



User... and
Provider!

sacs



Aerosols and methane products from
IASI and IASI-NG and applicability in
services

Sophie Vandenbussche & Charles Robert

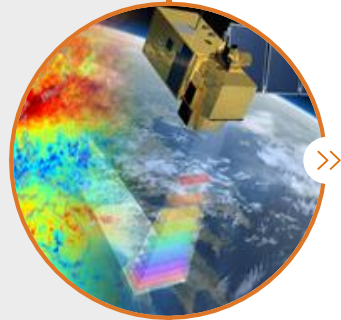
with contributions from Hugues Brenot & Nicolas Theys



ROYAL BELGIAN INSTITUTE
FOR SPACE AERONOMY



Presentation plan



CH₄, dust and volcanic ash

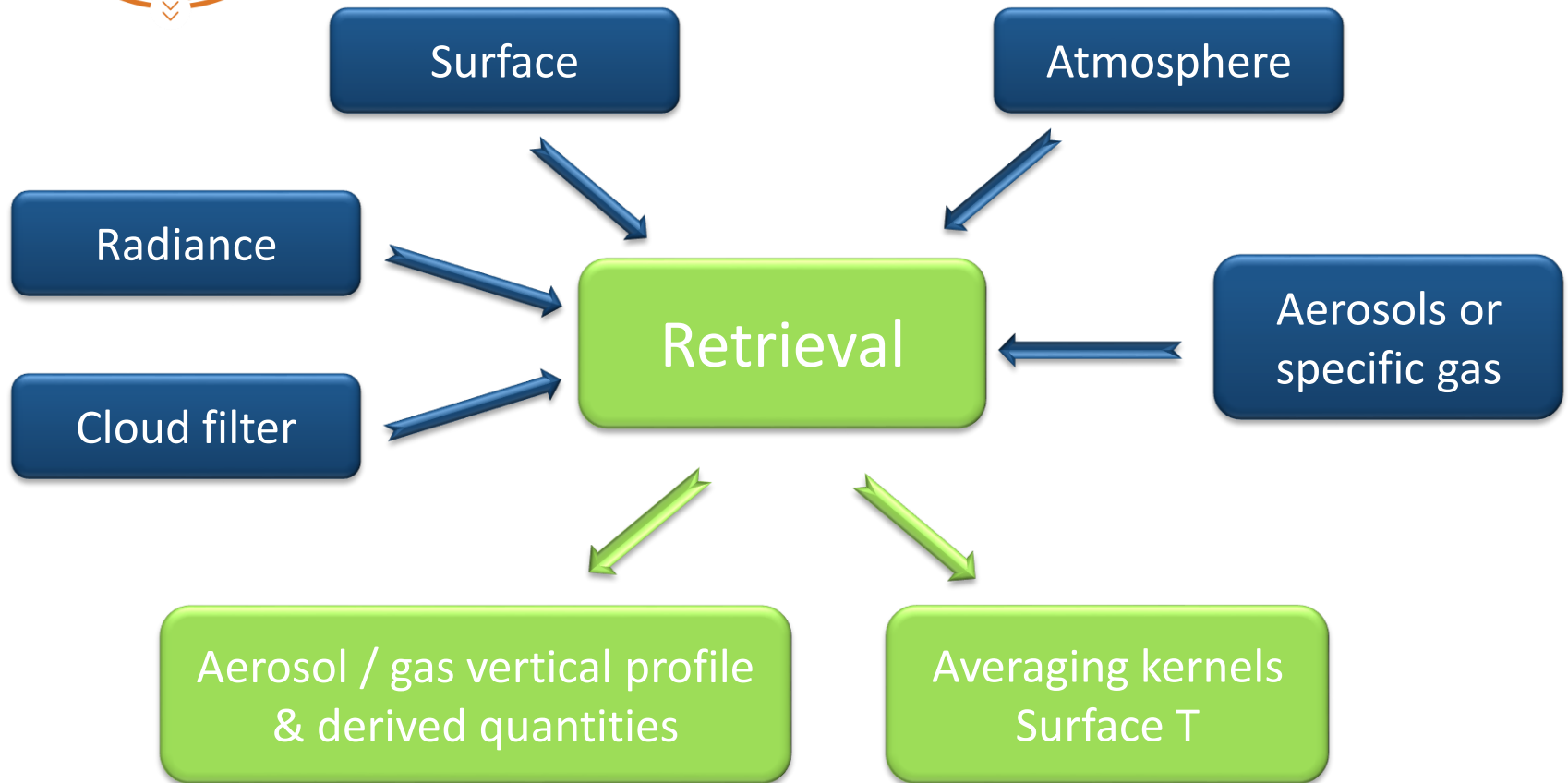
- Us as data user
- Us as data provider



Service applications

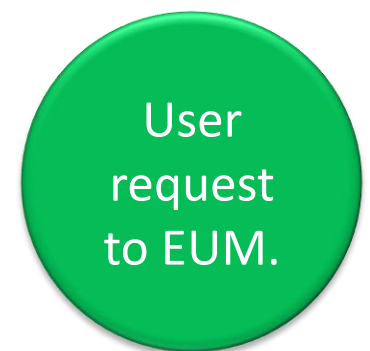
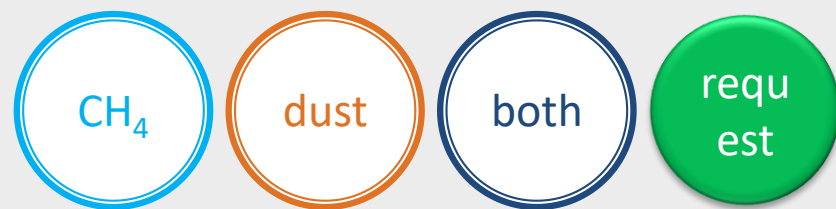


