

**Aerosol typing:
a key information**
Update of aerosol type inventory



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Overview of typing procedures



- **21 aerosol typing** procedures included in the review
- **15** classify particles in **source classes** with an interpretative scheme
- **6** stays with the **optical** observables

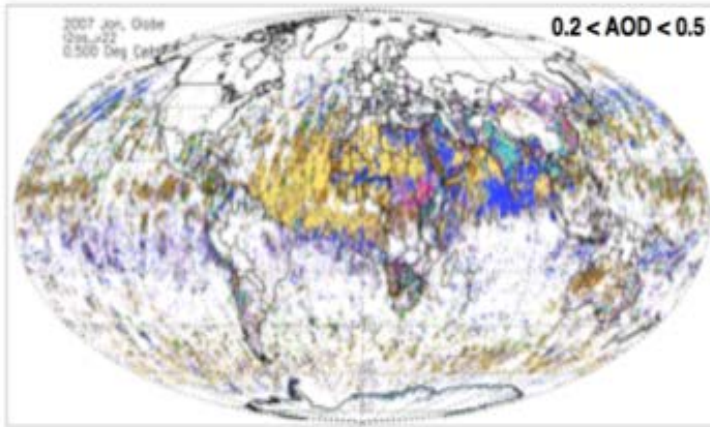


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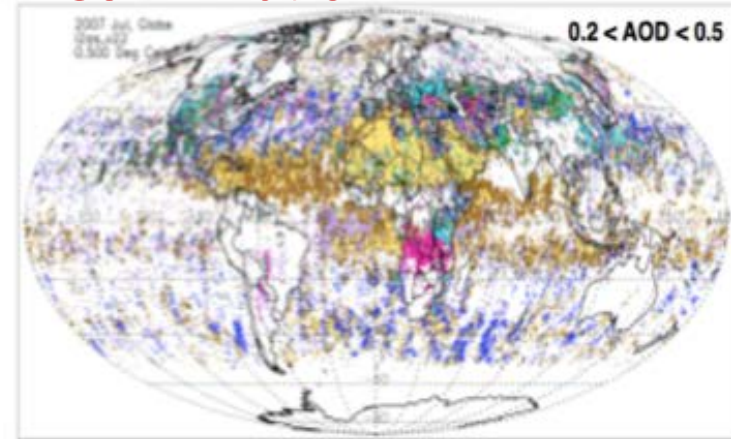


- Remote-sensing can provide **optical constraints** interpreted as **particle size, shape, and indices of refraction**
- A further **interpretative step**, entailing additional assumptions, reports particle **Source/Chemical Composition**
- **Validation Data** for aerosol type are very **limited**
- **Model** simulations and **in situ** measurements can help

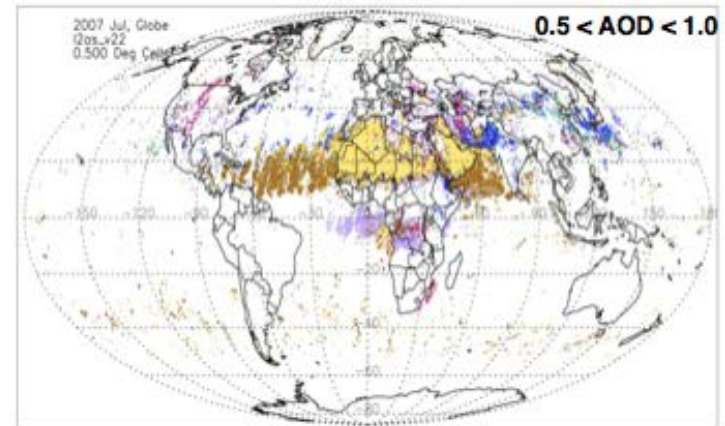
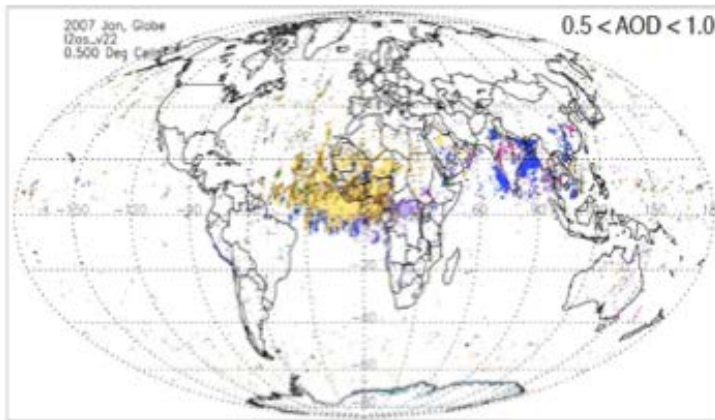
MISR Aerosol Type Discrimination



