Update of the SEVIRI scene identification within the GERB processing for Edition 2

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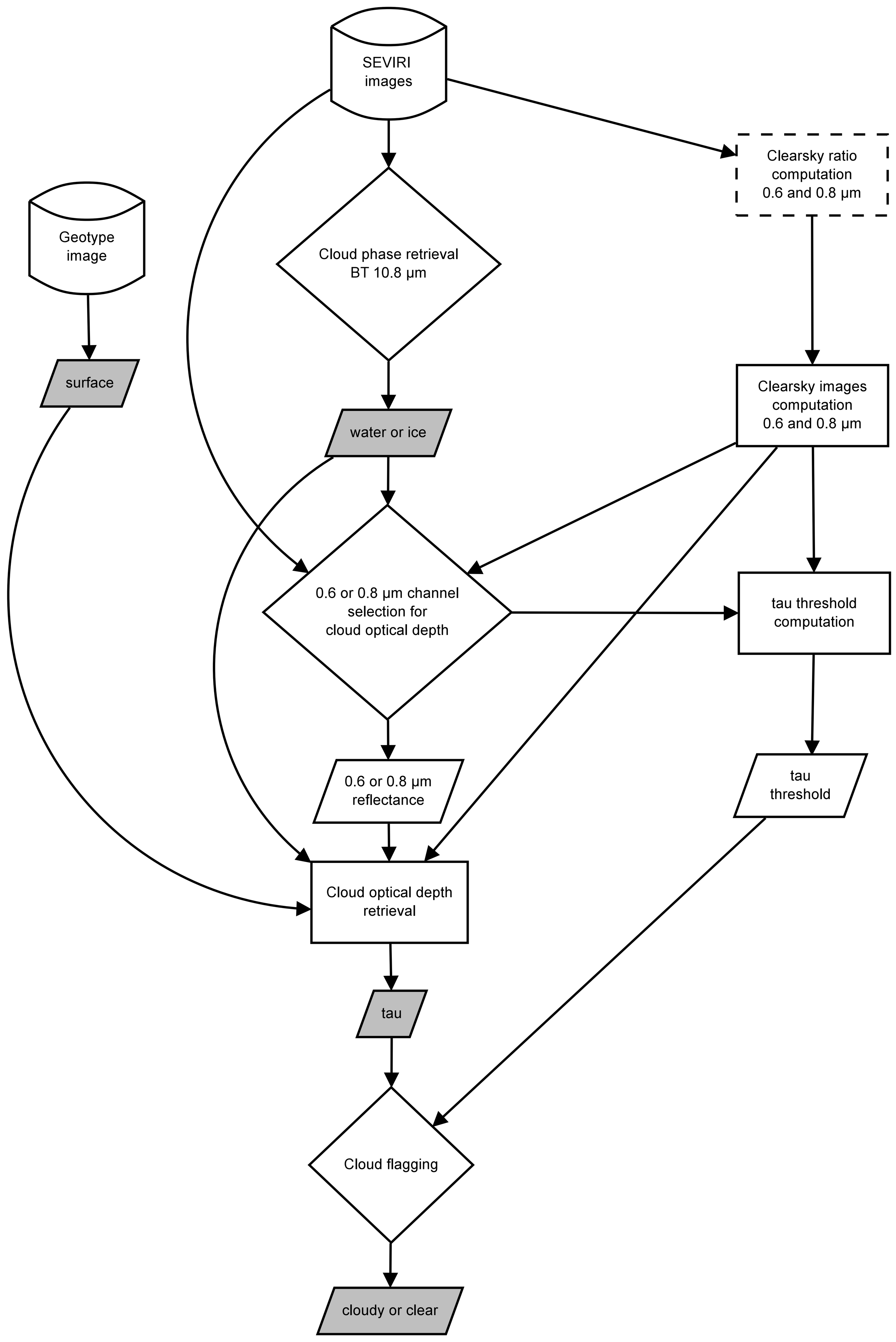
1 Current Edition 1 scheme

The current Edition 1 sceneID suffers from the following limitations:

