HYGEOS

# SMAC-G/MERRA-2

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SMAC scheme (Rahman & Dedieu, 1994), using GPU,
fed by MERRA-2 Re-analysis atmospheric parameters

# Rationale

In the context of the production of Climate Data Records **(CDR)** for land Surface Reflectances within the Copernicus Climate Change Service (C3S), we present one solution for the key step of Atmospheric Corrections (AC). The processing architecture and algorithms is chosen under the constraints:

- **Long time series** going back to 1980, thus with simple sensors like NOAA/AVHRR,
- Maximum **consistency** between sensors,
- Per pixel **uncertainty** characterization.
- **Maximum spatial & temporal coverage**

# Description

- Based on SMAC (*Rahman and Dedieu, 1994*):
  - Fast, generic, robust, analytical, invertible, pixel by pixel, band per band algorithm
  - Based on 5S, well validated (~ 1%)
  - Reduce sensor dependency, improve CDR consistency
- Improved in C3S
  - Made faster with GPU: SMAC-G (coded in CUDA and Open CL)
  - Aerosols AOT at 550 nm input from reanalysis 1 hourly data (MERRA-2)
    - MERRA-2, 0.5° gridded dataset with 1-hourly resolved aerosol optical thickness (AOT 550) and aerosol model starting from 01/01/1980.
    - MERRA-2 H2O and O3
  - Implementation of an error propagation scheme
    - Version 1 : Analytic
    - Version 2 : Add ensemble (Monte Carlo) corrections using varying aerosol models from reanalysis (Dust, Organic Carbon, Black Carbon, Sea-salt and Sulphates)
  - Eventually integrate 6S-like BRDF and adjacency correction (TBC)

# Description (continued)

- No cloud mask, SR(λ) only outputs, mainly over land
- Suitable for long time series, not single images analysis
- Generic, reduced biases due to AC
- Aerosol modules within big re-analysis become mature enough:
  - Assimilation of state of the art aerosols products including Aeronet
    - ! Validation bias around Aeronet sites
  - Act as a Spectral, Spatial and Temporal interpolator of atmospheric parameters for AC
    - No gaps
  - But Sensitive to model biases
- Fast, Data Cube approach