Data flow in our retrievals



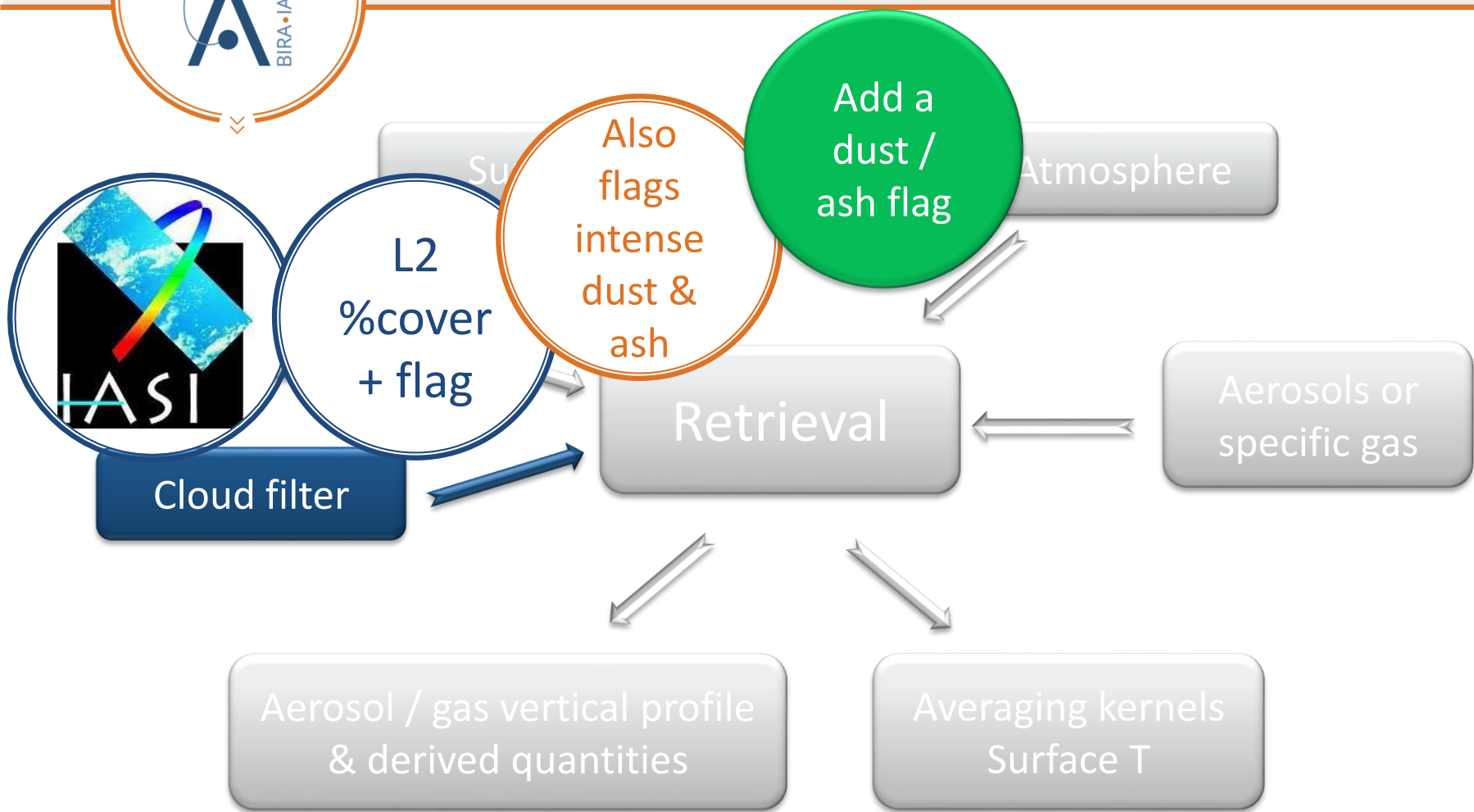
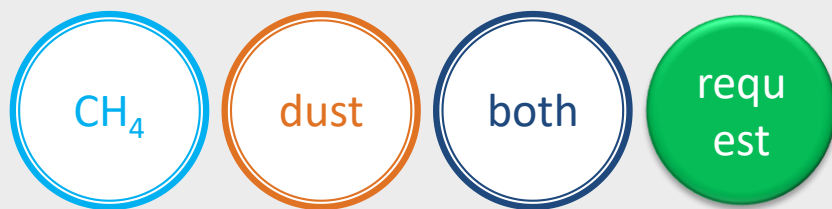


Colour codes



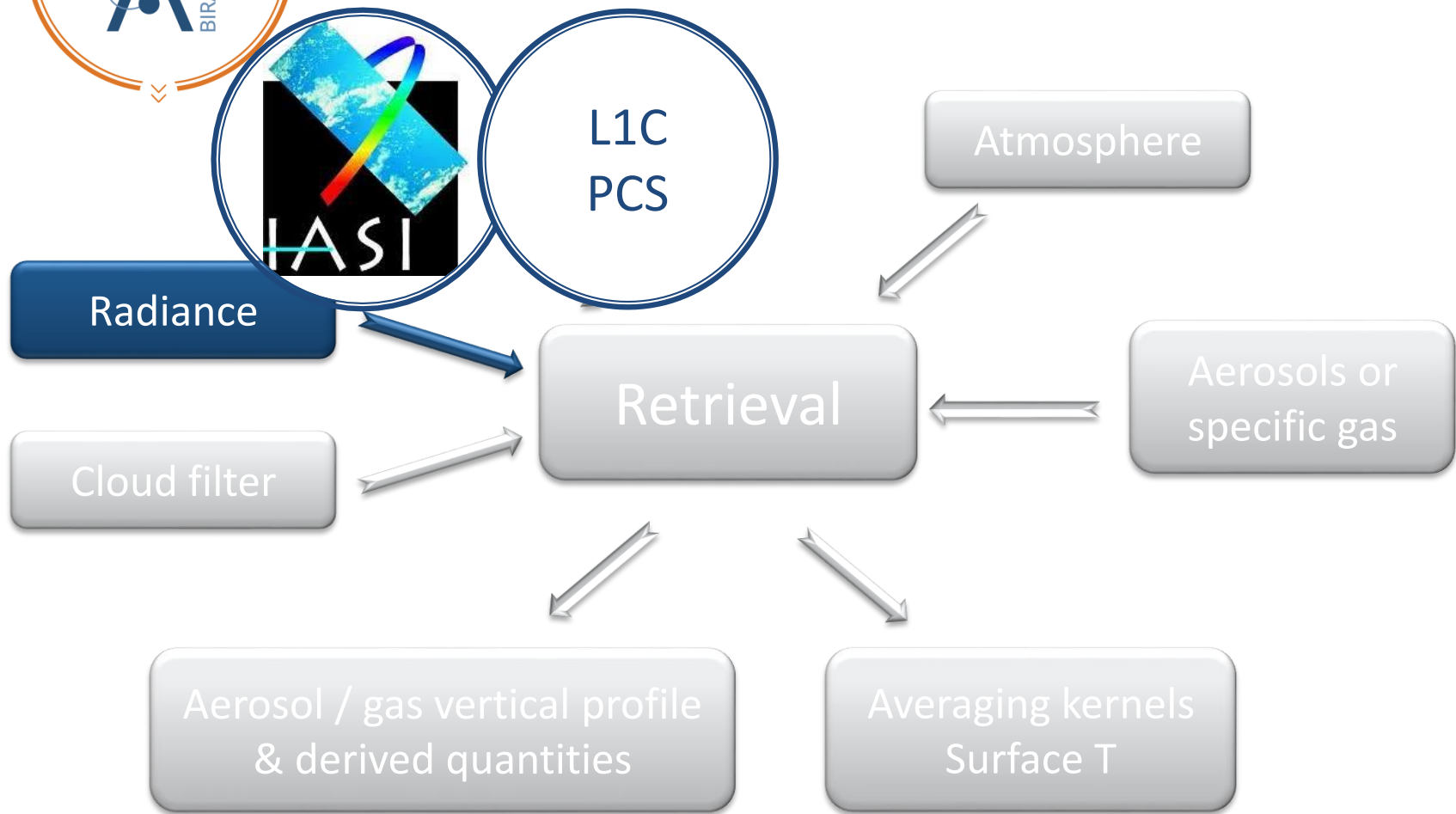
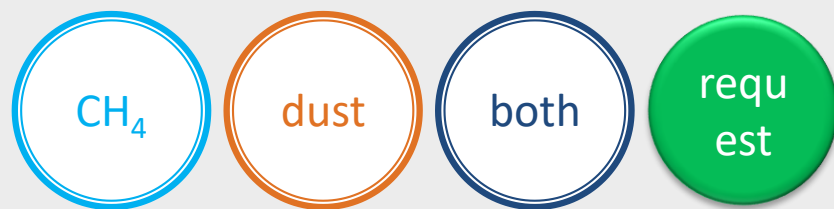


