



Remote sensing of XCO₂ and XCH₄ above the Atlantic from aboard the research vessel Polarstern

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Global measurements of the column average dry air mole fractions of carbon dioxide (XCO₂) and methane (XCH₄) are of great interest for inferring information on sources and sinks of these two major anthropogenic greenhouse gases. Satellite remote sensing of XCO₂ and XCH₄ is an emerging tool which promises to supplement the traditional ground-based in-situ sampling approach by vast data coverage. The usefulness of XCO₂ and XCH₄ measured by satellites such as GOSAT and OCO-2, however, crucially depends on precision and accuracy. Therefore, validation by ground-based remote sensing observations is of major importance.

The Total Carbon Column Observing Network (TCCON) has been designed to meet these validation needs. It covers a few tens of ground-based Fourier Transform Spectrometers operating at very high spectral resolution. Most of these instruments are located on continental regions especially in the northern hemisphere. However, oceanic regions are sparsely validated.

In the framework of the development of a robust, small and versatile spectrometer for harsh environments and mobile applications, we operated two instruments, a Fourier Transform Spectrometer (EM27/SUN by Bruker) and a custom-built grating spectrometer aboard the German research vessel Polarstern. Both instruments are modified such, that the solar tracking system can compensate for the ships movement.

Here, we will present and discuss instrument performance of the EM27/SUN instrument and the solar tracking device. The retrieved north to south gradient of XCO₂ and XCH₄ mixing ratios along the ship track from Capetown (SA) to Bremerhaven (GER) during the 5-week cruise in March 2014 will be presented and discussed. We assess the usefulness of the dataset for validating GOSAT ocean glint observations as well as an comparison with the global CO₂ and CH₄ model data.