Method: Extract time series for a large number of clear sky and cloudy targets

and fit a semi-physical model of the spectral response with 3 parameters \( \alpha, \beta, \gamma \)

\[ \tilde{\mathcal{R}}(\lambda, t) = \tilde{\mathcal{R}}(\lambda, 0) \left( e^{-\alpha t} + \beta (1 - e^{-\alpha t}) (1 + \gamma t) \right) \]

to obtain flat time series when compared with a model of the radiance. For meteosat-7, the optimization gives

\( \alpha = 0.000373 \text{ day}^{-1} \)
\( \beta = 0.7662 \)
\( \gamma = 0.000074 \mu \text{m day}^{-1} \)

Validation: the stability is computed over the full FOV in all sky and after cloud screening (clearsky) conditions in boxes of 200x200 pixels. In clearsky the stability is \( \pm 0.66/\text{decade} \), at 2 standard deviations. In all sky the stability is worst (\( \pm 3/\text{decade} \)) due to interannual variability in cloudiness.

Applying the method on Met-2, 3, 4, 5, 6 provides good results (Decoster et al, 2014) but:
- The effect of volcanic eruptions (e.g. El Chicon, Pinatubo) should be considered over dark surfaces
- The VIS spectral responses of Met-2 and Met-3 seem not to be consistent with the ones of Met-4, 5, 6, 7. Scene type dependent jumps are observed (not for bright desert as this scene type is used for the SSCC calibration).

Variability of the signal < 2% for the 6 scene types once Met-2 and -3 discarded. Clearly worst when Met-2 and -3 are considered.

Use in CM SAF

A dataset of MVIRI/SEVIRI/GERB Top-Of-Atmosphere Reflected Solar flux is being developed in CM SAF. The model of spectral degradation presented here will be considered to recalibrate the MVIRI visible data. The stability of the dataset is expected to be of the order of 1 W/m²/decade.

Further reading