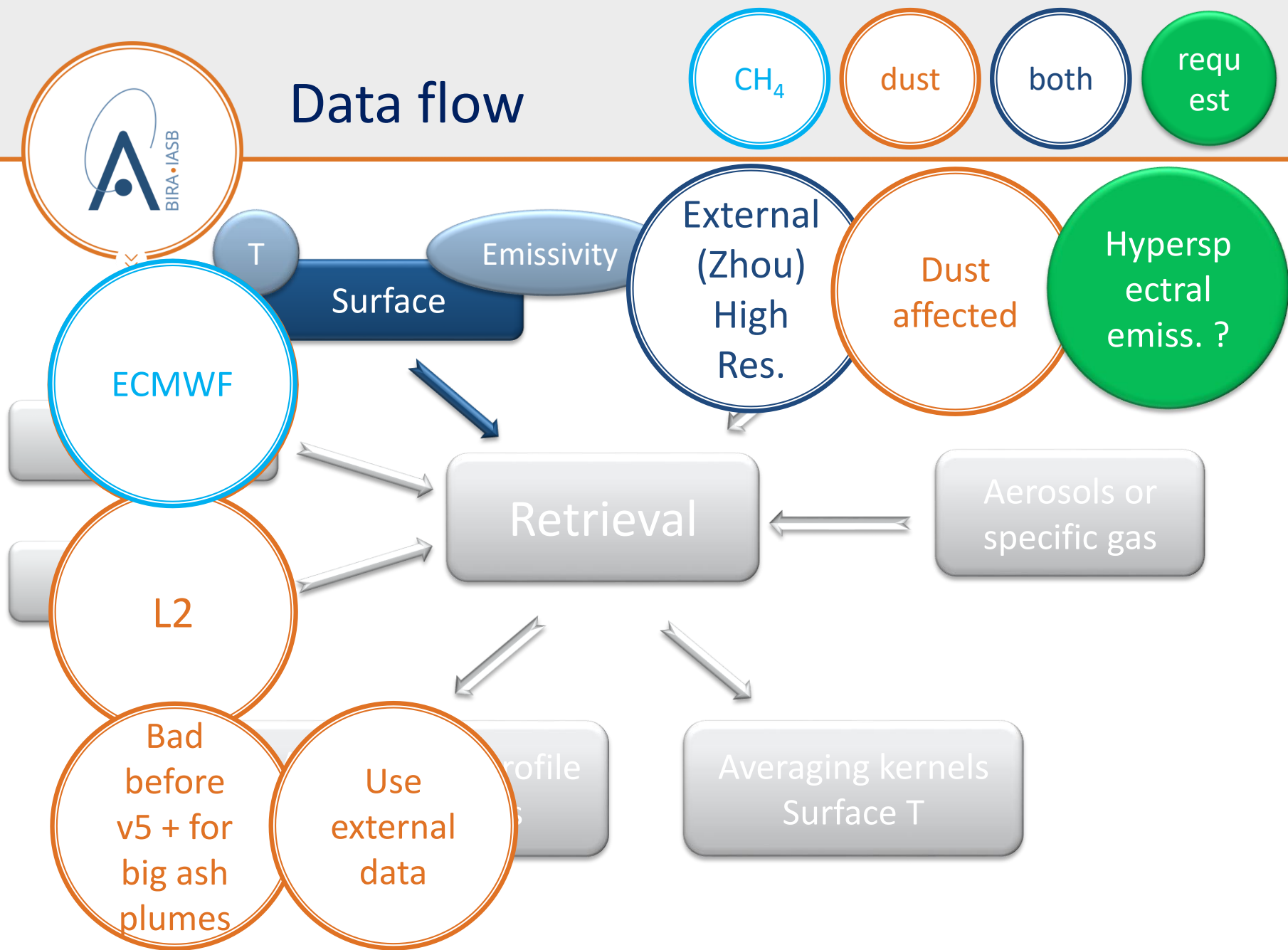
Data flow





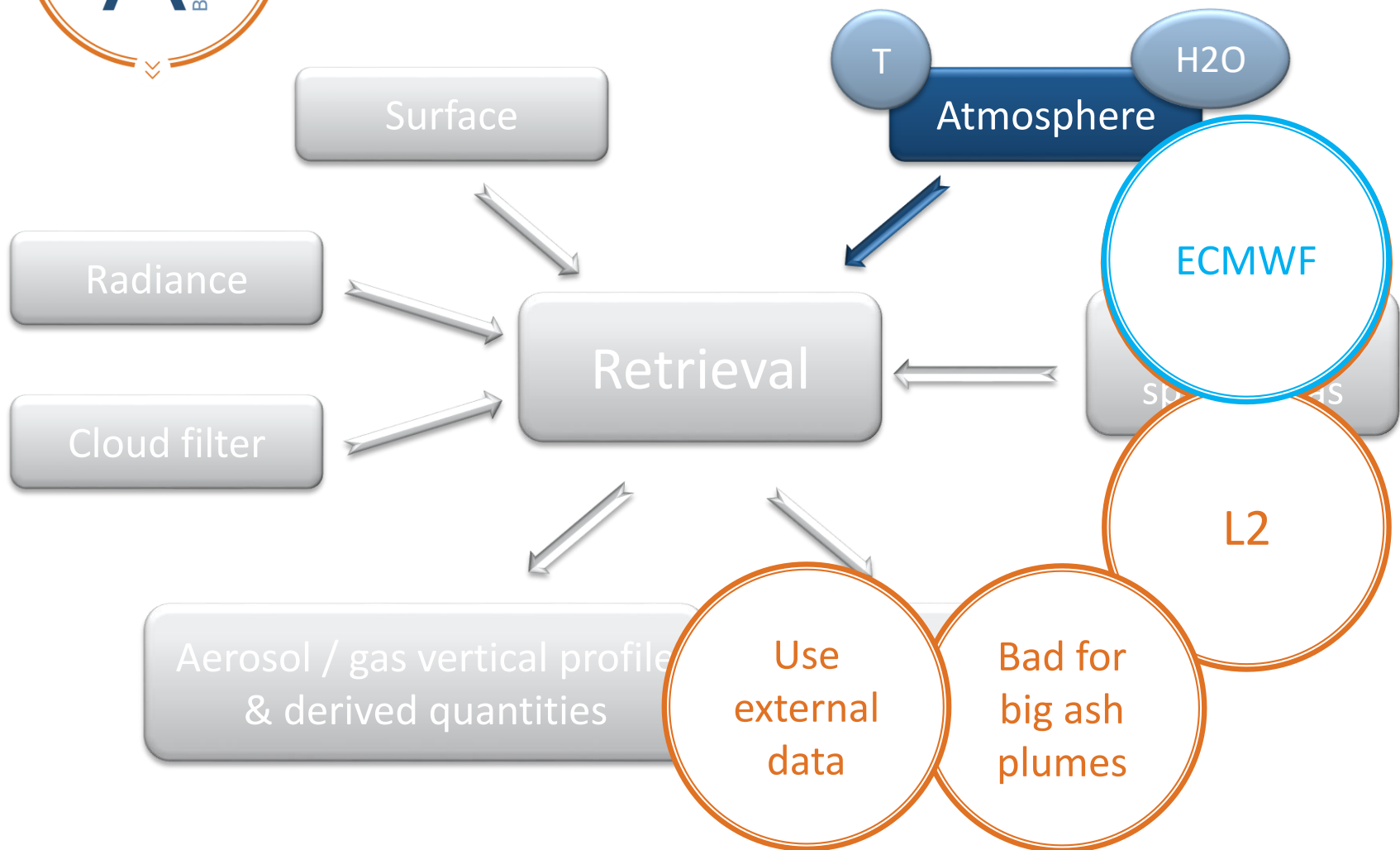
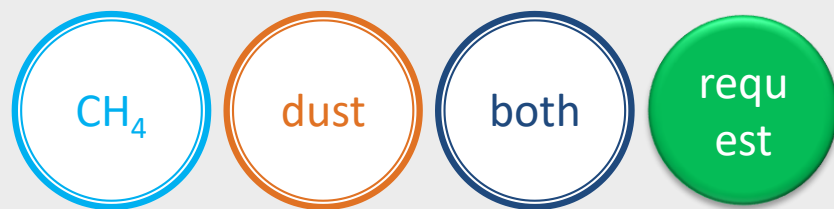