January 2007



July 2007



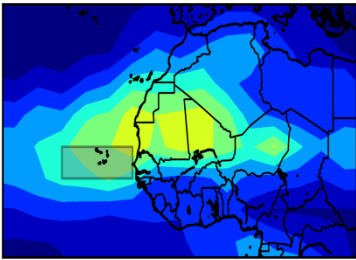
Spherical, non-absorbing

Non-spherical

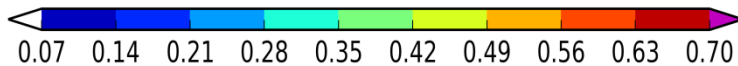
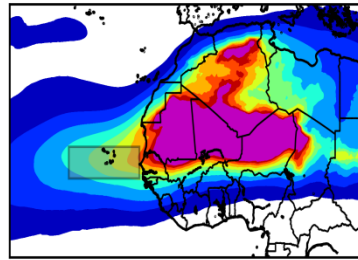
Spherical, absorbing

MISR Aerosol Type Discrimination

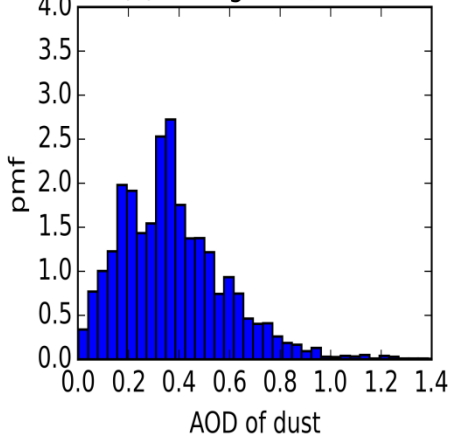
(a) combined dust [MISR]



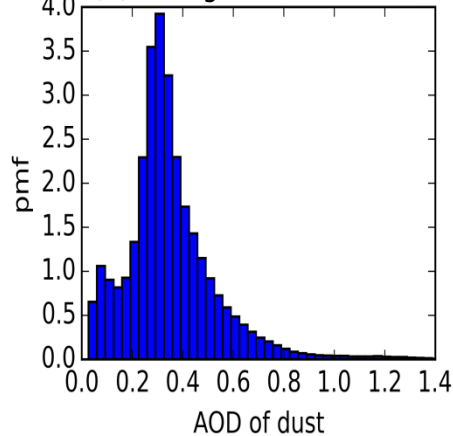
(b) dust [SPRINTAS]



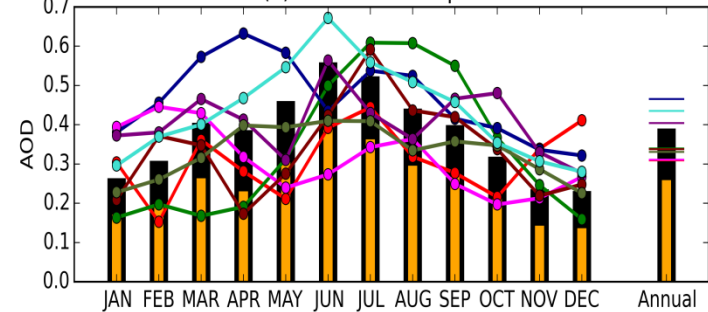
(c) histogram [MISR]



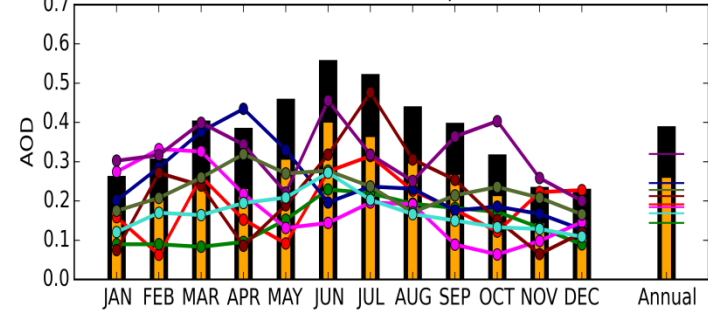
(d) histogram [SPRINTAS]



