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THE FRENCH AEROSPACE LAB
r e t u r n   o n   i n n o v a t i o n

Visible and Infrared natural Backgrounds modelling

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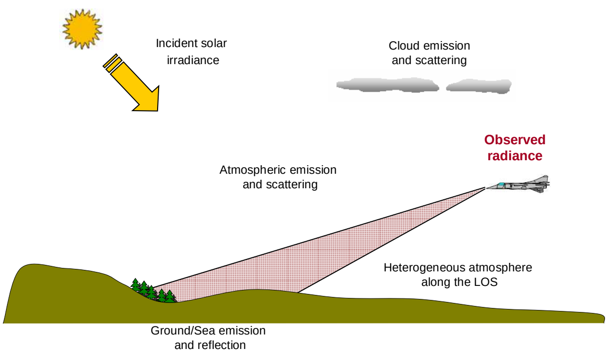
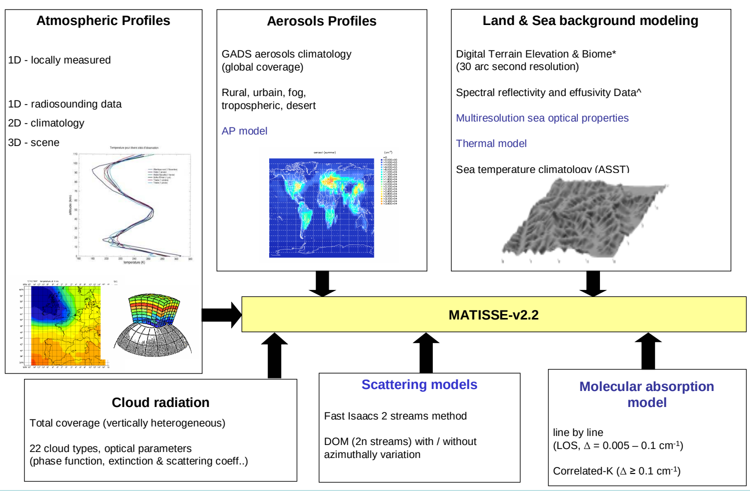
ONERA DOTA/MPSO

MATISSE V2.2 : Modélisation Avancée de la Terre pour l'Imagerie et la Simulation des Scènes et leur Environnment

Ground and atmospheric contributors

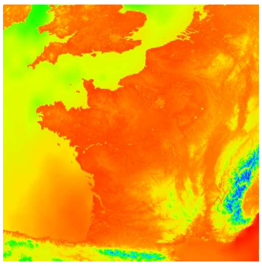


Models short description

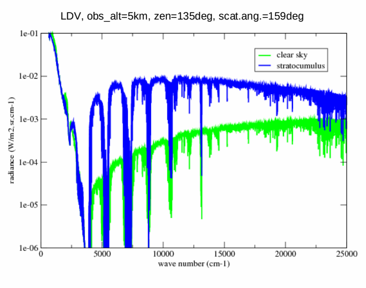


Exemples of results

Radiance 4µm, clear sky conditions

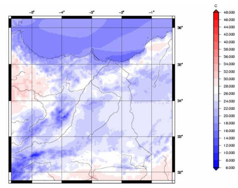


Sea surface radiance, band 2



Toward MATISSE : V3.0

Coupling with Météo-France forecast

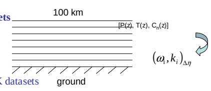


AROME output exemple
temperature (2m) above Maroc

In MATISSE-2.x:
- Use CK spectral transmission model (17 parameters)
- Compute CK datasets from HITRAN database
  - good accuracy vs speed
  - allows Beer's law

~17*nbintervals transmission computation

Conversion of thermodynamic profiles to CK datasets
- Drawback
  Require off line computations
- Advantages
  No CK generation on line / Reuse of the CK datasets



Decreased computation time strategies for MATISSE-v3.x :

CK dataset production
•Pre computed LUT of CK datasets and interpolation

Radiance and transmission computation
• fast wide spectral band calculations : CKLB method
• reducing transmission k computation/narrow band : OSS method (Optimal Spectral Sampling)

http://matisse.onera.fr

Rapid Project : NUAGES_3D

Technological objectives

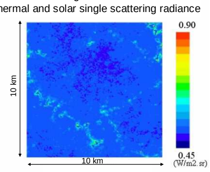
- "fast" generation of cloudy backgrounds by solving the Radiative Transfer Equation (RTE) from microphysical data in 3D
  * Realism and physics validity require the use of a high spatial resolution medium
  * It implies very costly calculations
- Best compromise to find : accuracy / time computation
  Two approaches are developed:
  * Optimizing 3D radiative transfer code reference : SHDOM (Alyotech Technologies)
  * Simplifying 3D RTE to have fast calculations (ONERA DOTA)
  Validation of different approaches from measured image (Thales Optronics)
- ONERA developed codes :
  According to required accuracy :
  * LUCI (medium spatial resolution : > 100 meters)
  * Rapid3D_L (high spatial resolution : ~ meters)

ONERA results

LUCI : Accuracy + , Fast ++

- Run time : 4s / 1 wave number (without Multiple Scattering DM)
- Estimated time for DM (to implement) :
  ~ 1s / 1λ
  Method : DM computed on equivalent uniform cloud + 3D analytical fluctuations model

Image 200 x 200
Thermal and solar single scattering radiance



19 min (band 2)

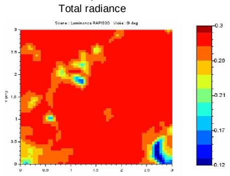
RAPID3D_L : Accuracy ++ , Fast +

- Validated with SHDOM

Computation time

Average	Prep	Comput.	Visual
RAPID3D-L	0,94857143	33,7271429	13,7242857
Total	48,4		

Scene : 3 x 3 km, resolution : 50m
Total radiance



70 s / 1 λ
(SHDOM : 4700 s /1 λ)

Astrid Project : ECLIPS

Climatological study of surface cover reflectance: from visible to infrared

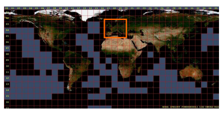
LSCE   LOA   ONERA   NOVELTIS

Objective:
Surface cover reflectance database generation with 500m and 8-days spatio-temporal resolution, in the [0.4-14 µm] spectral range

From generation to exploitation of a climatological database

- Detailed knowledge of spectral signature of land cover with only few spectral satellite measurements (processing of in situ measurements or modelling of spectral signature of various land surfaces + statistical analysis)
- Collection and processing of 10-years satellite MODIS measurements (Use of devoted processing tools and performance computing)
- Database size reduction for an easiest processing (best database structure selection, data formats and compressions options, analysis of the data spatial and temporal variabilities in order to estimate the resolution degradation impact, automatic classification tools to find a limited number of characteristic reflectance spectra and associate each pixel with its own class)

Feasability on Europe area

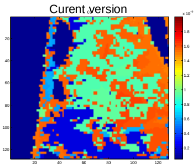


Results

Coupling prototype between ECLIPS and MATISSE-v2.1

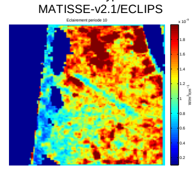
Irradiances images at 2.5 µm

MATISSE-v2.1
Curent version



2 images / year
17 surface cover reflectance spectra

Prototype
MATISSE-v2.1/ECLIPS



46 images / year
> 27 millions surface cover reflectance spectra