

Impact assessment of IASI temperature and humidity retrievals in the ECMWF system

Kirsti Salonen¹, Thomas August², Tim Hultberg² and Anthony McNally¹

¹ECMWF, Reading, United Kingdom ²EUMETSAT, Darmstadt, Germany
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Introduction

EUMETSAT is producing forecast independent statistical retrievals of atmospheric temperature and humidity from IASI hyperspectral infrared radiances in preparation for the future product generation from MTG-IRS. The quality and characteristics of the retrievals have been investigated, and an impact assessment has been performed in the ECMWF system. The impact is compared to assimilation of IASI radiances. Focus is on clear sky data over sea only.

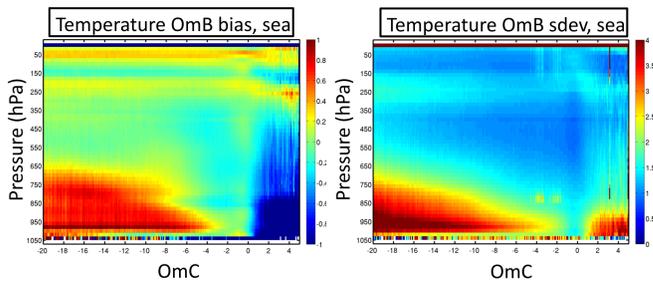
Understanding the quality and characteristics of the retrievals

Clear sky vs cloud affected retrievals

One of the meta data provided with the retrievals is the measure of cloudiness, OmC (obs minus calc).

The clear sky retrievals have the best quality both in terms of bias and standard deviation and the errors rapidly increase for the cloud affected data.

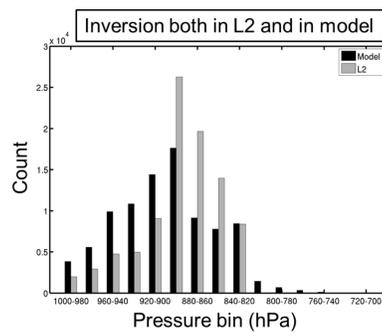
For selecting the cloud free retrievals, a criterion of $|OmC| < 1$ is applied in all the following results. This excludes pixels affected by high clouds under which the IASI retrievals are not expected to bring new information.



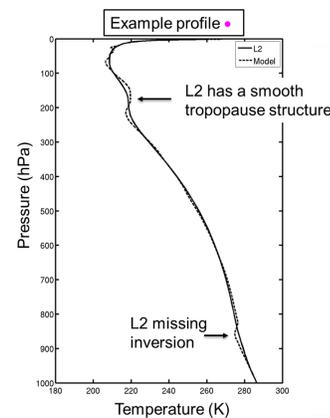
Fine scale vertical structures

The L2 retrievals are generally rather smooth and typically lack fine vertical temperature structures during inversions and around the tropopause, as the example profile indicates.

Inversions: Model is capturing low level temperature inversions much more frequently than L2. When inversion is present in both, on average L2 inversions are found from higher altitudes than the model inversions.

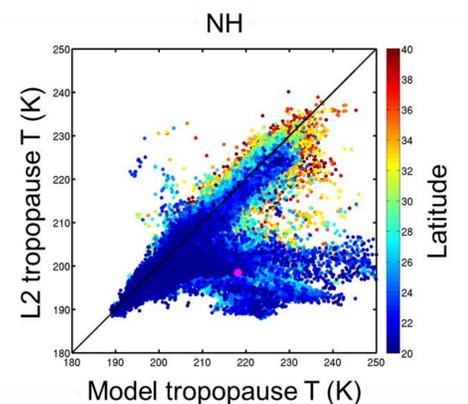


	Model inversions	L2 inversions
NH	64.6%	10.8%
TR	67.3%	17.6%
SH	67.6%	19.4%



Tropopause: Comparison of the L2 and the model tropopause temperature shows that there is a set of observations where the agreement is very good.