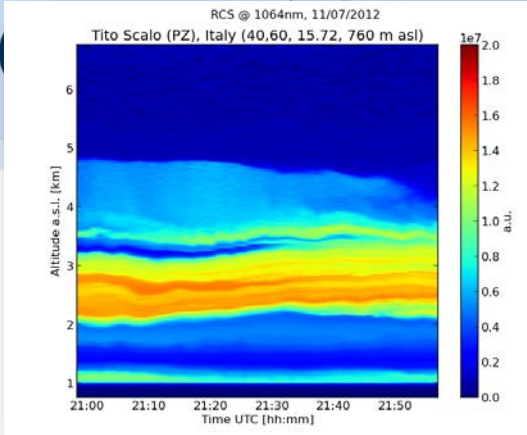
(a) Total AOD comparison



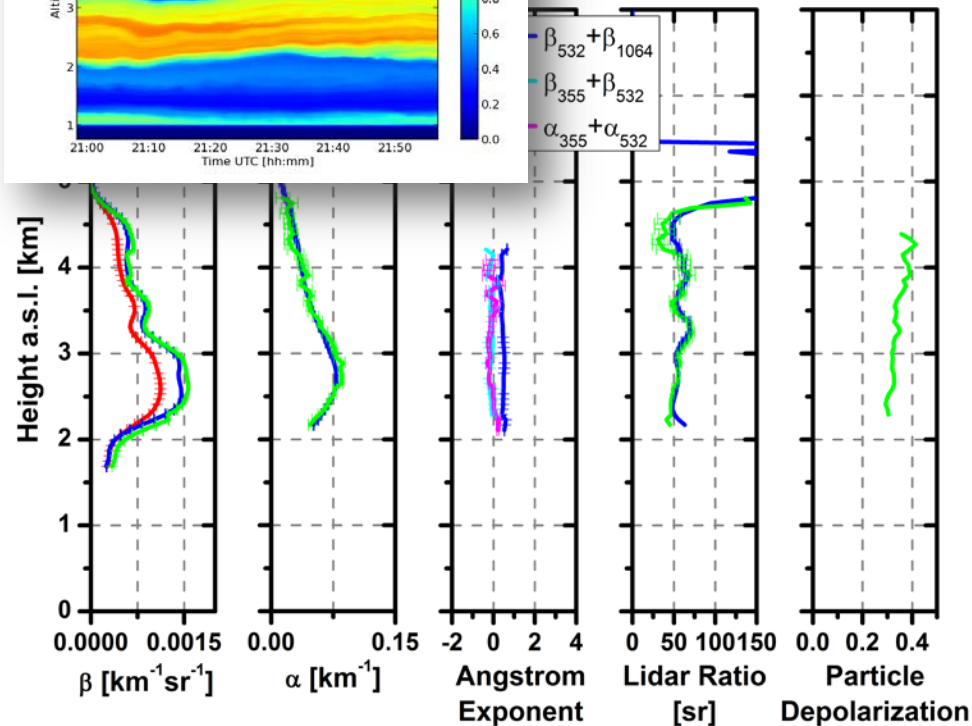
(b) Dust AOD comparison



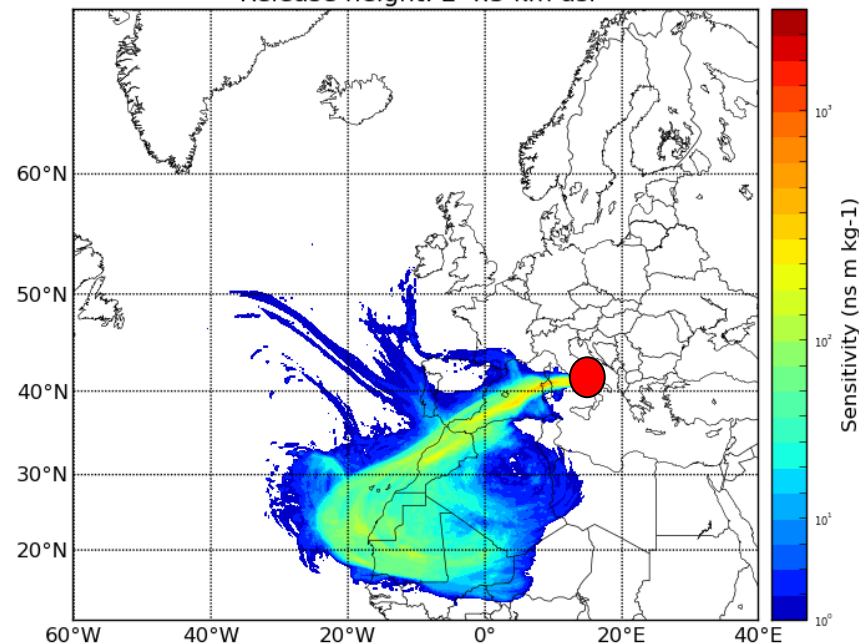
Interpretive scheme



11 July 2012, 20:59 - 21:58 UTC



Total column Sensitivity (2012/07/11, 19:30-23:00 UTC)
Release height: 2-4.5 km asl



