Intercomparison of retrieval codes

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Objective

To get a better understanding of the different components which makes a retrieval algorithm, comparison of several different methods is being performed. This comparison not only identifies strengths and weakness of the particular methods, it also aims to foster communication between the various groups.

Preamble

The retrieval methods considered for the present presentation are very diverse so only some limited results can be presented here. Results presented here are for IASI observations which have been classified as clear by several methods. Despite this, it is quite possible that some of the issued found are a result of undetected clouds.

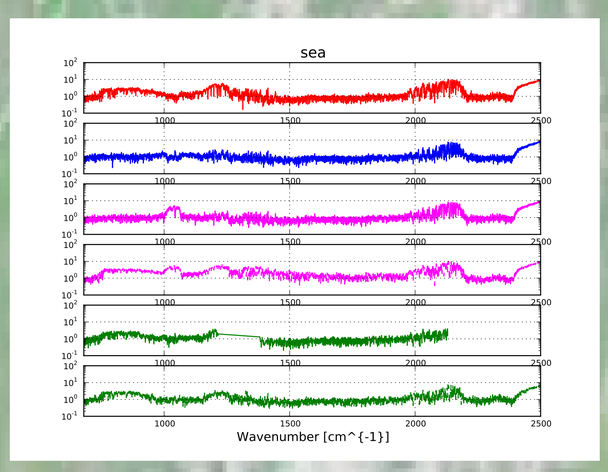

Figure 1 Standard deviation calculated from succesful retrievals using cloud free observations over sea.

Radiance residuals

For the retrieval methods which compares synthetic radiances to the observed radiances Fig. 1 shows the radiance residuals, defined as the difference between the observed and simulations, normalised by variance of IASI radiometric noise. Standard deviation of radiance residuals averaged of all observations can be compared to the IASI radiometric noise. Interesting is that despite differences in retrieval methodologies, the mean radiance residual has the same large scale structure. Values are around 1 as expected, with some excursions which needs to be understood.

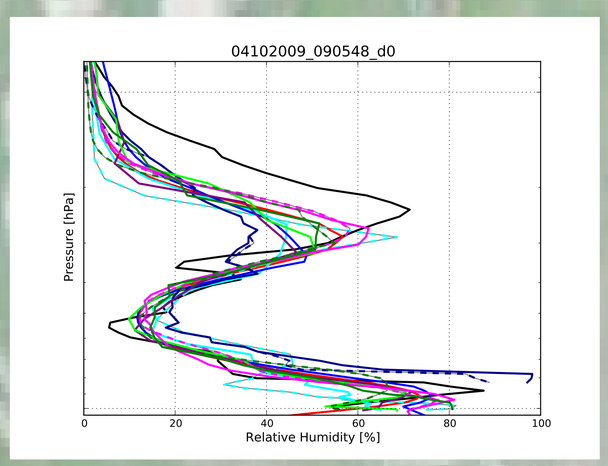

Figure 2 Profile of relative humidity derived from IASI observation 04102009_090548_d0.

Relative humidity

Comparison of retrieved relative humidity for a specific case is shown in 2. This shows the close correlation between the different results despite the very different approaches. The color lines in Fig. 2 indicate the results of the different

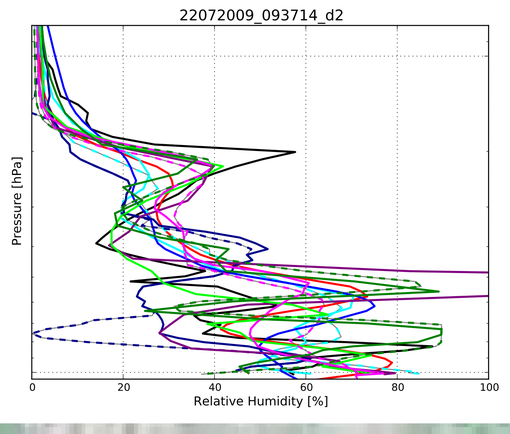

Figure 3 Profile of relative humidity derived from IASI observation 22072009_093714_d2.

retrieval algorithm. The black line indicates observations by a radiosonde launched from Udine. The radiosonde observation is not collocated in space or time with the IASI retrievals.
However, the good correlation shown in 2 is not always observed as shown in 3.
Reason for the difference needs to be understood.

