



Contribution of the laboratory experimental simulation activity within EUROCHAMP-2020/ACTRIS to the aerosol retrieval from satellite observations

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CNRS & CNR

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Barcelona



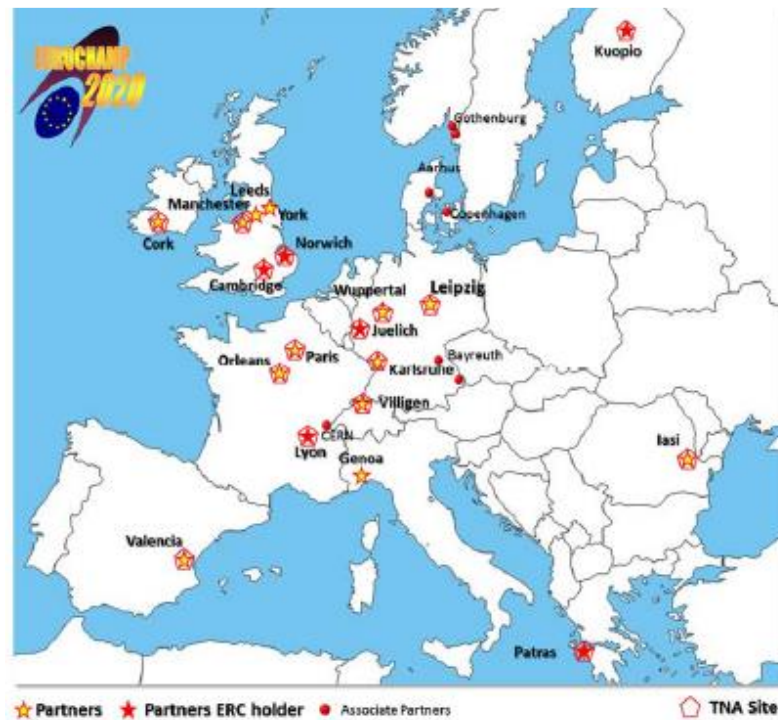
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EUROCHAMP-2020. Integration of European Simulation Chambers for Investigating Atmospheric Processes – Towards 2020 and beyond

coordinator: Jean-Francois Doussin Jean-Francois.Doussin@lisa.u-pec.fr

Further integrate the most advanced European atmospheric simulation chambers into a world-class infrastructure for research and innovation.

- Improve chamber operability across the infrastructure
- Standard protocols for data generation & analysis
- Development of measurement techniques & experimental protocols



Trans-national access to 16 chambers and 4 calibration centres

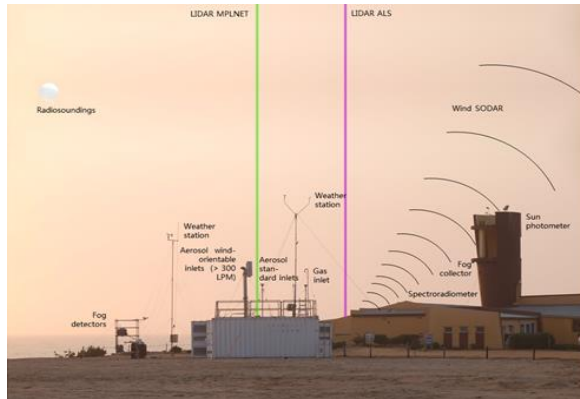
Data centre providing access to experimental data & advanced analytical resources

Atmospheric simulation chambers are the most advanced tools for elucidating processes that occur in the atmosphere. They lay the foundations for air quality and climate models and also aid interpretation of field measurements.