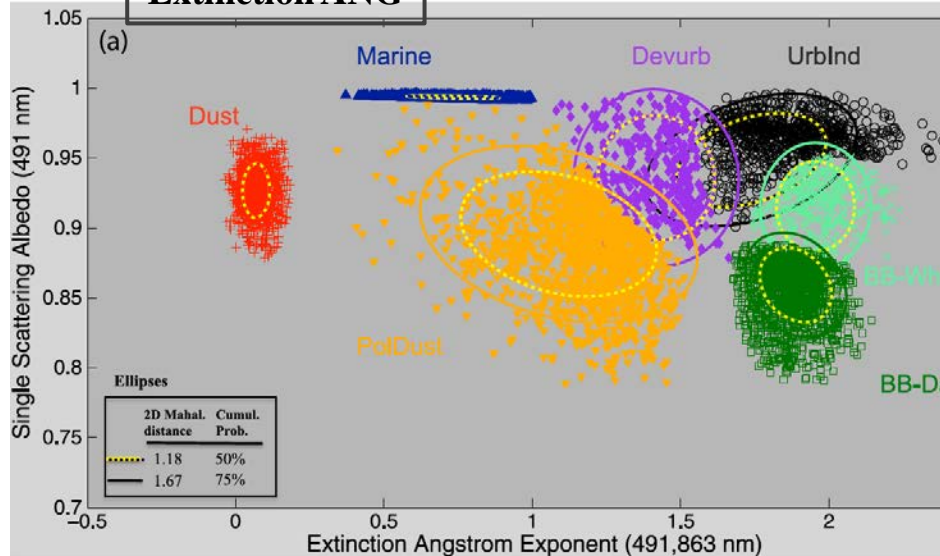
- AE indicates coarse particles (values around 0) → could be dust
- LR mean values of 56.7 ± 6.1 and 54.1 ± 10.1 sr, for 355 and 532 nm in respective → probably dust

- Linear particle depolarization ratio of 34 ± 3 % consolidates the hyp → Dust
- Finally, backward trajectory analysis indicates the pathway travelled of air masses → foothills of Atlas

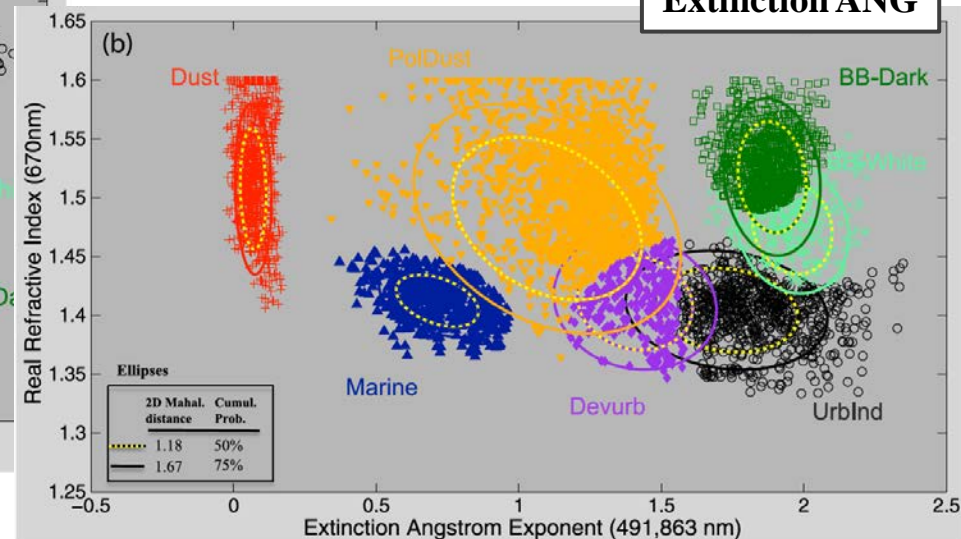
On the base of case studies the observed optical properties are ascribed to certain aerosol classes

AERONET Aerosol Type 7-Grouping Classification based on EAE_{491,863}, SSA₄₉₁, RRI₆₇₀, dSSA_{491,863}