1. It is using a fixed geotype map [5] for the selection of the cloud optical depth look–up tables (LUTs) and therefore lacks a dynamical fresh snow and ice detection scheme. It implies that the cloud properties retrieval is applied to freshly snow and ice covered surfaces, resulting in large discrepancies for those scenes and preventing the use of snow/ice angular dependency models (ADMs) in the radiance–to–flux conversion.
2. No aerosol optical depth retrieval is applied within the sceneID, resulting in a misidentification of major dust events as water clouds.
3. It is using a basic cloud thermodynamic phase detection scheme by simply thresholding the 10.8 μm brightness temperature (BT). It implies that thin (such as cirrus) as well as super–cooled water clouds can be misidentified.
4. It is using cloud optical depth LUTs stratified according to 5 surface BRDFs and generated using the radiative transfer (RT) band–model STREAMER [3] which is exhibiting significant discrepancies when simulating narrow imager channels such as SEVIRI. Furthermore, updated ice crystals parametrizations are available compared to the one used within this model [4].
5. It is unreliable in the sunglint affected regions due to systematic underestimation of the estimated visible clear–sky reflectances used like reference for the cloud properties retrievals. This is resulting from the use of static parameters in the sunglint clear–sky reflectance model.
6. It is using conservative parameters for the thresholds in the cloud detection as well as for the clear–sky reflectances estimation. It implies that some thin clouds can be misidentified as clear–sky.

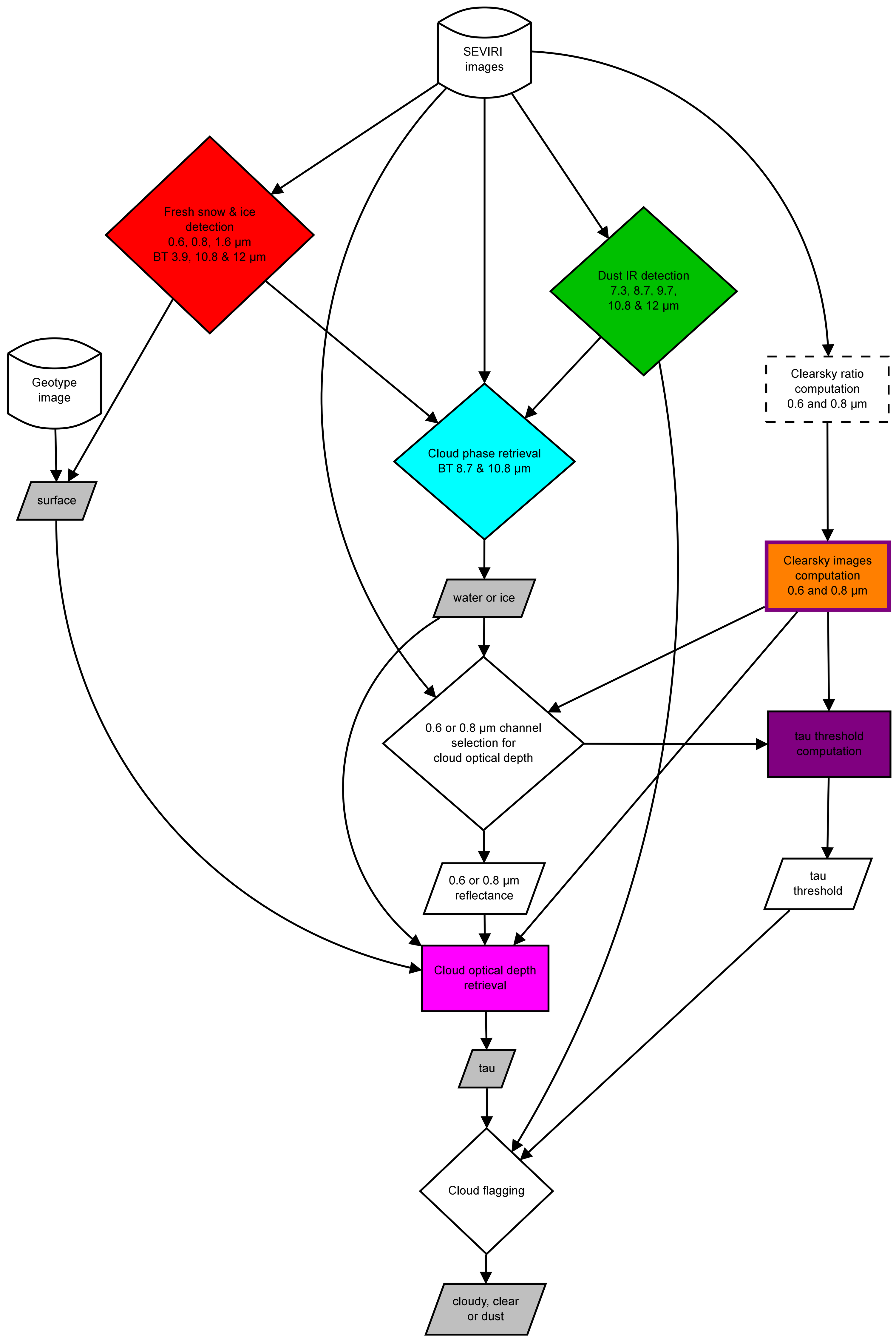
These limitations results in Clouds and the Earth's Radiant Energy System (CERES) ADMs misselection within the radiance–to–flux conversion which is applied to the GERB broadband radiances and therefore on the GERB TOA solar fluxes.



