

Processing SEVIRI images for estimation of vertically integrated cloud liquid water or ice water content

Praveen Pandey^{1,2} and Koen De Ridder¹

Introduction

The geostationary satellite, Meteosat Second Generation (MSG) has onboard the Spinning Enhanced Visible and Infrared Imager (SEVIRI) imaging radiometer. SEVIRI is a 12-channel imager, with 11 channels observing the earth's full disk with a temporal resolution of 15 min and spatial resolution of 3 km at nadir, and a high resolution visible (HRV) channel. The visible and thermal channels of SEVIRI are being used to retrieve the cloud physical properties (CPP).

Our study domain is over Europe covering the region between 35°N - 70°N and 10°W - 30°E. SEVIRI level 1.5 images over this domain are being acquired from the European Organisation for the Exploitation of Meteorological Satellites (EUMETSAT) archive. The processing of this imagery, involves a number of steps before estimating the CPP, viz. cloud optical depth (COD), cloud effective radius (R_{eff}).

Methodology

The channels used for the study are shown in table 1. For detection of COD, visible channels are used and for R_{eff} , thermal channel. Fig 1 shows a raw image observed by SEVIRI in channel 1, 0.6 μm .

The steps involved in pre-processing are as follows. First, the digital count number is acquired from the imagery. The step of image geocoding is performed in order to relate the pixel positions to the corresponding longitude and latitude. Solar zenith angle is determined as a function of latitude and time. The radiometric conversion is done using the values of offsets and slopes of respective band. The values of radiance obtained are then used to calculate the reflectance which is proportional to ratio of observed radiance, R , to solar radiance. The brightness temperature is estimated using the Planck's law.

Channel No.	Characteristics of spectral band (μm)	λ		
		λ_{cen}	λ_{min}	λ_{max}
1	VIS0.6	0.635	0.56	0.71
2	VIS0.81	0.81	0.74	.88
3	NIR1.6	1.64	1.50	1.78
4	IR3.9	3.90	3.48	4.36