7 Groupings
SSA₄₉₁ vs.
Extinction ANG

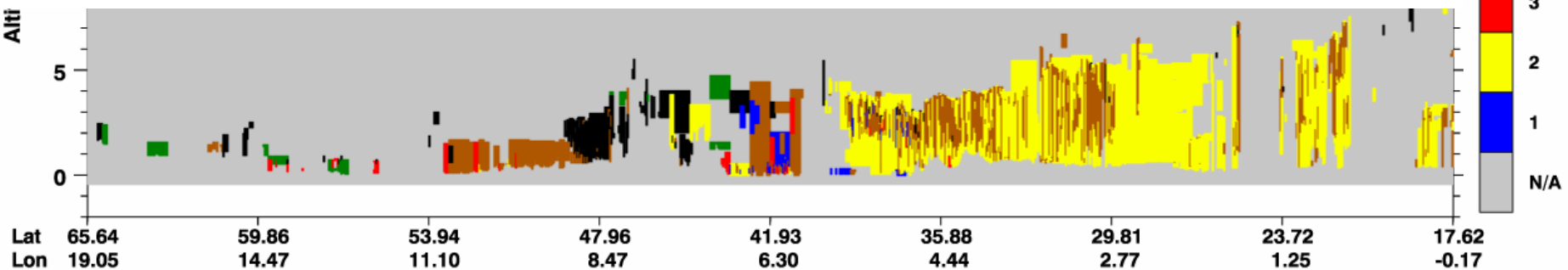
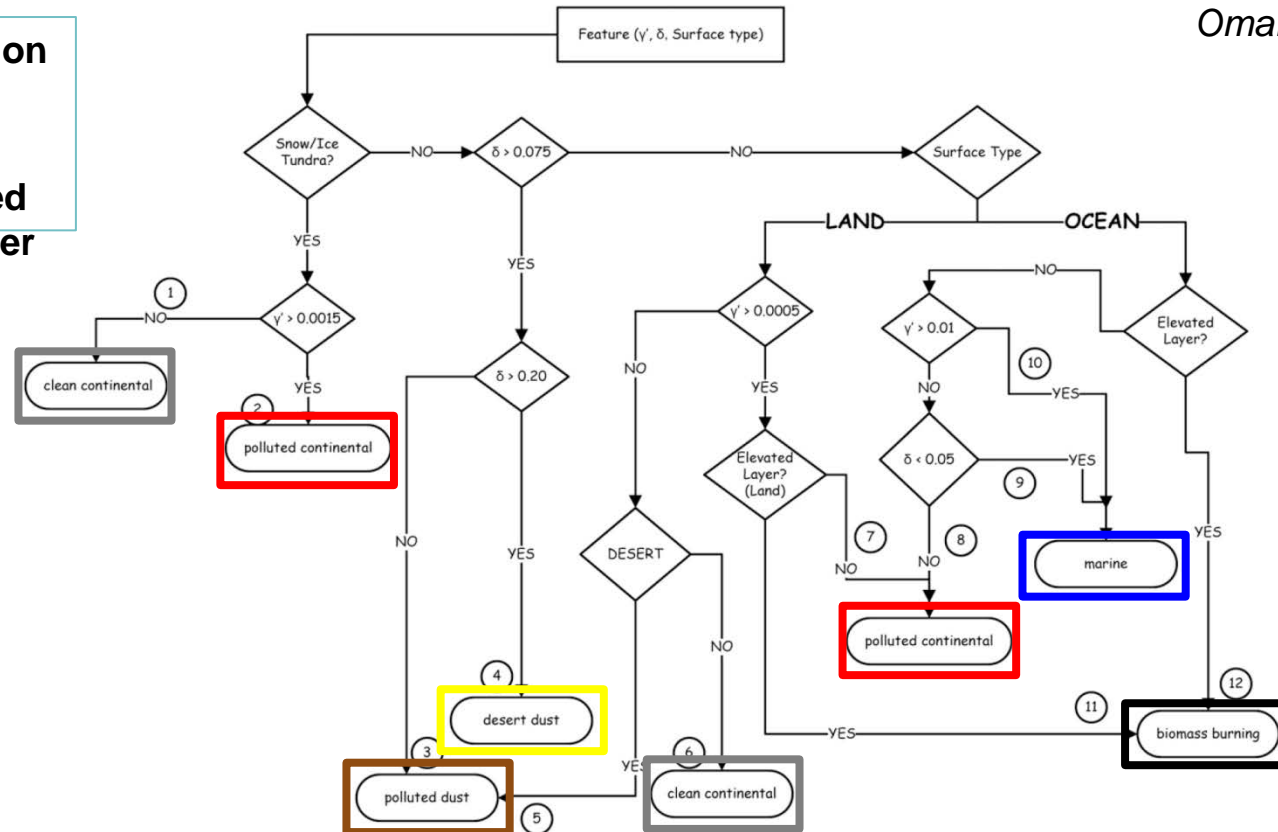


7 Groupings
Real RI₆₇₀ vs.
Extinction ANG



Omar et al., JAOT
2009

δ – depolarization
 γ' – layer-integrated attenuated backscatter



N/A = not applicable 1 = clean marine 2 = dust 3 = polluted continental 4 = clean continental 5 = polluted dust 6 = smoke



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Which were the plans?



Reference database for aerosol typing (**REDAT**)

The idea: collecting a set of measurements from each sensor for each aerosol type.

A set of pure aerosol components + their mixtures

Labeled and identified with sensor typing procedures and grouping them in big categories.