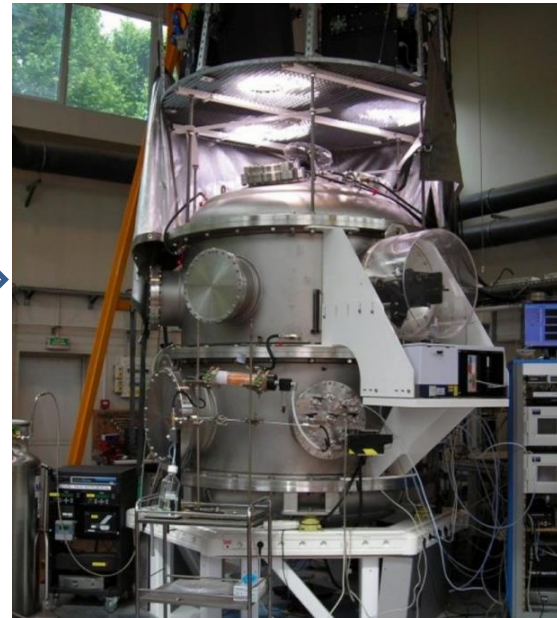
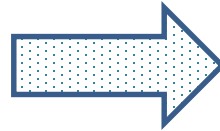
Why to study aerosols in simulation chambers?

To elucidate processes that occur in the atmosphere/interpret field data

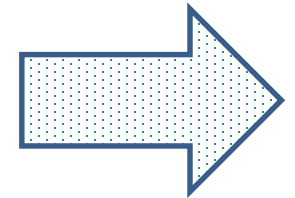
To complement remote sensing observations by providing data not easily measurable in the field



Field information



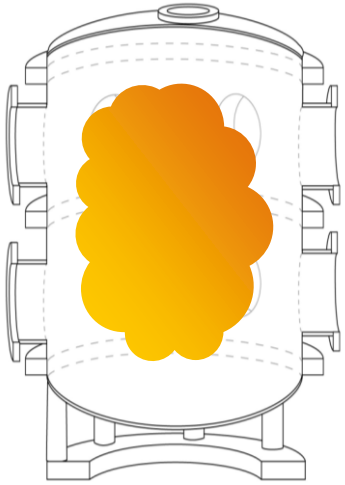
Chamber investigation



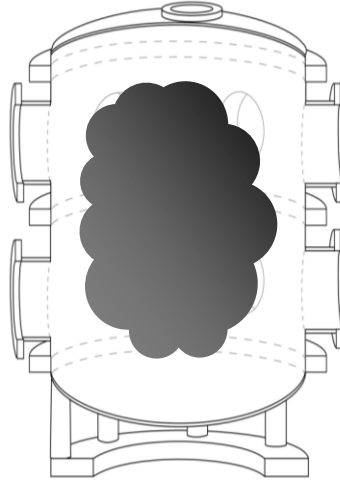
To models
&
remote sensing

Reproduce in the laboratory the atmospheric complexity (but in a controlled way)

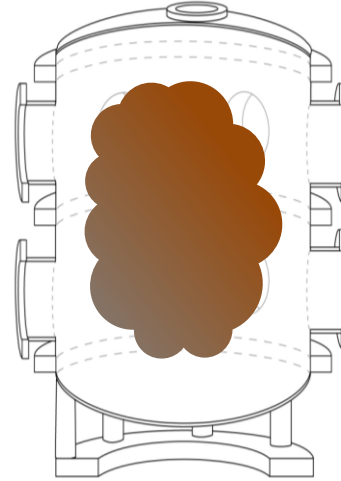
DESERT DUST
VOLCANIC ASH



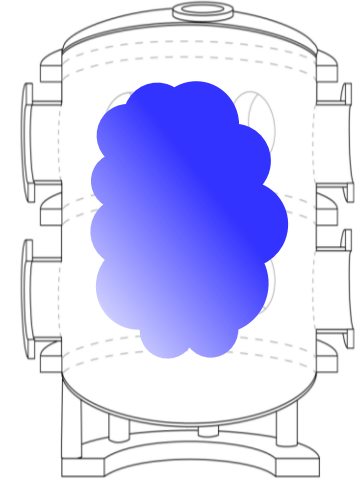
SOOT



BROWN
CARBON



MARINE
AEROSOLS



Variability of aerosol properties at the source
(modification of the aerosol generation procedure)



Simulating atmospheric aging
(multiphasic reactions, aerosol mixing, photochemistry, etc.)

