentation, we first introduce how the versatility of WRF-Chem and modular structure of CTDAS enables our model to estimate ghg fluxes across scales, from point sources to integrated continental fluxes. Next, we used our new model to demonstrate the potential skill of the proposed SCARBO satellite constellation for reducing uncertainties of national-scale CO2 fluxes, focusing on aerosol-induced errors. We demonstrate that this concept has the potential to greatly improve upon existing CO2 monitoring systems because of its unprecedented coverage. Lastly, we outline our plans for using CTDAS-WRF to assess the skill of the proposed CO2M monitoring system to estimate city-scale CO2 emissions.

References:
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