Retrievals of trace gases in the Earth’s atmosphere can be obtained using data from instruments such as the Infrared Atmospheric Sounding Interferometers (IASI), which are nadir-viewing Fourier transform spectrometers flown on MetOp satellites. Each of the three instruments measures over a million spectra per day, so it is a challenge to process the data fast enough to interpret it in near-real-time.

As a result, many fast ‘linear’ retrievals have been developed. These involve effectively taking a dot product of a pre-defined gain vector with the spectrum. This is something of an oversimplification, however, as spectra depend on many atmospheric parameters. Scaled Linear Retrievals (SLRs) aim to compensate for this with the introduction of a scaling factor – a retrieval parameter which can account for external influences. This factor not only appears to improve the accuracy of the retrieval, but also helps to provide a meaningful error estimate.

Evaluating NH3 Retrievals

A scaled linear retrieval of NH3 was carried out globally, an example of which can be seen in Figure 1. The atmospheric concentration of ammonia is highly variable, so there are still uncertainties in models and retrievals.

The SLR was compared to other retrievals as a means of evaluation. A month of various NH3 retrievals over South Asia in August 2010 were combined and divided into quartiles. Co-located points between different retrievals were compared and, for each day, the percentage of points which were in matching quartiles for two retrievals was calculated. This is referred to as the quartile diagnostic, and should indicate how well retrievals agree without considering bias correction.

The two retrievals used for this comparison were the MORSE1 optimal estimation scheme, and the IASI NH3 neural network retrieval algorithm (ANNI), which uses similar linear methods to the SLR.

Figure 2 is an example of the comparison between the SLR and the ANNI retrieval on 1st August 2010.

MORSE is an iterative retrieval which we might expect to be more reliable than the relatively simple linear technique used by SLR. However, comparison of the MORSE and SLR retrievals to the neural net retrieval indicates that SLR shows much better agreement with ANNI than MORSE over the course of August 2010 over South Asia. The exact reasoning behind this difference in agreement is undetermined, but could be linked to the fact that ANNI and SLR use more similar methods.

References


For more scaled linear retrievals, scan QR code or visit https://bit.ly/32dIN3C