Reproduce in the laboratory the atmospheric complexity (but in a controlled way)

- Create in the chamber the desired atmosphere (T, RH, p, aerosol, gas, irradiation,...)
- Isolate different aerosol species and separate the effects (composition, size, shape) on the properties of fresh aerosols
- Reproduce and isolate/combine aging processes (mixing, chemical reactions, photochemistry,...)
- Test the wide range of atmospherically-relevant conditions (concentrations, humidity, irradiation, gaseous precursors, T, ...)
- Accelerate/focus on processes (reproduce in few hours what in the atmosphere takes several days or occur over too large spatial scales)

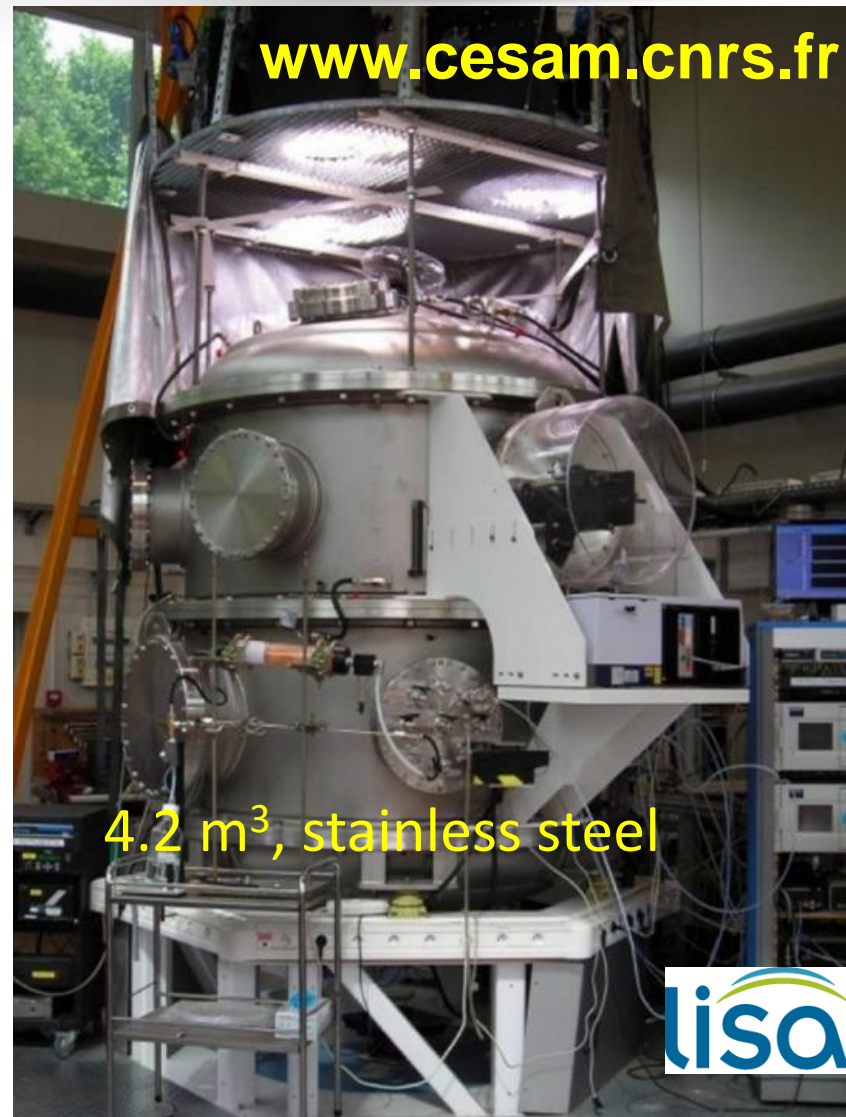
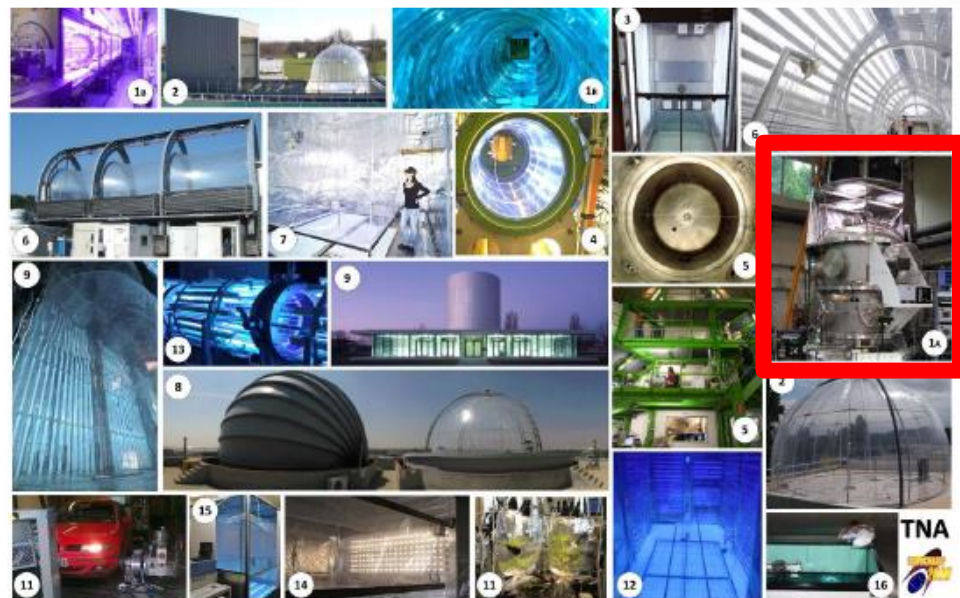
Very difficult to get in the field