Data flow





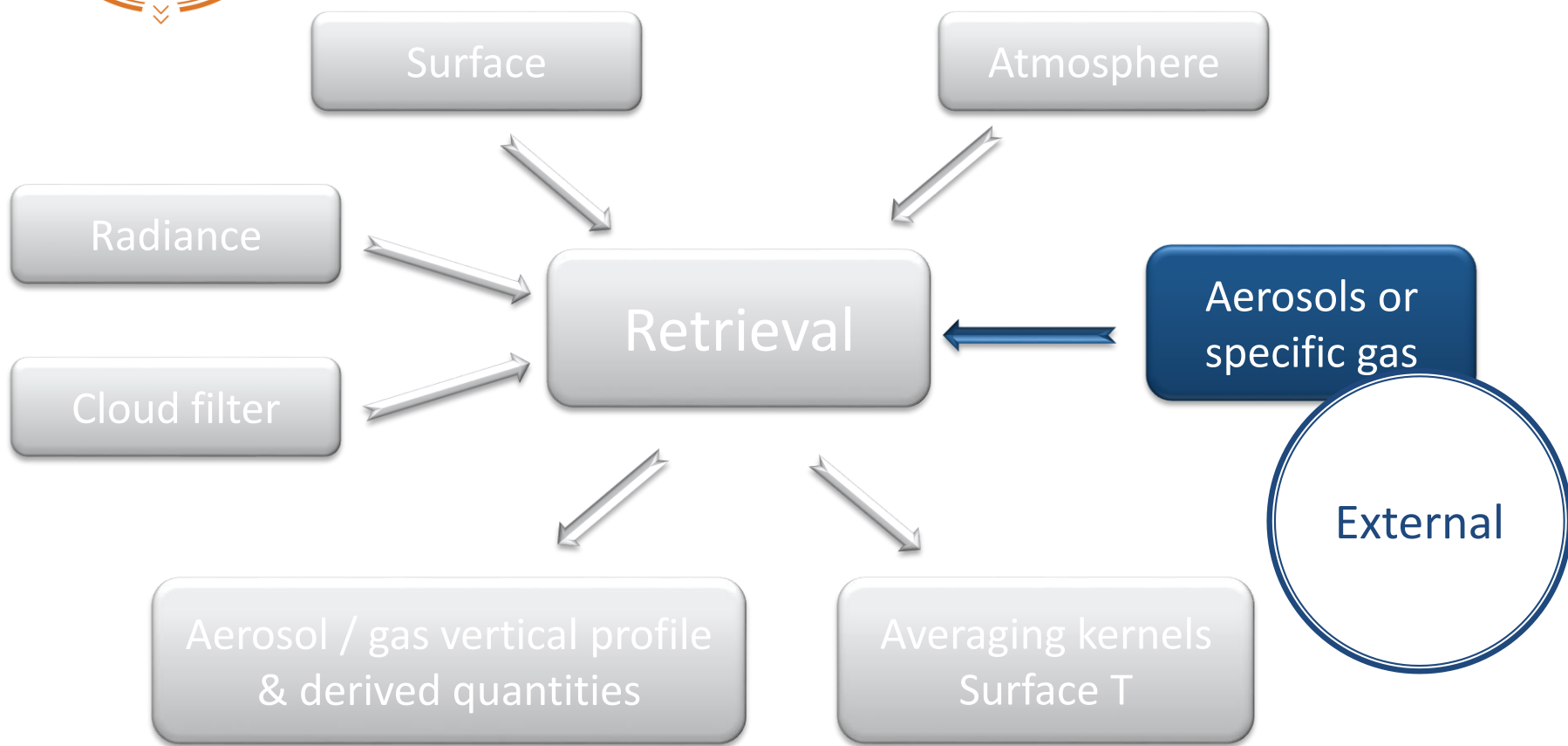
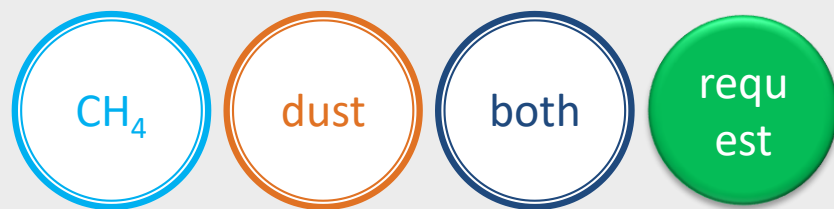


