

climate change initiative

→ CLIMATE MODELLING USER GROUP

Description of WP 3.10 and 3.11

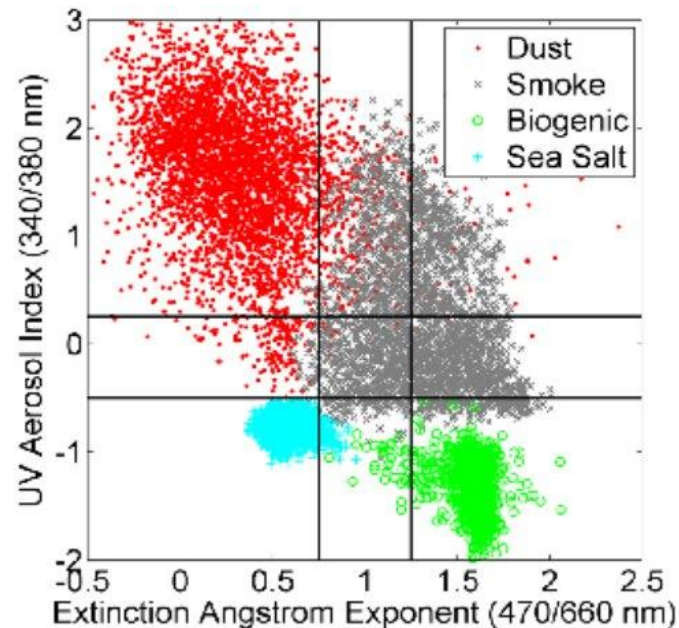
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Current aerosol (and dust) data assimilation is mainly based on retrievals in the visible part of the electromagnetic spectrum, and with no information on aerosol speciation

IASI dust retrievals have the potential to overcome these drawbacks. A previous CCI case study made by BSC showed the potential of IASI for dust DA but with a few important limitations.

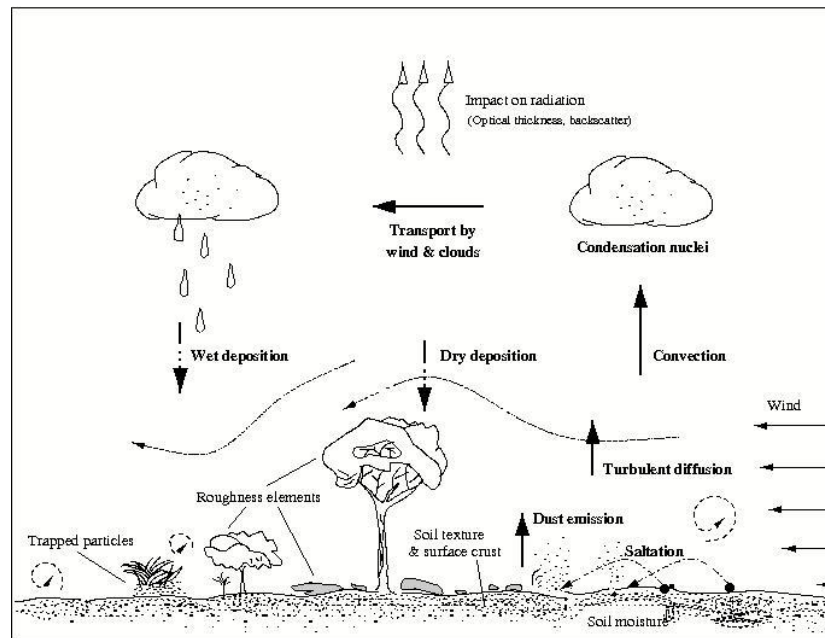


(Vries et al., 2015)



Current use of Land Cover information in dust models is provided at a coarse resolution and is related to green vegetation only.

Surface characteristics are important for dust emissions



(Knippertz et al. 2014)



WP3.10: Assessment of the potential of CCI/CCI+ data to constrain mineral dust simulations at the regional scale

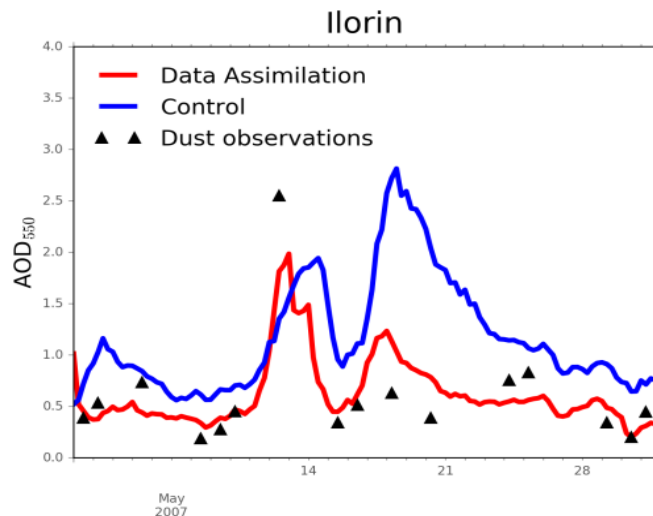
ECVs involved: Aerosol dust and High Res LC

CCI IASI dust data will be assimilated in model simulations, while CCI+ high resolution land cover data (once data will become available) will be used to enhance the NMMB-MONARCH's land use type, with a consequent impact on dust emissions



Aims:

- demonstrating the use of CCI/CCI+ data to produce **dust analyses** at the regional scale;
- assessing the **synergy of CCI aerosol** data (in particular when constraining atmospheric concentrations over dust source areas) **with CCI+ land cover** data (used for an enhanced characterization of dust emissions);



- set the **basis** for the assessment activity 11 on the production **of a pilot dust reanalysis**, where the impact on dust cycles at different temporal scales will be evaluated;
- providing **feedback on these ECVs** to the ESA CCI/CCI+ teams.