To complement remote sensing observations by providing data not easily measurable in the field

(with a reasonable uncertainty compared to what required by models)

- **Aerosol optical properties SW and LW** (complex refractive index, CRI, MEE, SSA) and their relation to particle physico-chemical state, **both dry and wet conditions** (→ improving assumptions in satellite retrievals & models)
- **Spectral variation of SW and LW MEE/SSA/CRI** for pure species and aged/mixed aerosols (→ aerosol speciation from remote sensing)
- **Hygroscopic properties** of aerosols
- Measurements for both **spherical & non-spherical aerosols** from **primary & secondary sources**

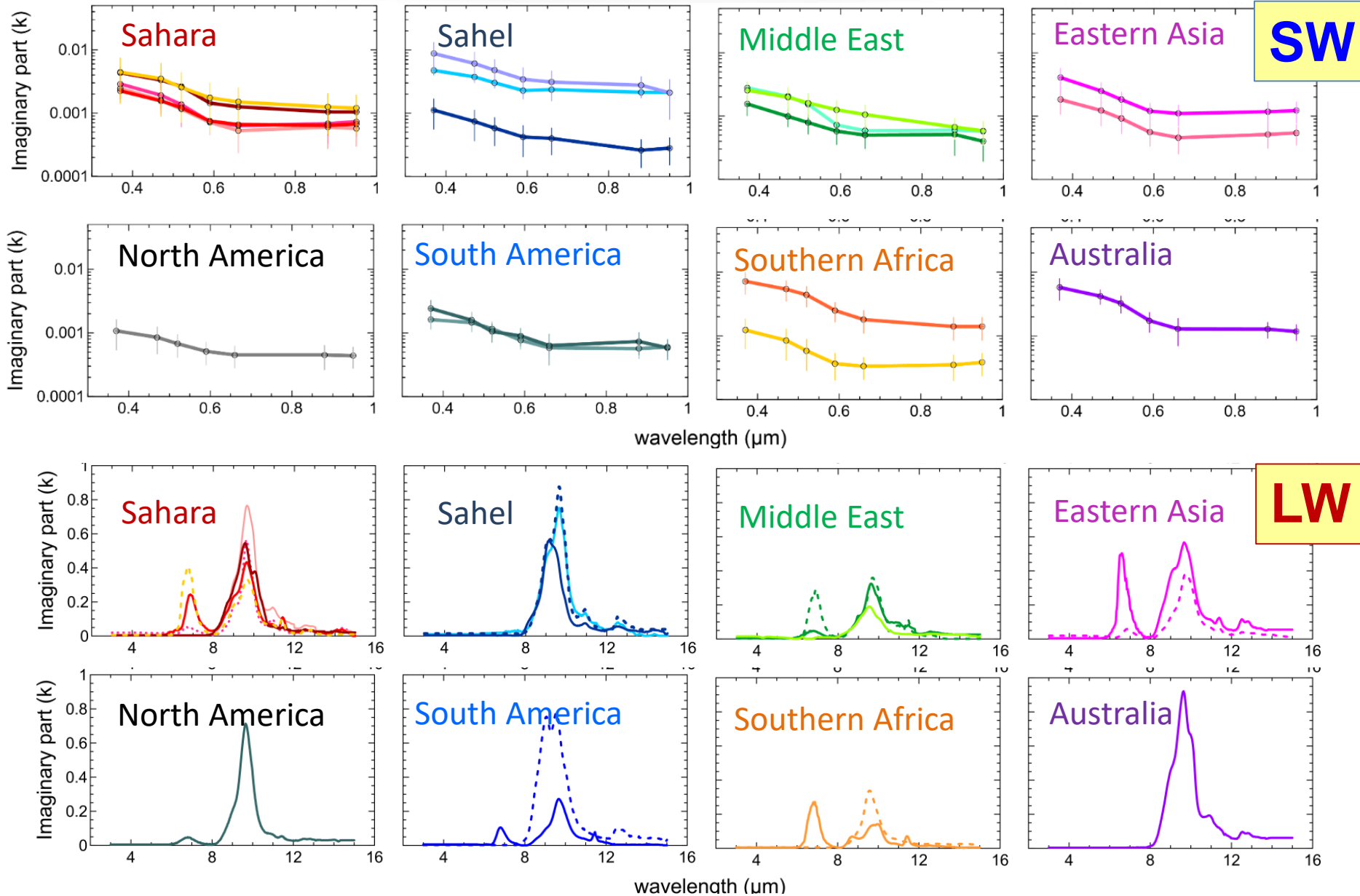
EUROCHAMP-2020 – Many chambers, different capabilities



