The effect of aerosols for carbon dioxide emission plume retrieval

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Abstract

Greenhouse gas emissions from anthropogenic activities is the main driver of current global climate change. Emission monitoring is essential in aiding the emission reduction effort and a feasible way for attaining global coverage are satellite observations. Recent developments in space-based hyperspectral cameras open up new possibilities for greenhouse gas emission monitoring also on a smaller scale.

Most of the anthropogenic greenhouse gas emissions originate from urban areas. Urban areas are also sources of atmospheric aerosols, which decrease the local air quality and complicate the atmospheric radiative transfer. Even slight concentrations of atmospheric aerosols cause considerable inaccuracies in space-based remote sensing observations of carbon dioxide (CO_2).

In this work, a simulated hyperspectral camera scene of a co-emitted CO_2 and aerosol plumes is examined. The non-linear inverse problem of determining the aerosol and CO_2 content of the atmosphere in each camera pixel is studied. The radiative coupling of adjacent camera pixels is dependent on the viewing geometry and it can be used to gain extra information for the retrieval process. This method is not only applicable in recent and upcoming satellite missions such as PRISMA or CO2Image, but also for airborne and drone-based hyperspectral observations.