Table 1. SEVIRI channels being used

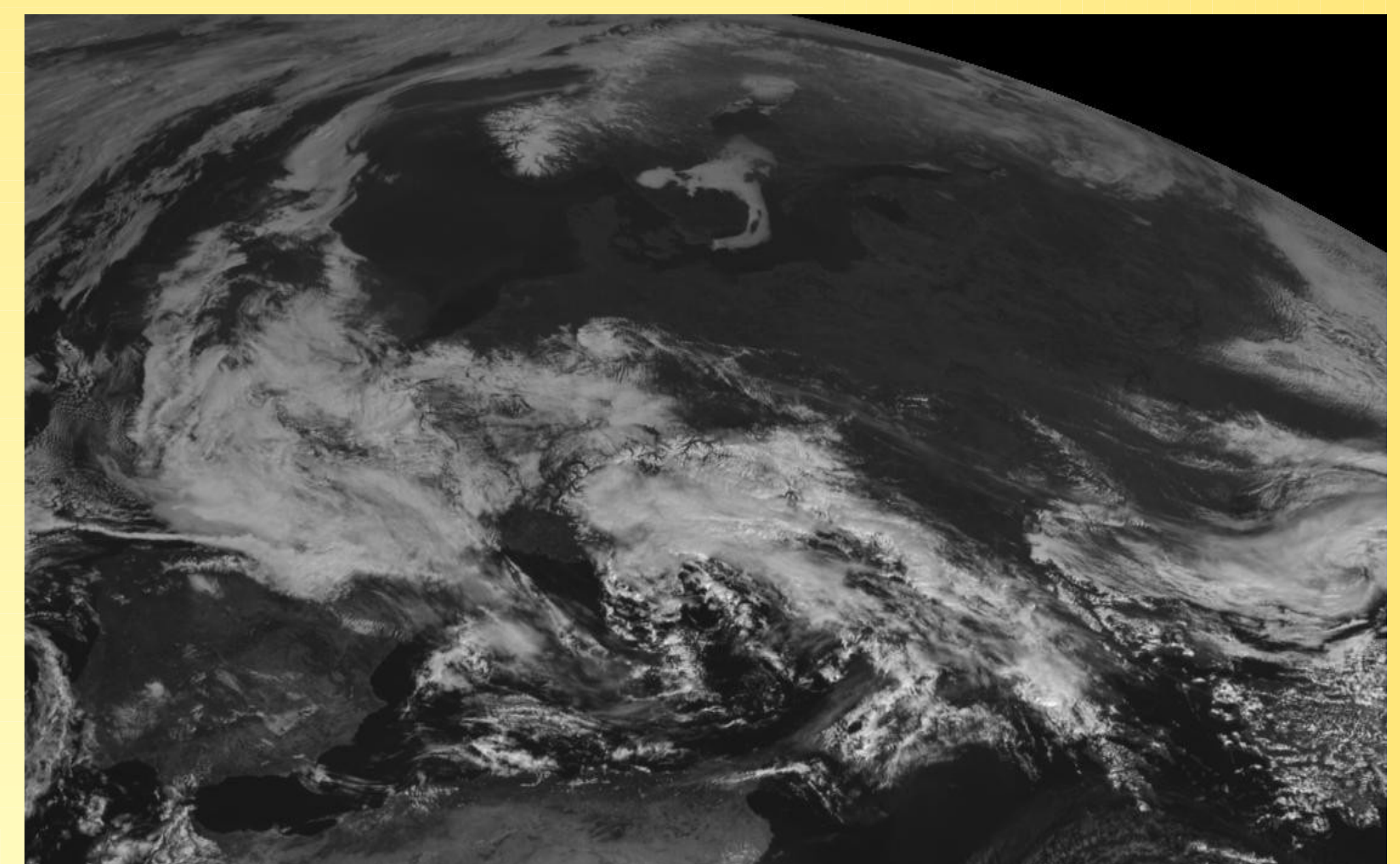


Fig. 1 SEVIRI raw image over Europe in visible wavelength 0.6 μm

Flow diagram of the image processing

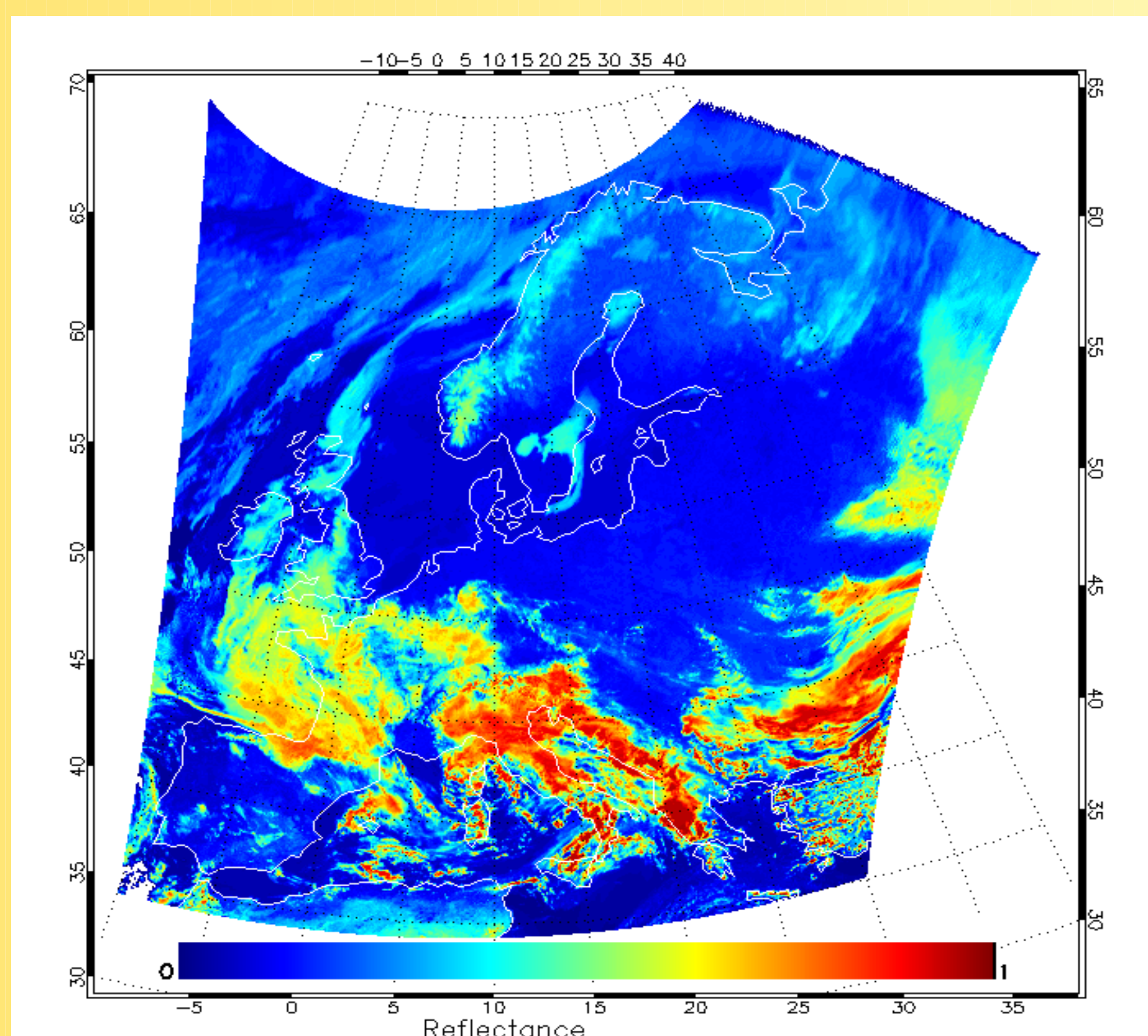
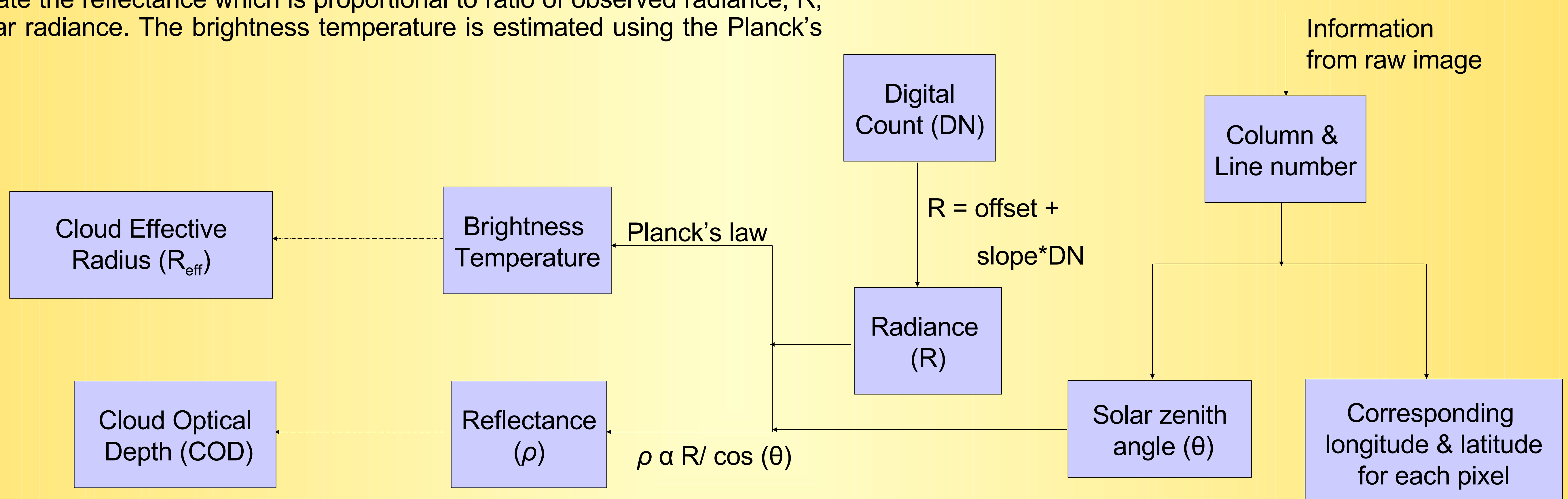


Fig. 2 Reflectance calculated for fig. 1 after performing the steps described in the flow diagram

Result

Fig. 2 depicts the result of image processing and the reflectance at 0.6 μm for the image shown in fig. 1.

Furthermore, a semi analytical scheme will be used to solve the asymptotic radiative transfer equations for retrieving COD and R_{eff} . Henceforth, vertically integrated liquid water (w) or ice water content will be retrieved. This w obtained from SEVIRI will be used to estimate the solar radiation flux at the surface and will be validated with in situ measurements.