CESAM (CNRS, FR)
Optical properties of aerosols
Wang et al., AMT, 2011



Ex.: the source-dependent CRI for mineral dust

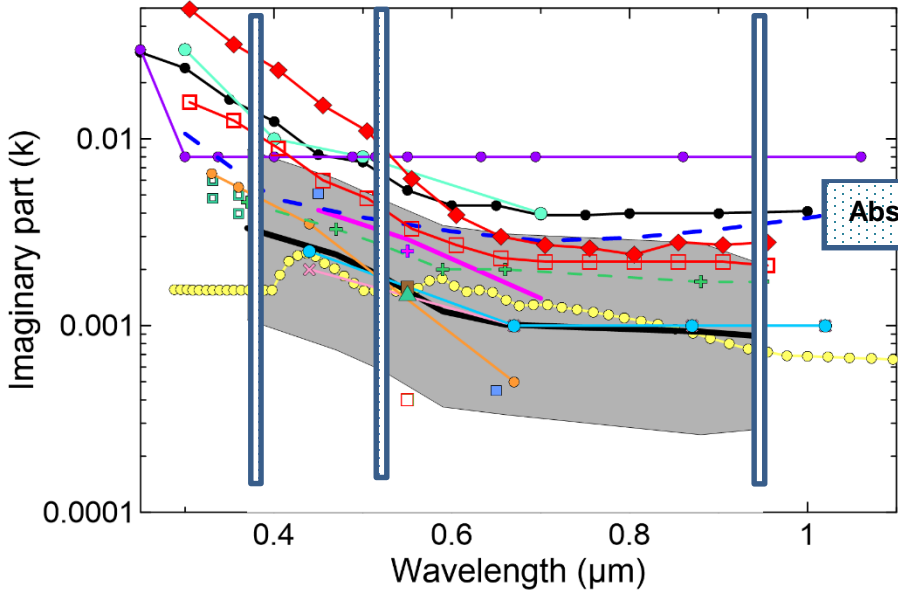


Ex.: parameterization of CRI vs mineralogy

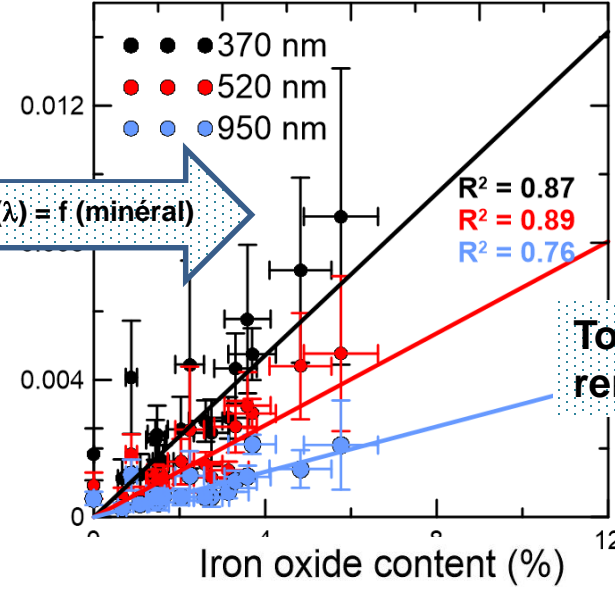