Data flow



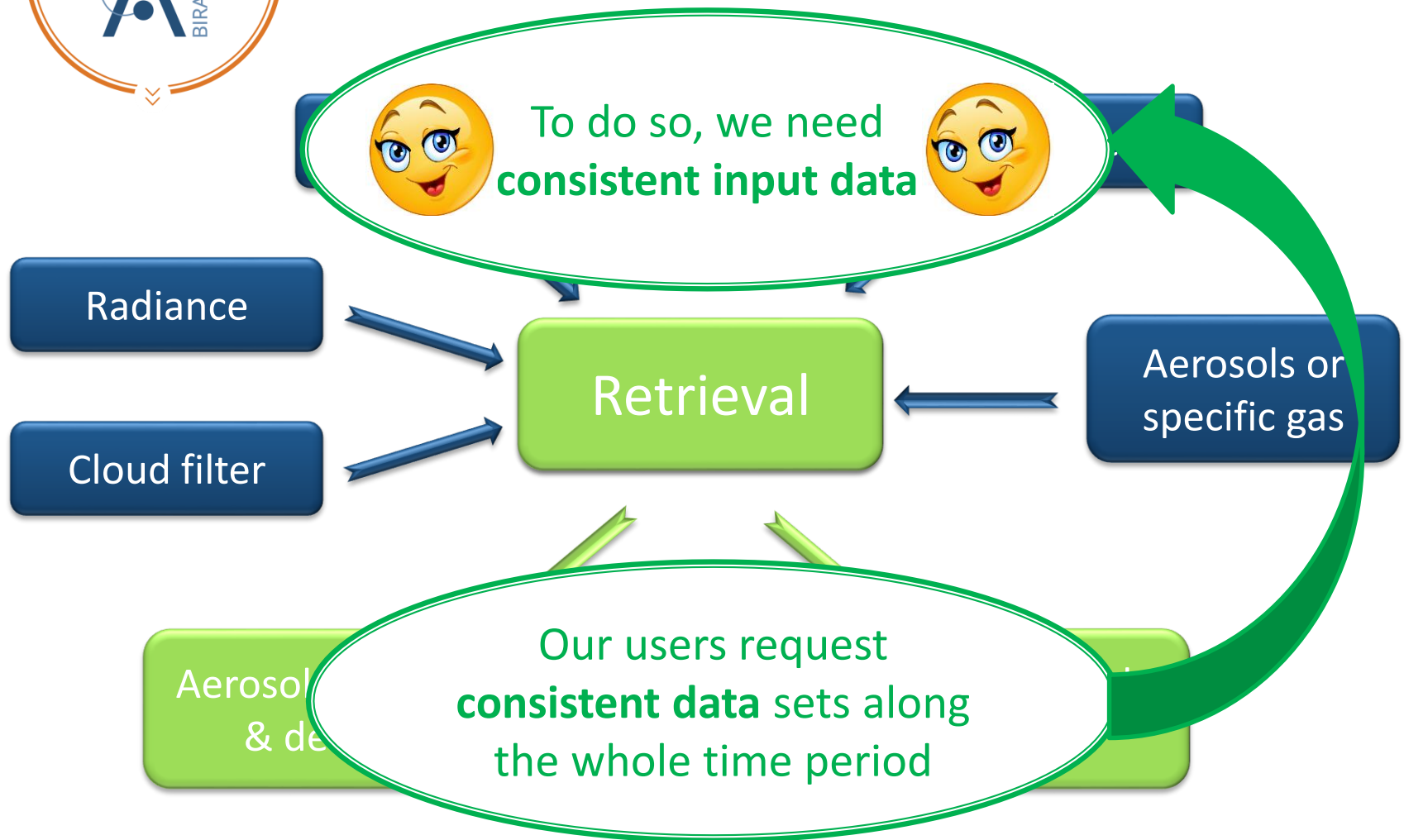


Data flow



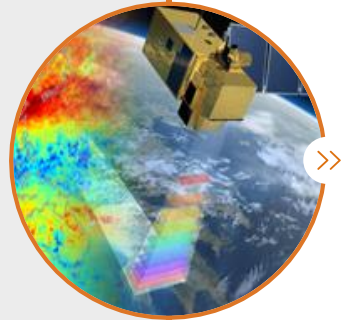


“THE” user request





Presentation plan



CH₄, dust and volcanic ash

- Us as data user
- Us as data provider



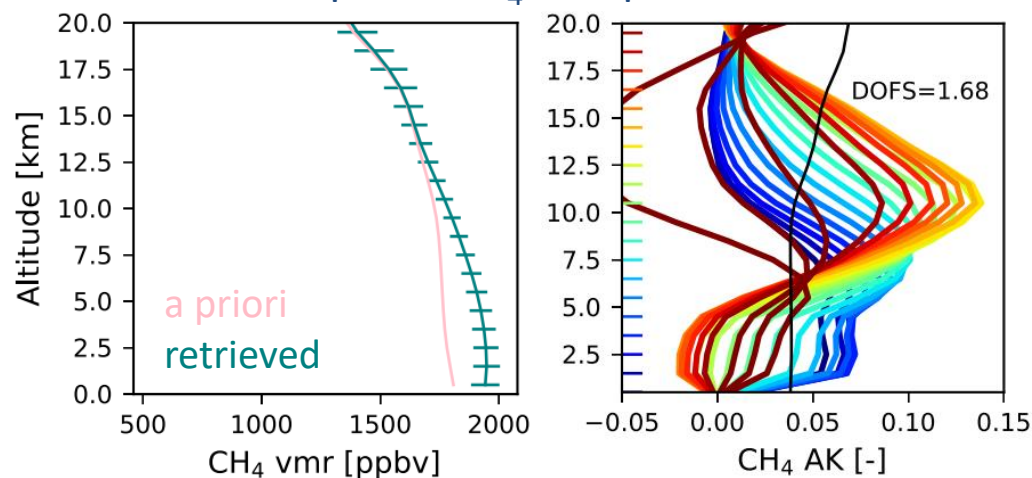
Service applications



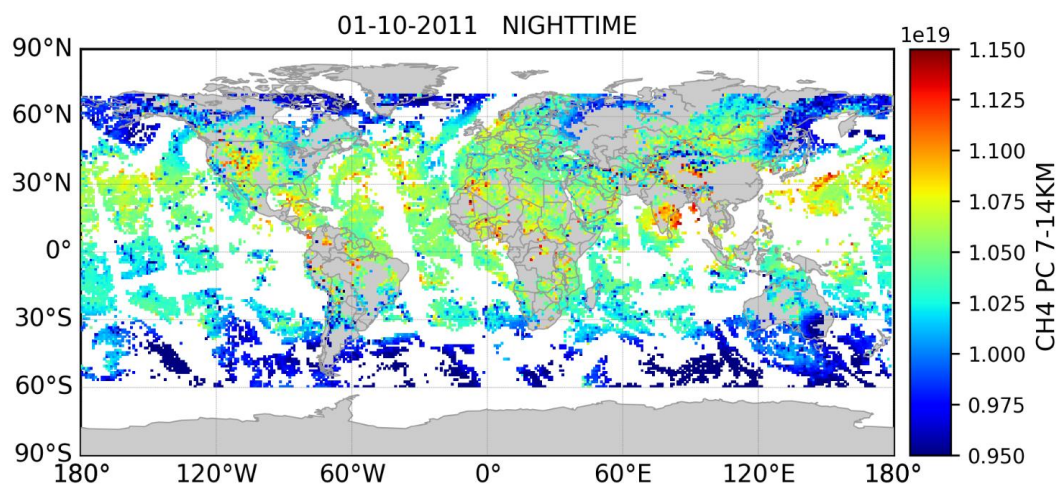
IASI CH₄ Data Product



Example of CH₄ vmr profile and AK

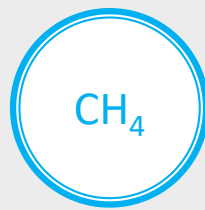


Example of IASI-A
CH₄ Partial Column
Daily map





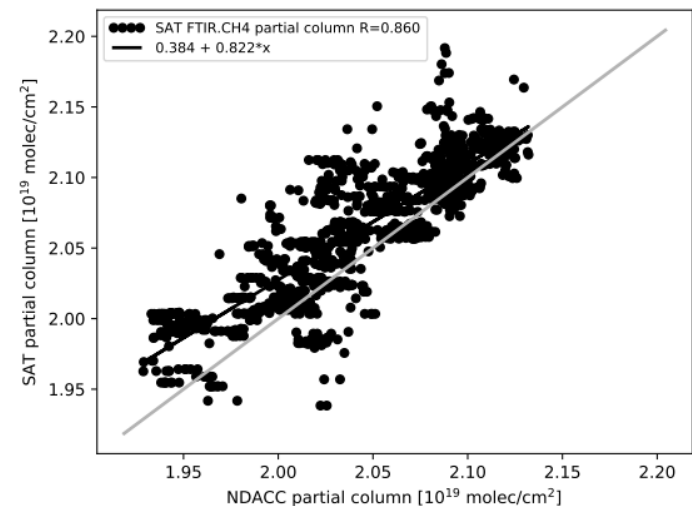
