Atmospheric methane monitoring and analysis using tropOMI retrievals at ECMWF.

Jerome Barre¹, Ilse Aben², Melanie Ades¹, Anna Agusti-Panareda¹, Gianpaolo Balsamo¹, Nicolas Bousserez¹, Margarita Choulga¹, Richard Engelen¹, Johannes Flemming¹, Antje Inness¹, Zak Kipling¹, Jochen Landgraf², Alba Lorente-Delgado², Sebastien Massart¹, Joe McNorton¹, Mark Parrington, and Vincent-Henri Peuch

¹ECMWF, Shinfield Park, Reading RG2 9AX, UK
²SRON, Netherlands Institute for Space Research, Sorbonnelaan 2, 3584 CA Utrecht, Netherlands

The European Union’s Copernicus Atmosphere Monitoring Service (CAMS) operationally provides daily forecasts of global atmospheric composition. It uses the ECMWF Integrated Forecasting System (IFS), which includes meteorological and atmospheric composition variables, such as reactive gases, greenhouse gases and aerosols, for its global forecasts and reanalyses. The current greenhouse gases operational suite monitors CH₄ and CO₂ and assimilates TANSO and IASI retrievals for both species. The TROPOspheric Monitoring Instrument (TROPOMI) on board the Sentinel-5 Precursor (S5P) satellite launched in October 2017 yields a wealth of atmospheric composition data, including CH₄ retrievals at unprecedented high horizontal resolution (7km) and up to daily revisit time. We used the IFS to perform monitoring experiments at different horizontal resolutions (25 km and 9 km). We also performed first data assimilation experiments at 25 km horizontal resolution.

This first set of monitoring experiments shows the potential of the TROPOMI CH₄ retrievals to correct known biases that exist in the current CAMS analyses and forecasts. Assimilation experiments of TROPOMI CH₄ shows that adding the instrument in the operational chain would significantly improve the analysis and forecasts. Detection of CH₄ sources seen by TROPOMI compared to CAMS also shows the potential of the instrument to inform on and infer anthropogenic and natural sources. For example, discrepancies between TROPOMI retrievals and CAMS fields in the CH₄ levels associated with oil and gas extraction activities show very promising perspectives for monitoring and analysis of CH₄ concentration and emissions. We will finally discuss the challenges and progress made towards performing inversions using the IFS operational system.