

Alternative Level 1 IASI cloud mask based on sub-IFOV imagery radiance clustering

SPASCIA



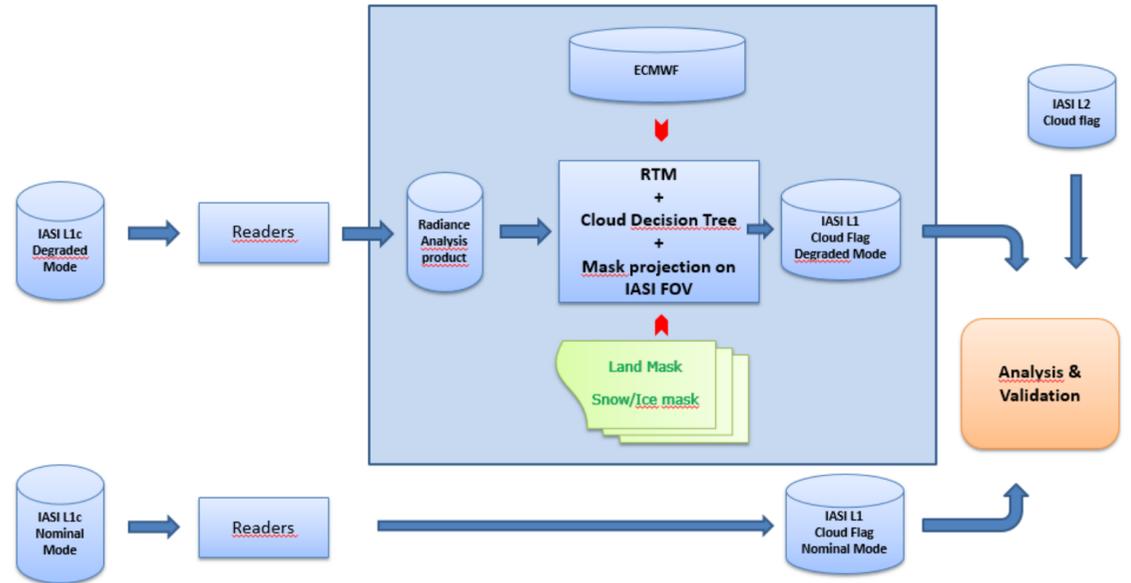
Pascal Prunet¹, Bernard Tournier¹, Olivier Lezeaux¹, Javier Andrey⁶, Lydie Lavanant², Marc Crapeau³, Dorothee Coppens³, Bertrand Theodore³, Cathy Clerbaux⁴, Claude Camy-Peyret⁵
¹SPASCIA, ²Météo-France, ³EUMETSAT, ⁴LATMOS, ⁵IPSL, ⁶Walfr

CONTEXT

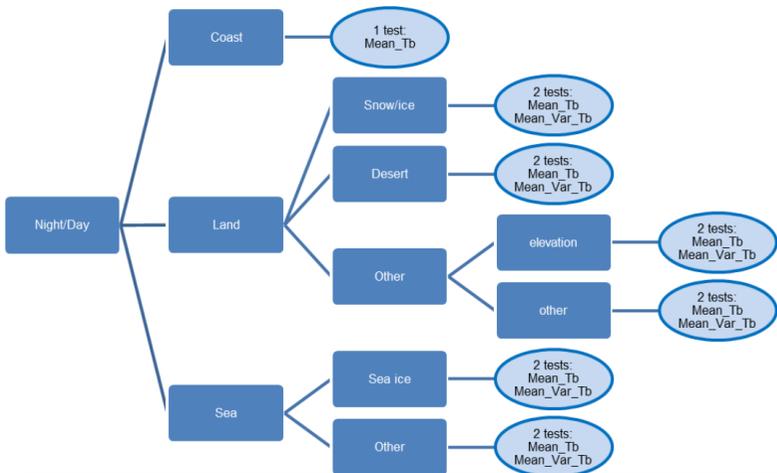
The IASI level 1C product (L1C) includes (in addition to the spectral radiances) a cloud mask estimating whether the Instantaneous Field Of View (IFOV) corresponding to each IASI spectrum is cloud contaminated or not. A cloud fraction value (between 0 and 100) for each IFOV is provided. In the nominal operation mode, the cloud fraction is derived from the AVHRR level 1B cloud mask after projection of synchronised AVHRR measurements in each of the IASI spatial footprint. In case of failure of AVHRR, a “degraded-mode” cloud fraction has to be implemented. In addition, the radiative scene classification (the L1C radiance clusters within any IASI IFOV) is obtained in a degraded mode from the measurements of the Integrated Imager Subsystem (IIS) sharing the same line-of-sight as the interferometer. In this latter case, the radiance analysis is applied to two IIS “pseudo-channels” at the spatial sampling of the imager (~ 0.75 km at nadir). The first one is the radiance average over 3x3 imager pixels, the second one is the local variance of the radiances over these 3x3 pixels.

1. Cloud flag processing

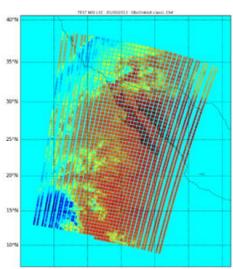
A prototype processing has been developed for computing IASI L1C cloud mask in degraded mode. It exploits the IIS radiance clusters within the IASI IFOV to have radiance observations at sub-IFOV scale, and it uses a RTTOV simulation of the IFOV based on ECMWF information for computing a clear-sky radiance reference. It has been validated against nominal AVHRR-based IASI L1C cloud fraction product and IASI L2 cloud fraction product. The capacity of this processing to be exploited in an operational context has been verified..