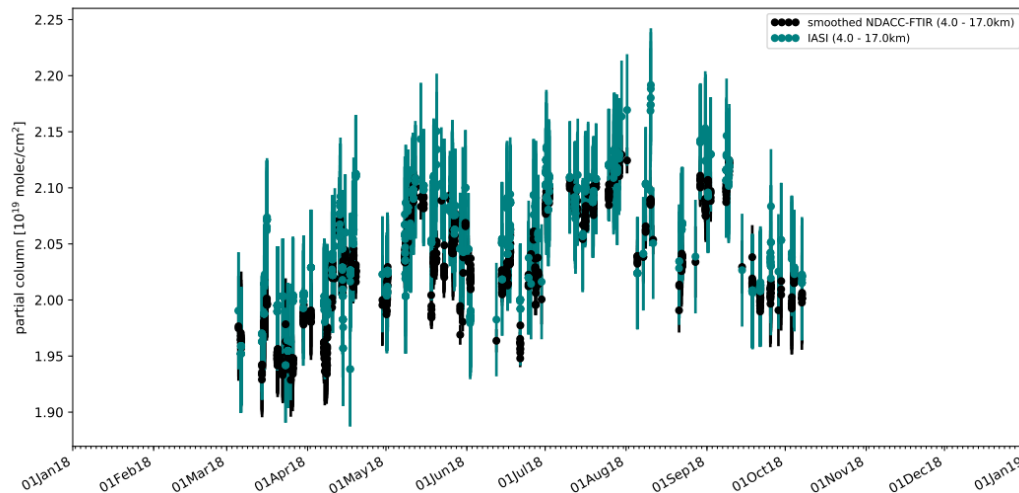
IASI CH₄ Validation



- Overall CH₄ product uncertainty (vs NDACC): ~3-4%

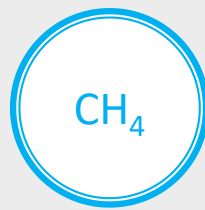
Sodankyla

SAT FTIR.CH4 partial column values (4.0 - 17.0km) SODANKYLA (lat.=67.4°),
2018-03-05 till 2018-10-07, 1204 meas. ($\mu = 1.01\%$, $1-\sigma = 1.33\%$)





CH₄ dataset

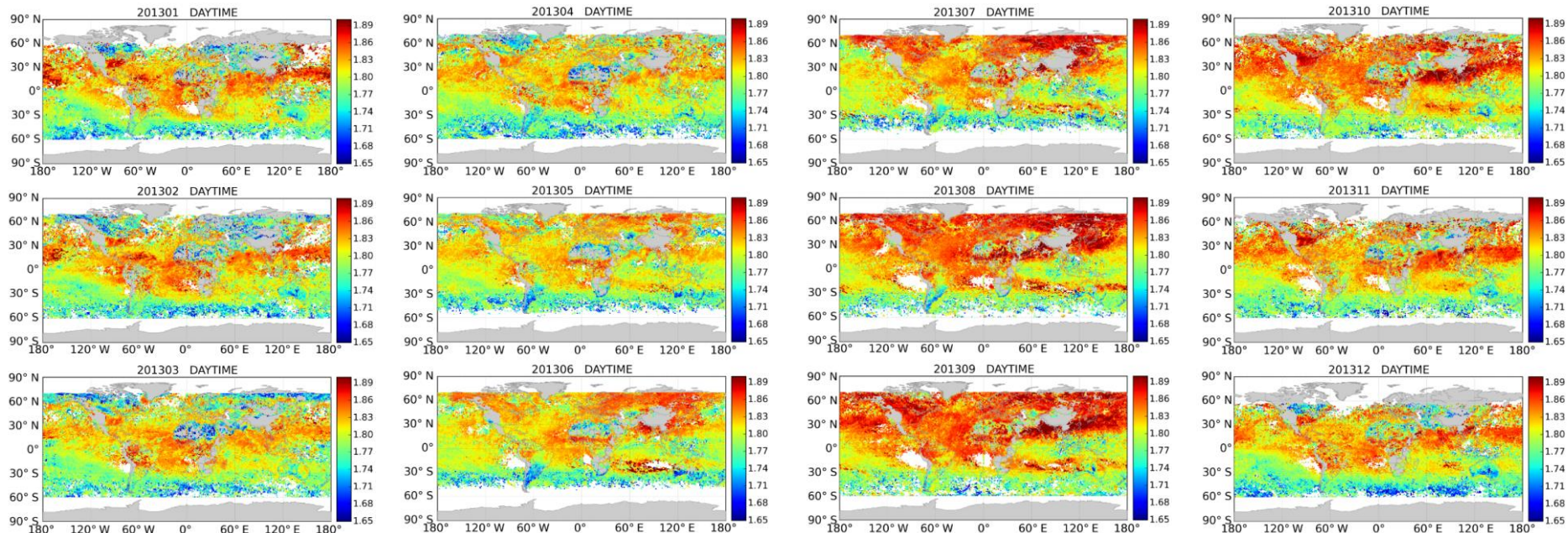


CH₄ maps

- Daily maps available on website
- 2011 – 2015 currently available

2013 Monthly maps

CH₄ vmr 4–17 km [ppm]