A first proposal could be:

***Mineral dust - Biomass burning – Marine -
Urban/industrial - Volcanic ash – Sulfates***

This set could become a reference dataset for the whole community and will provide opportunities for:

-Comparing typing procedures

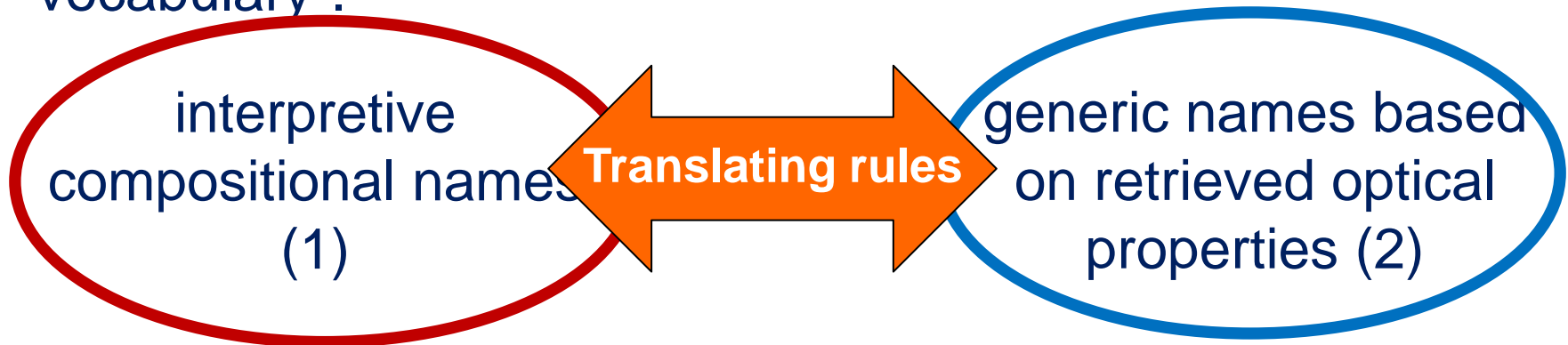
(for this we should probably try to start from ground-based measurements, which are limited datasets, and check for satellite matches)

-Providing a reference dataset and a link with the modeling community

(also models typing and outputs could be relevant for this kind of database)

REDAT could provide the opportunity for

□ finding matching / **translating rules** (which will be non-unique) between words belonging to a “controlled vocabulary”.



□ Providing an indication of typing products **reliability**

REDAT could provide the opportunity for

- Finding matching / **translating rules** (which will be non-unique) between words belonging to a “controlled vocabulary”
- Providing an indication of typing products **reliability**
- Overcoming of the “small” dataset
- Construction of a **multi-dimensional** and **multi-platform** space of characteristic optical properties

Identified **needs**:

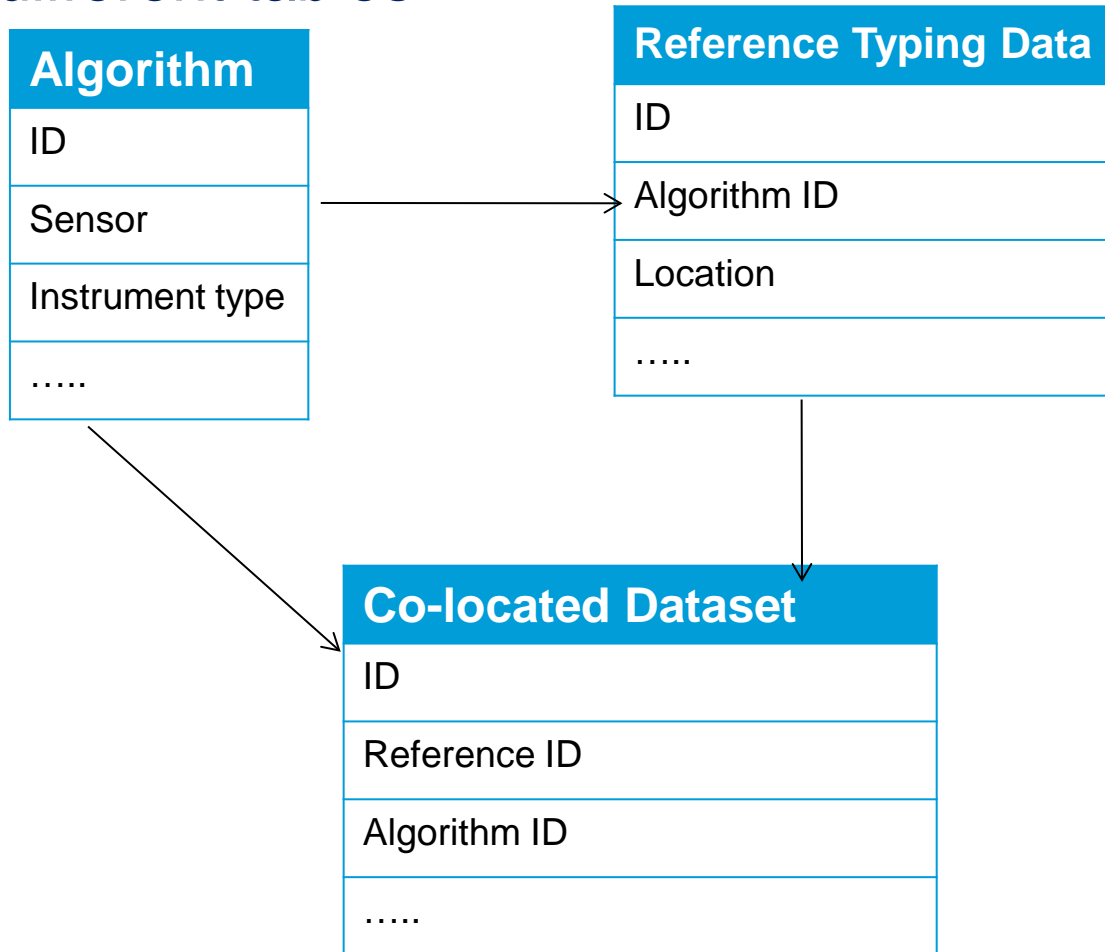
Hierarchical structure

Flexibility for accommodating substantially different data

Pointing to the specific typing algorithm and procedures



Relational database with cross references between the different tables.



.....others could be added

Algorithm table: describes the algorithm applied at a specific (multi) platform observation.

Algorithm	
ID	
Sensor	
Instrument type	active passive GB satellite model near surface etc
Algorithm approach	
Mixing Flag	if mixture are considered
# classes	
Input for retrieval Flag	if typing is needed as info for the retrieval of AOD ...
# of aerosol constraints	
Aerosol constraints	optical (radiance in case of passive sensors), geographic (space and/or time), source (aerosol transport model defined source type
Algorithm reference (DOI)	
Climatological Typing Reference (DOI)	
Product Unique Attribute	
Contact point	

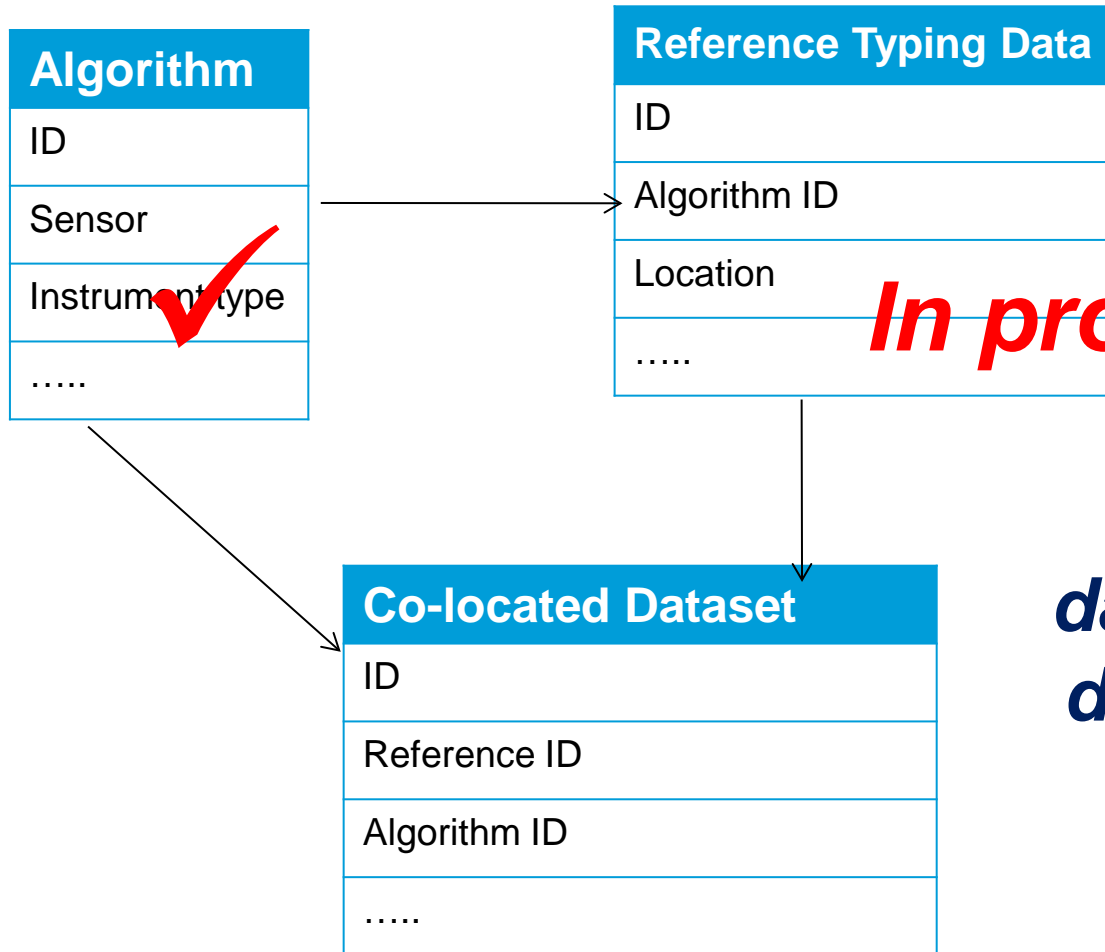
Reference Typing Data: Quantitative set of information and optical properties measurements for the different aerosol types/sensor/algorithm