2 Proposed Edition 2 scheme

To address some of these limitations, we suggest the following improvements for the Edition 2 sceneID:

1. A dynamical fresh snow and ice detection scheme [1] has been specifically developed for the sceneID. It will be applied at the beginning of the sceneID to supplement the fixed surface map.
2. An infrared dust detection scheme [2] will be applied before the cloud thermodynamic phase retrieval to skip highly dust contaminated pixels in the cloud properties retrieval.
3. A bispectral IR technique [10] will be adopted for the cloud thermodynamic phase retrieval to improve the detection of thin clouds as well as super–cooled water clouds.
4. New cloud optical depth LUTs stratified according to surface albedo were generated using the libRadtran RT model [6] using state–of–the–art ice crystals parametrizations, line–by–line spectral computations and higher angular resolution. Their use should be more accurate for the SEVIRI narrow visible channels.
5. For sunglint affected regions, two strategies are competing. The first one is based on the extrapolation of unaffected sceneID retrievals over the previous 3 hours. However, this will be implemented as a post–processing on GERB L20 TOA flux products and not included within the SEVIRI sceneID scheme. The second strategy would be to tune the parameters of the clear–sky computation through comparisons with an independent clear–sky reference database (see section 3).
6. Sensitivity of the cloud detection could possibly be increased by tuning the parameters of the clear–sky estimation as well as of the cloud flag threshold, thus improving the thin clouds characterization (see section 3).



3 Validation strategy

The adopted strategy will be two–fold:

1. Allow to tune sceneID parameters to improve the accuracy of the various retrievals through comparisons with reference datasets.
2. Quantify the impact of the various suggested improvements on sceneID retrievals as well as on TOA GERB L20 solar fluxes and estimate error bounds through comparisons with reference datasets.

To perform meaningful comparisons, tuning and error estimations, we have selected in a given year, 2011, one week in each season, i.e. February 1–7, May 1–7, August 1–7 and November 1–7. These specific weeks have been chosen to avoid GERB eclipse seasons, where the instrument is switched off, as well as to avoid missing SEVIRI data due to decontamination.

We will then first start as reference datasets with the associated 2011 CM-SAF fractional cloud cover (CFC), cloud optical thickness (COT) and cloud phase (CPH) products. This will allow us to develop automatic comparisons and parameters tuning techniques.

In a second stage, we will used as reference dataset SEVIRI cloud properties retrievals [9, 8, 7] from the CERES Cloud Working Group. Indeed, the ADMs used the GERB radiance–to–flux conversion were stratified according to the CERES sceneID [5]. Therefore, to mitigate any bias that could result from using distinct sceneIDs for generating and selecting these ADMs, we should mimic as close as possible the CERES cloud properties retrievals.

Acknowledgement

This study was supported by EUMETSAT and the Belgian Science Policy Office under the contract EUMET-GERB.

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