First steps towards scene dependent observation errors for hyper-spectral IR

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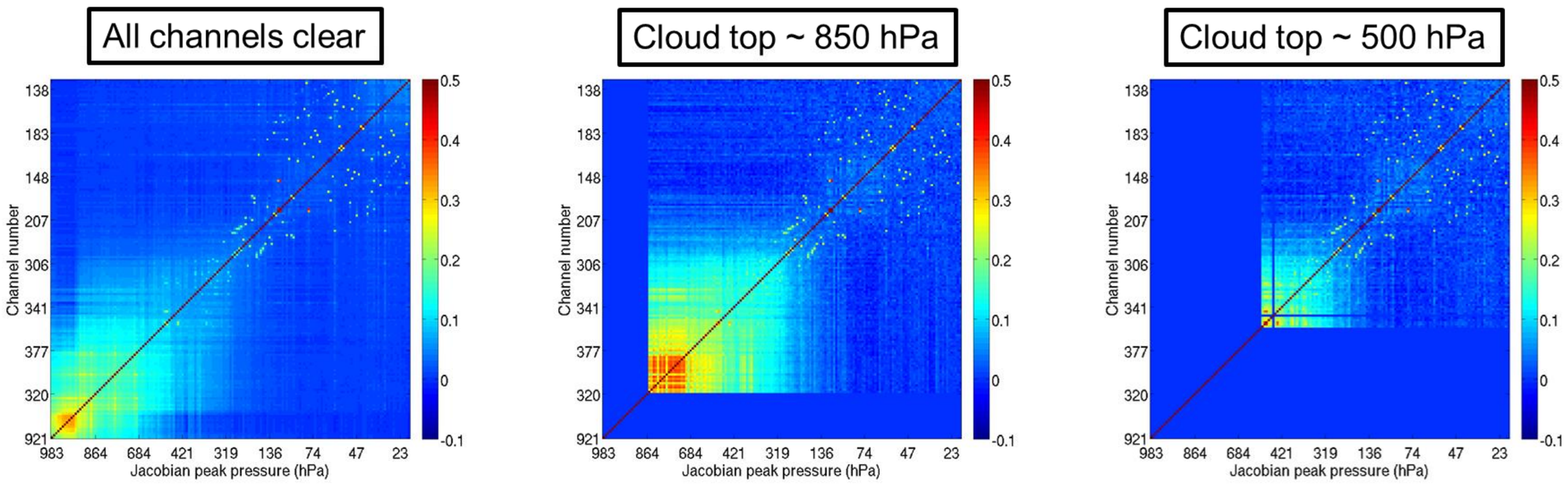
Motivation

Currently infrared (IR) sounder data is used in clear scenes only. This includes completely clear spectra, and in addition channels which are considered to be unaffected by the cloud above a cloudy scene. Completely clear scenes represent approximately only 10% of the used data. Thus, majority of the hyperspectral data used actively in assimilation are potentially affected by cloud, and hence by residual cloud contamination with highly correlated errors which are not taken into account in the assimilation.

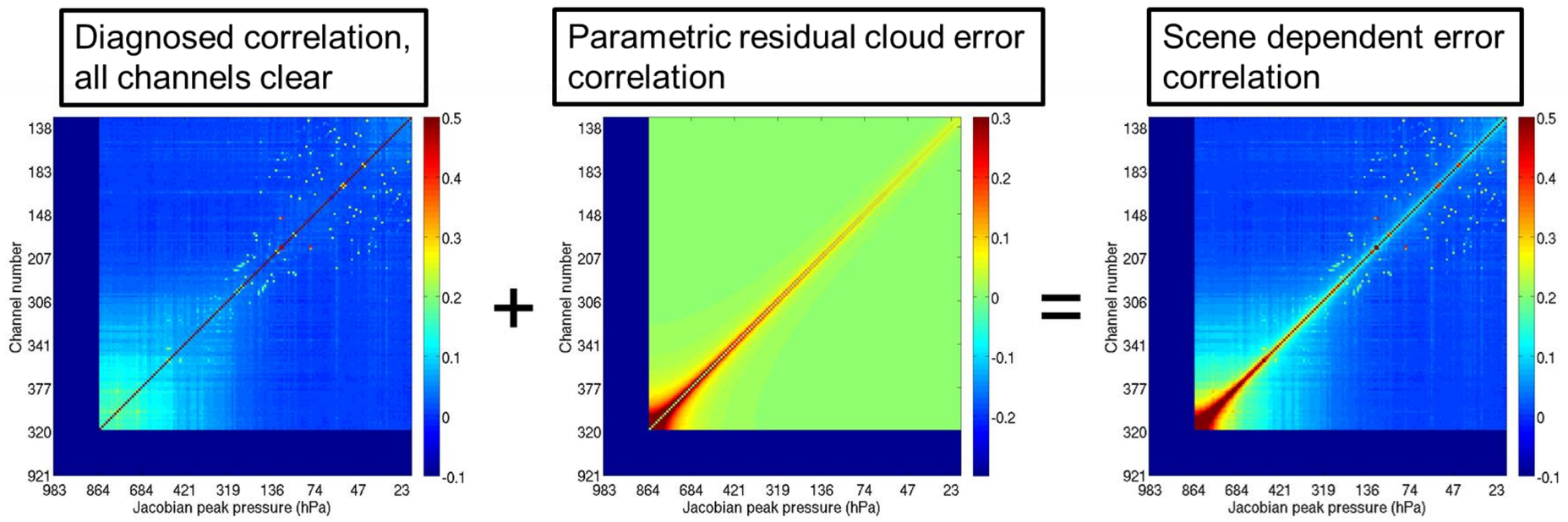
Diagnosing the observation error correlations

Observation errors and correlations used operationally in the ECMWF system have been diagnosed with the Desroziers method for completely clear spectra. Diagnosing the errors for cloud affected channels indicates that the errors increase and the error correlations become stronger, especially just above the diagnosed cloud top. Here, only temperature sensitive channels for IASI are considered and the channels are ranked according to their mean jacobian peak pressure.



Parametric approach for residual cloud error

It is not feasible to diagnose and archive dedicated covariances for each possible scenario as there are infinite number of possible cloud conditions in the atmosphere. Thus, a parametric approach for the scene dependent errors is being developed.



Candidate for residual correlated cloud error for n channels considered clear above cloud:

$$C(ichan, jchan) = {}^{1}/_{(1 + p(ichan + jchan) \times |ichan - jchan|)}$$

p is the strength of the correlation (in this example the least squares fit p = 0.04)