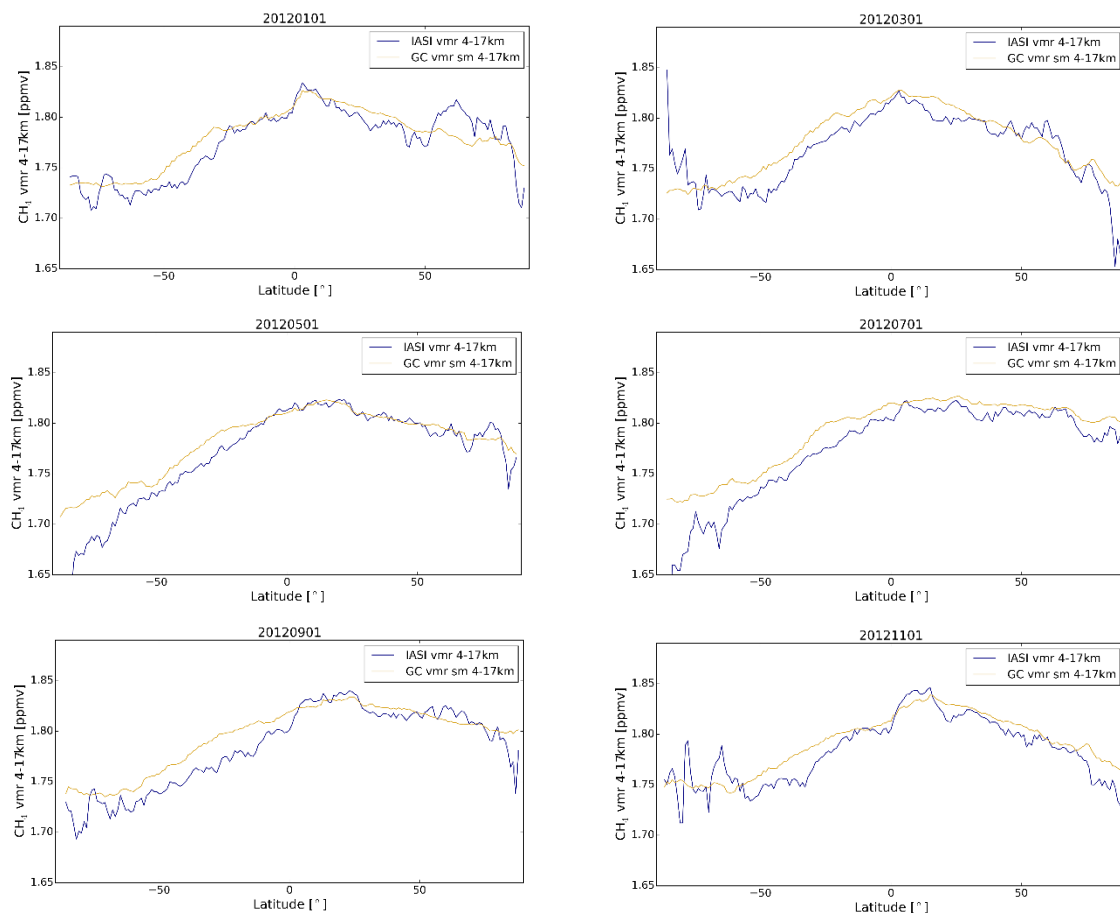




CH₄ comparison with GEOS-Chem

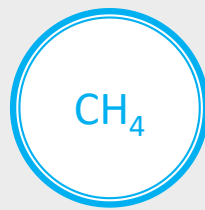


Comparison of the latitudinal variation of IASI CH₄ and smoothed GEOS-Chem (2012)



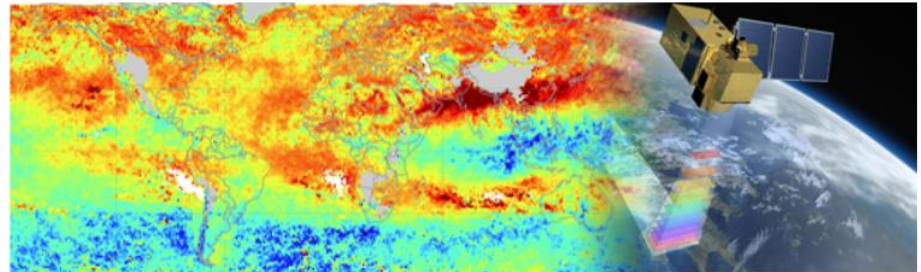


How to get the CH₄ data?



→ iasi.aeronomie.be

← → ↻ ⓘ Not secure | iasi.aeronomie.be/index.php



Main Menu

[Home](#)
[IASI](#)
[Methane](#)
[Mineral dust](#)
[Data products](#)

Data link →

Where can I find ..

Search ...

Home

This website provides an overview of the METOP/IASI methane (CH₄) and aerosols data products developed at BIRA-IASB.

The [IASI CH₄ product](#) is developed with the ASIMUT-ALVL algorithm. ASIMUT-ALVL is a radiative transfer and inversion software developed at BIRA-IASB, designed for simulating atmospheric radiances and inversions in planetary atmospheres (Vandaele et al., 2006). The ASIMUT-ALVL code has a specific interface dealing with the IASI instrument characteristics. The retrieval is based on the optimal estimation method (Rodgers, 2000). The contact person for this product is Charles Robert (charles.robert@aeronomie.be).

The [IASI aerosols product](#) includes mineral dust (from deserts) and volcanic ash aerosols. The former is produced almost operationally while the latter is currently still on a case-study basis (for example Maes et al., 2016). The product is obtained through a specific optimal estimation algorithm using RTTOV as radiative transfer (Saunders et al., 2018). The most recent reference is Callewaert et al., 2019. The contact person for this product is Sophie Vandenbussche (sophie.vandenbussche@aeronomie.be).

