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Poster
As sunlight is reflected and scattered through the atmosphere, greenhouse gases such as carbon dioxide (CO2) and methane (CH4) absorb the light at specific wavelengths. Based on this absorption, retrieval algorithms can estimate how much of these gases were present along the light path. To convert this to the commonly used column-integrated dry air mixing ratio (XCO2 or XCH4), an estimate of the dry air mixing ratio is also required. While this can theoretically be retrieved using oxygen absorption lines in the near infrared, more commonly modelled surface pressure from numerical weather prediction models is used. Because these meteorological models are generally at a coarser spatial resolution than the footprint of satellite sensors, a highly-resolved digital surface model (DSM) is used in order to correct the pressure based on the local elevation. Recent studies have illustrated how important the use of an accurate DSM is to the accuracy of the retrieval: an error of only 10-m elevation results in an error in XCO2 of approximately 0.4 ppm.

The Copernicus DEM (Digital Elevation Map) provides a state-of-the-art global DSM at approximately 30-m resolution (1 arcsecond). It is based on measurements from TanDEM-X (TerraSAR-X add-on for Digital Elevation Measurements), a radar mission from DLR based on a SAR interferometer composed of two almost identical satellites flying in close formation. The data for this DSM were acquired between 2011 and 2015, averaging over measurements made during this period. The recently released TanDEM-X DEM Change Maps (DCM) provide differences to the reference DSM for data acquisitions since 2016. Some differences represent step-changes, such deforestation or open-pit mining, while others show long-term trends, such as stand growth in a forest or melting glaciers. All of these differences are mapped onto the retrieved XCO2 or XCH4 as systematic measurement biases. The focus of this analysis is on seasonal signals associated with biogenic fluxes, specifically with respect to the effective height of deciduous forests over the course of a year. The implications of a seasonal bias in XCO2 correlated with the carbon uptake period will be discussed.
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