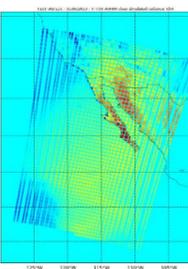
2. Decision Tree processing exploiting IASI sub-IFOV radiance analysis clusters and RTTOV online simulation



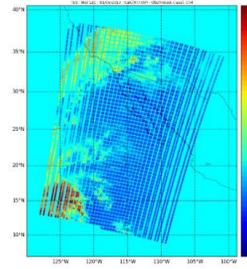
OBS = Radiance of the hottest cluster radiance



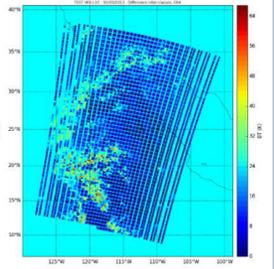
CALC = RTTOV clear radiance



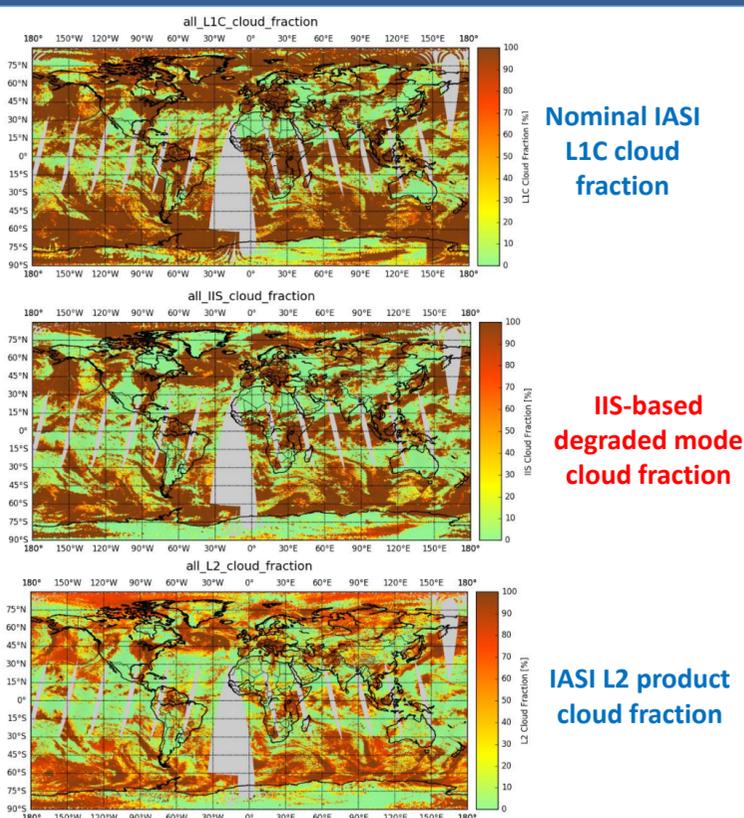
CALC-OBS used for cloud tests



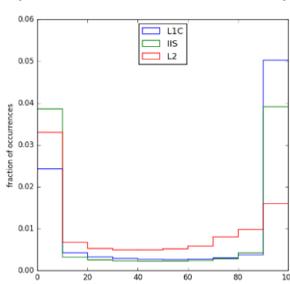
Clusters dynamic used for quality test



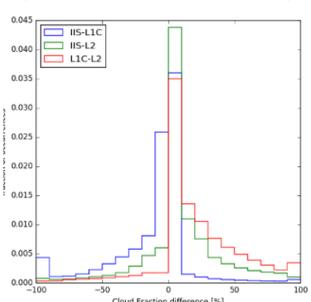
3. Validation and case studies of degraded mode IIS cloud fraction against IASI L1C and IASI L2 nominal cloud



Cloud fraction histogram expressed in decimals of fraction (0.01 indicate 10% or 0.1 fraction)

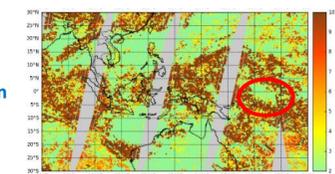


Histogram of cloud fraction differences between masks expressed in decimals of fraction (0.01 indicate 10% or 0.1 fraction)

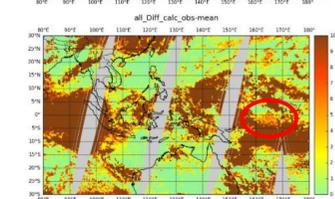


Focus on a case where IIS differ from L1C AND L2 (red)
 In this zone, small values of IFOV cluster dynamic suggests no clouds (1). But CALC-OBS indicate clouds (2)

1. Inter cluster differences within IASI IFOV

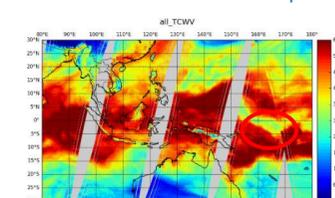


2. CALC-OBS within IASI IFOV



In this zone, presence of water vapour fronts (3) : possible cause of bias in ECMWF forecast for front position ?

3. ECMWF Total water content used by CALC



The sub-pixel inter-cluster differences appears as a good indicator for identifying false alarm : in that case: no clouds despite high calc-obs values

Conclusions:

- 1) A « degraded-mode » cloud mask based on IIS has been possible thanks to L1C IIS radiance analysis clusters within the IASI IFOV.
- 2) Validations against nominal IASI L1C and IASI L2 cloud fraction products show good performances and suggest possible improvements of the nominal L1C cloud fraction by exploiting the information from a radiance analysis in the IASI IFOV (cluster variance and inter-clusters dynamic)
- 3) An alternative cloud mask based on the standard AVHRR radiance analysis has been prototyped and evaluated. It gives promising results by comparison against the L1C and L2 nominal cloud masks.