WP3.11: Production of a pilot dust reanalysis at the regional scale

ECVs involved: Aerosol dust and High Res LC

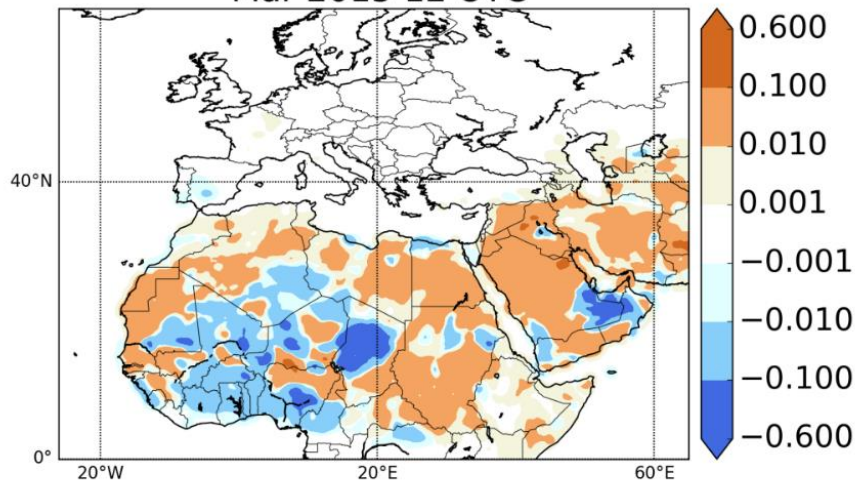
CCI IASI dust data will be assimilated in model simulations for the reanalysis period. Simulations will make use also of CCI+ high resolution land cover data, once these will become available, in order to enhance the NMMB-MONARCH's land use type.



Aims:

- producing a **pilot dust regional reanalysis** based on CCI/CCI+ data, over a 1 year period
- detection of **systematic (spatial and temporal) patterns of data impacts** on the dust analysis through statistics of innovations
- assessing whether their integration in model simulations can improve the **monitoring of mineral dust** and the characterization of **dust cycles**

Dust AOD (550nm) analysis - first guess
Mar 2015 12 UTC





Planned interactions:

- CCI+ ECV teams: LC, HRLC teams

Initial discussions: domain, variable values&types, temporal resolution, period, format

- CCI ECV teams: email discussion started with ULB (C3S ECV)

External:

- DustClim consortium (dust reanalysis)
- WMO SDS-WAS hosted by BSC/AEMET



Links within CMUG: Aerosol global reanalysis (ECMWF)





Additional back-up slides





Currently used in MONARCH (BSC model):

Land cover type:

- Meteorological component estimates aerodynamic roughness length (z_0) based on USGS 94-category land use and regionally (N Africa and Asia) uses $1/4 \times 1/4$ degree resolution z_0 based on POLDER-I (Laurent et al. 2008)

(Green) Vegetation cover fraction:

- The meteorological and land-surface component uses USGS monthly climatology at 1km resolution
- The dust module uses MODIS LAI at 0.1×0.1 degree resolution, at a monthly variation, and available for 2000-2015
 - to calculate a drag partition to correct the threshold friction velocity for sediment mobilization
 - to estimate the erodible (bare) area for dust flux calculation
 - [optional] to scale dust flux



Actions:

- processing IASI dust aerosol data to follow the assimilation cycles
- implementation of an observation operator for the thermal infrared
- identifying optimal assimilation settings for observation error statistics and covariance localization
- implementation of the use of CCI+ high resolution land cover to characterize the model land type
- DA simulations on a regional domain covering Northern Africa, Europe and the Middle East for specific dust events (usually lasting 1 to 10 days) during the active dust season
- assessment of the impact of assimilating the data during relevant dust events and validation with independent observations





Actions:

- production of a pilot reanalysis over the course of a specific year characterized by relevant dust events
- statistical analysis of innovations throughout dust cycles at different temporal scales
- reanalysis validation with independent observations
- comparison of the dust reanalysis with other reanalyses



Scientific questions:

- Which is the added value of assimilating thermal infrared retrievals?
- Which is the impact of IASI data assimilation at the regional scale in high resolution simulations?
- Are CCI (pixel-level) uncertainties realistic?
- Does enhanced land type information improve the first-guess of mineral dust tracers, and consequently dust analyses?
- Are the used CCI/CCI+ ECVs consistent?
- Can CCI/CCI+ data improve aerosol reanalysis?
- Can CCI/CCI+ data improve in particular the characterization of dust cycles?
- How well does the regional dust reanalysis compare to global reanalyses?



A data assimilation/modelling assessment of CCI/CCI+ data will be of added value to the standard CCI experiments as it will provide a **different perspective to the evaluation efforts**, and will allow to **assess ECVs for cross-consistency**.

A reanalysis assessment is able to showcase the potential of CCI/CCI+ data to contribute to the formulation of **management and mitigation plans of different socio-economic sectors**. A dust reanalysis in particular can be used to provide resources for studying the impact of dust on **health, weather and climate**.

BSC's strong **links to specific user communities** through its **WMO SDS-WAS** activities can guarantee the visibility of such potential for the data considered.