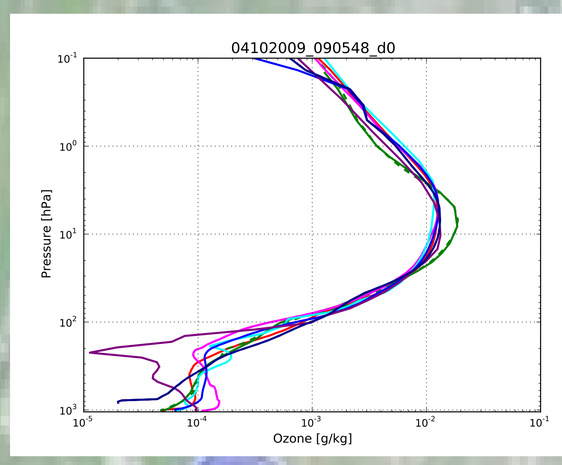

Figure 4 Profile of Ozone derived from IASI observation 04102009_090548_d0..

Trace Gases

Though the prime interest is with moisture and temperature, other parameters included in the intercomparison are surface temperature, emissivity, ozone and carbon dioxide as they might explain some of the differences found. In 4 an ozone profile is shown derived by different participants. It should be noted that not all methods derive the same state vector.

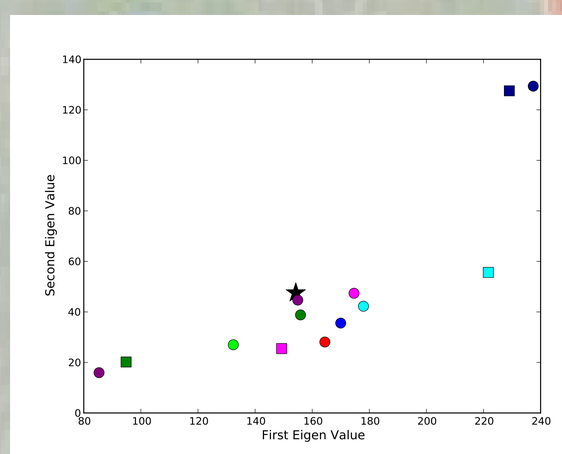

Figure 5 Relation between the first and second largest eigenvalues for the specific humidity retrievals derived from all IASI observations considered here.

Small Scale Variability

A fundamental question is: what scales are being resolved by retrieval methods. Principal Component analysis is being used to depict the various modes in the retrieved distribution of specific humidity or temperature. Figure 5 the stratification of the eigenvalues of the two leading eigenvectors is shown for each of the submitted results. The star indicates the results derived from radiosonde observations over Udine.

Experiments

We hope to conduct some controlled experiments to investigate the performance of the models further. An example is shown in 6, where for one participant the response of the retrieved state (in this case the relative humidity profile) on a change in method to derive the surface emissivity is documented.

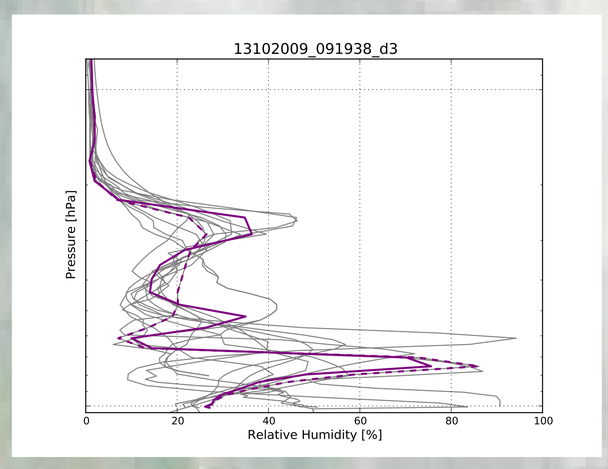

Figure 6 Vertical profile of relative humidity for IASI observation 13102009_091938_d3. The color lines are result of same general retrieval method, but different way of retrieving surface emissivity. The gray lines are other submissions for this particular IASI observation.

Key elements of comparison:
- Large diverge set of retrieval codes: pure optimal estimation (OE), OE with first guess from regression analysis, pure regression methods (linear and non-lineair), retrieval in pc domain. In total 10 different retrieval results are available.
- Test area is Udine, It. No ground truth. So only relative comparison.
- More information, interested to participate: email to stephen.tjemkes@eumetsat.int