Reference Typing Data	
Reference Data ID	
Algorithm used	
Location	Long, lat, time , altitude asl
Resolution	Effective resolution
Layer altitude	base and top for vertical resolved measurements (for total-column TOA)
Surface type	Land, ocean ...other possibilities to be included?
Observing geometry	Zenith limb
Type	Type number respect to the classes in the Algorithm table
Measured parameters for typing	Measured parameters used/important for the typing (with uncertainty): multi dimensional field with observed value + uncertainty
Columnar AOD	
Layer AOD	if available + below and above from profiling techniques

Co-located dataset: Quantitative set of information and optical properties measurements for the different aerosol types/sensor/algorithm in correspondence of the reference dataset of Table2 (not all the sensors can have it for all the cases, of course)

Co-located Dataset	
Co-located data ID	
Reference Data ID	
Sensor/algorithm ID	
Location	Long, lat, time , altitude asl
Resolution	Effective resolution
Layer altitude	base and top for vertical resolved measurements (for total-column TOA)
Surface type	Land, ocean ...other possibilities to be included?
Observing geometry	Zenith limb
Type	Type number respect to the classes in the Algorithm table
Measured parameters for typing	Measured parameters used/important for the typing (with uncertainty): multi dimensional field with observed value + uncertainty
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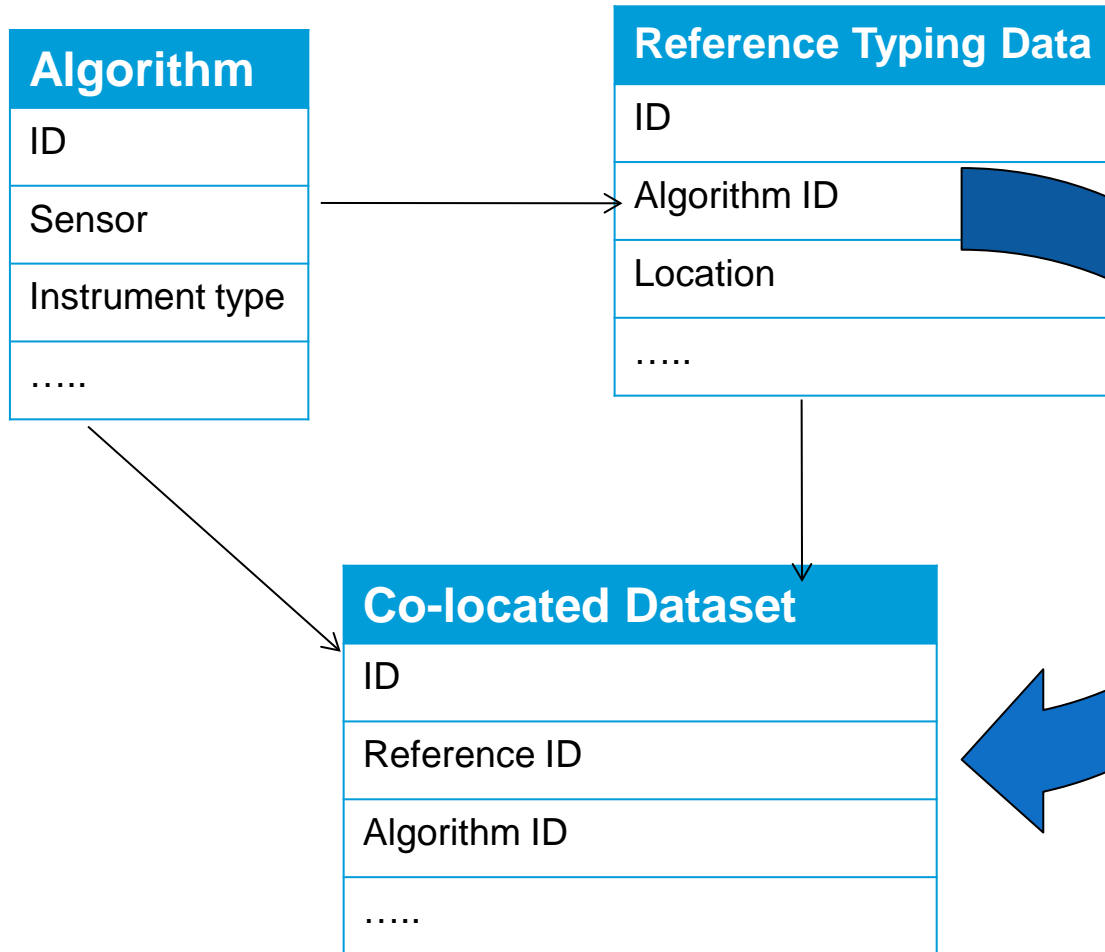
What we have **now**?



In progress

***PostgreSQL
database under
development at
CNR-IMAA***

Table 2 to be feeded



Location needed as input for co-located dataset selection