Spectral and mineralogical dependence

Parametrization

SW

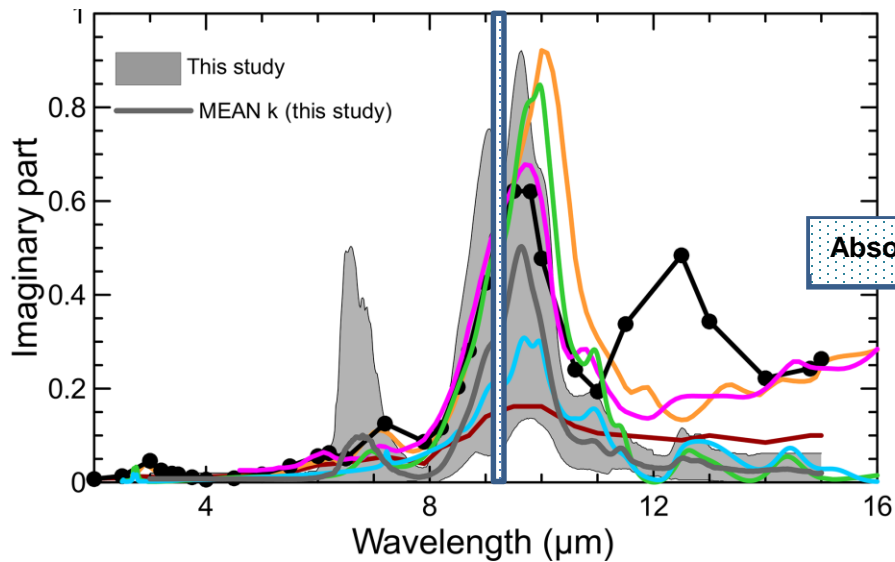


Absorption (λ) = f (minéral)

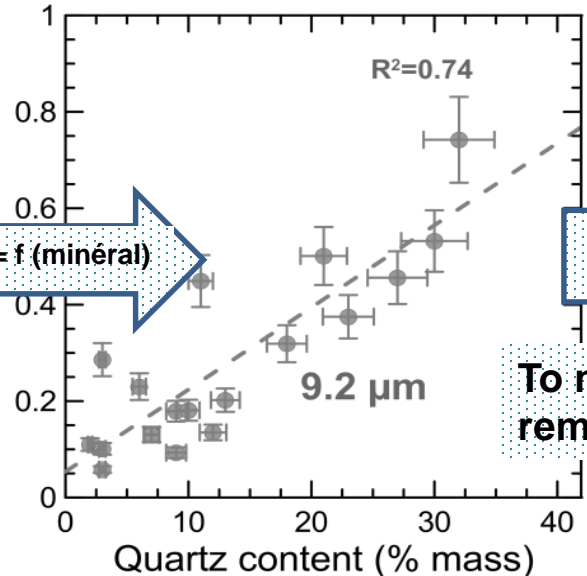


To models and remote sensing

LW



Absorption (λ) = f (minéral)