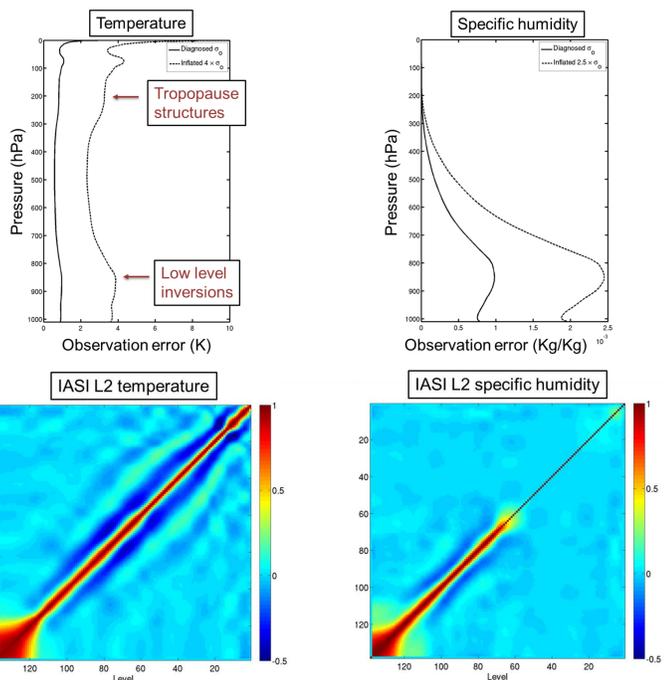
Cases where model tropopause is significantly warmer originate mainly from midlatitudes near the tropics. In these regions it is typical that there is a double tropopause structure, i.e. colder tropical tropopause is above the warmer polar tropopause which the L2 is not capturing.



Diagnosing the observation errors for clear sky retrievals

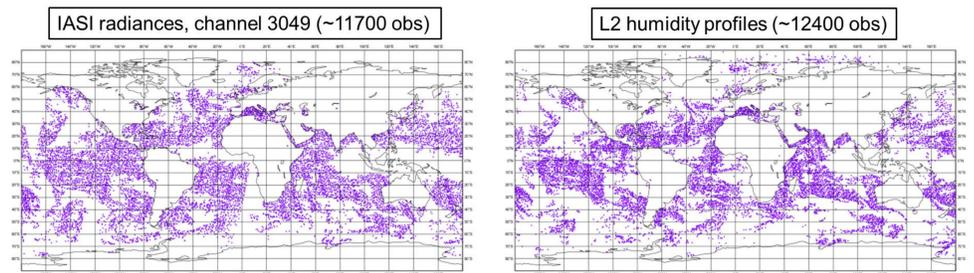
The observation errors and error correlations for the assimilation experiments are diagnosed with the Desroziers method.

- **The observation errors for temperature require significant inflation** and an inflation factor 4 is used in the assimilation experiments. **For humidity more moderate inflation is enough** and a factor of 2.5 is applied.
- **The observation errors are also highly correlated between vertical levels.** It is essential to take these correlations into account in the experiments.



Data assimilation experiments

The data selection is designed to be as similar as possible for the L2 retrievals and IASI radiances. Overall impression from the 12-hour sample coverage is that the number of active data is rather similar for both and the cloud detection is acting roughly in the same areas.



Impact on short range forecasts

- **Temperature forecasts are degraded when the L2 retrievals are assimilated** (grey lines) while assimilating the IASI radiances (blue lines) improves the forecast. The degradation is most likely due to assimilating the smooth or missing vertical structures for temperature, without taking the limited vertical resolution of the retrievals into account.
- **For humidity the results are very encouraging and assimilation of the L2 retrievals is able to bring rather similar positive impact on humidity than assimilation of the radiances.** The results in the depleted and full observing system are consistent.

Depleted observing system (conv + AMSU-A)

Full observing system