To models and remote sensing

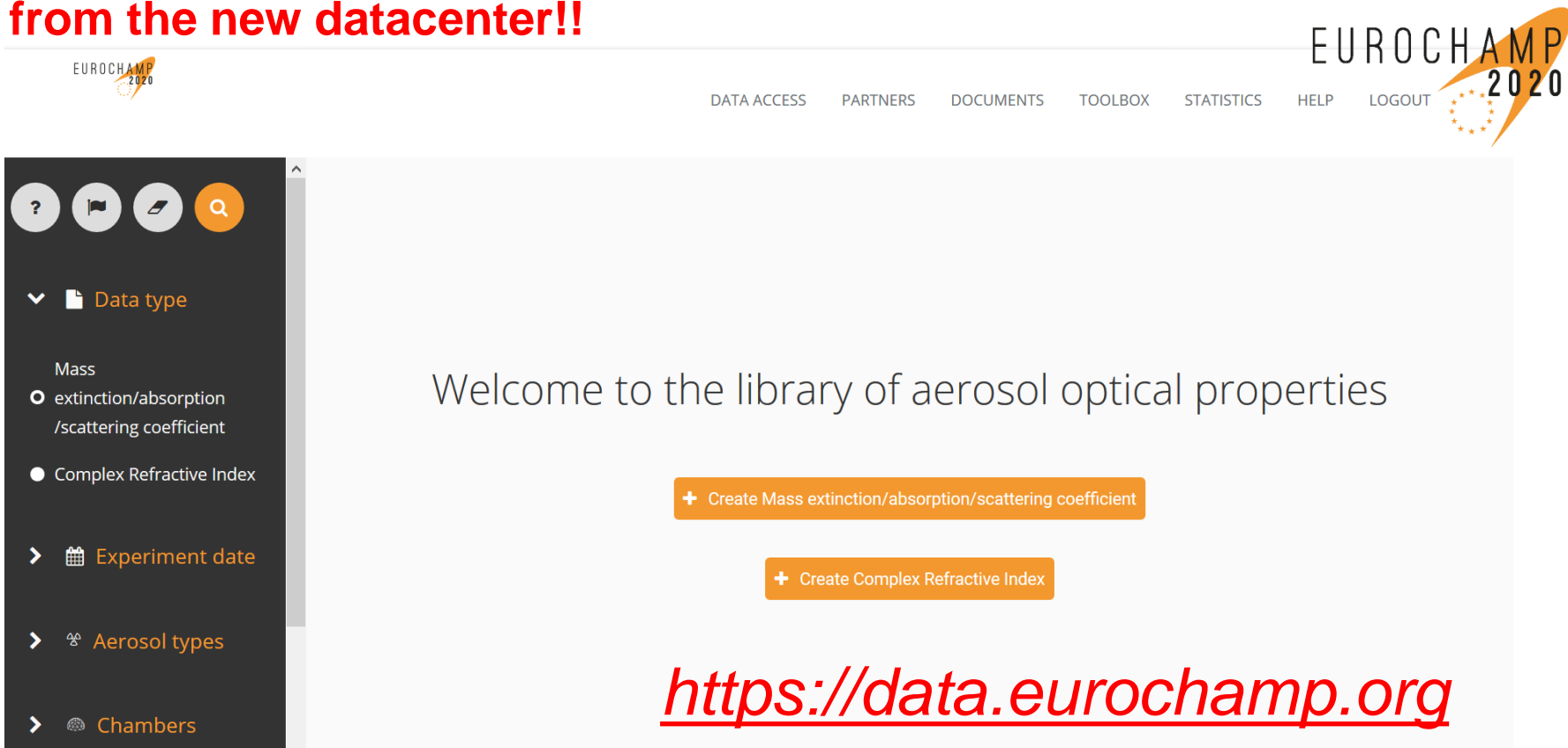
Way forward

Satellite users: IASI, EMIT, CALIOP,...

Model users: global and regional models (LMDzOrINCA, SPRINTARS, NASA-GISS, REG-CM,...), FRAGMENT project,

→ **Target objectives / work together**

MOST IMPORTANT: data are available and freely downloadable from the new datacenter!!



The screenshot shows the EUROCHAMP 2020 datacenter website. The top navigation bar includes the EUROCHAMP 2020 logo on the left and menu items: DATA ACCESS, PARTNERS, DOCUMENTS, TOOLBOX, STATISTICS, HELP, and LOGOUT on the right. A dark sidebar on the left contains navigation icons and a menu with categories: Data type (expanded), Experiment date, Aerosol types, and Chambers. Under 'Data type', there are radio buttons for 'Mass extinction/absorption/scattering coefficient' (selected) and 'Complex Refractive Index'. The main content area displays the text 'Welcome to the library of aerosol optical properties' and two orange buttons: '+ Create Mass extinction/absorption/scattering coefficient' and '+ Create Complex Refractive Index'.

<https://data.eurochamp.org>