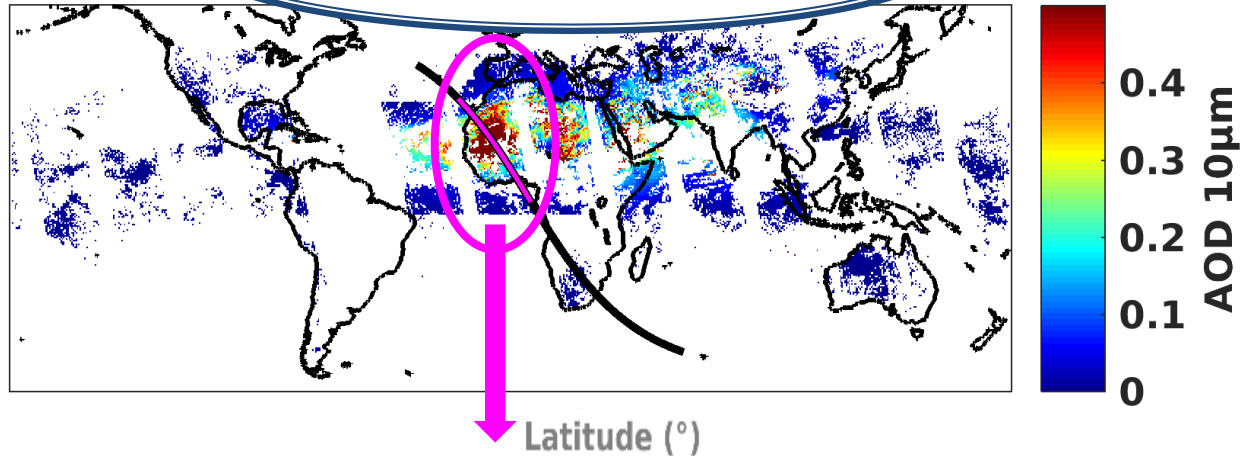


Example of dust retrievals

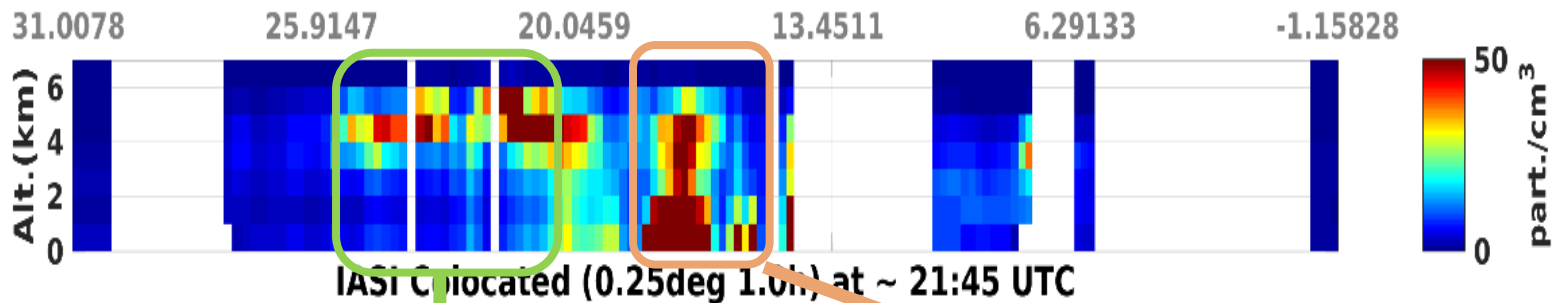


19 June 2015

10 μ m dust AOD



Latitude (°)



IASI Cross-section (0.25deg 1.0h) at ~ 21:45 UTC

Large emission event

Mostly transported dust, with a probable small emission at the east

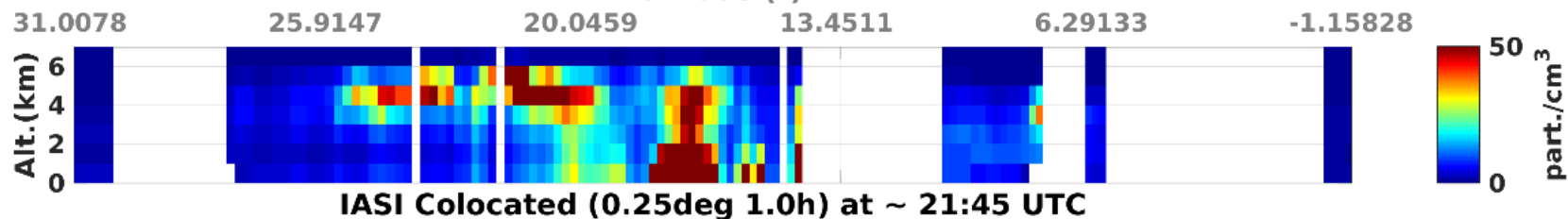
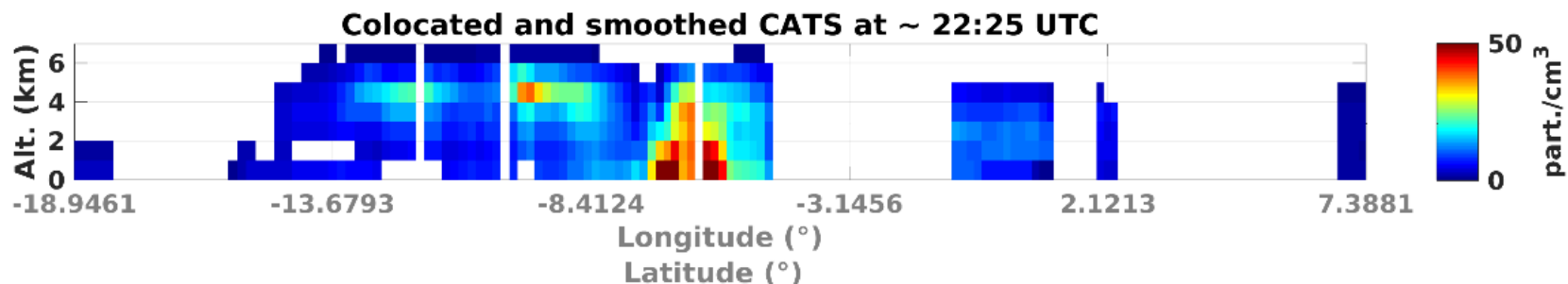
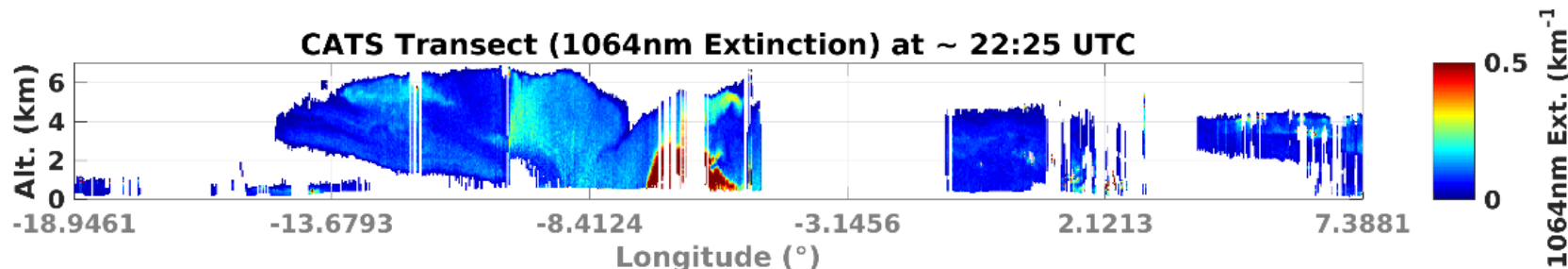
Every 1 km



Example of dust retrievals



19 June 2015

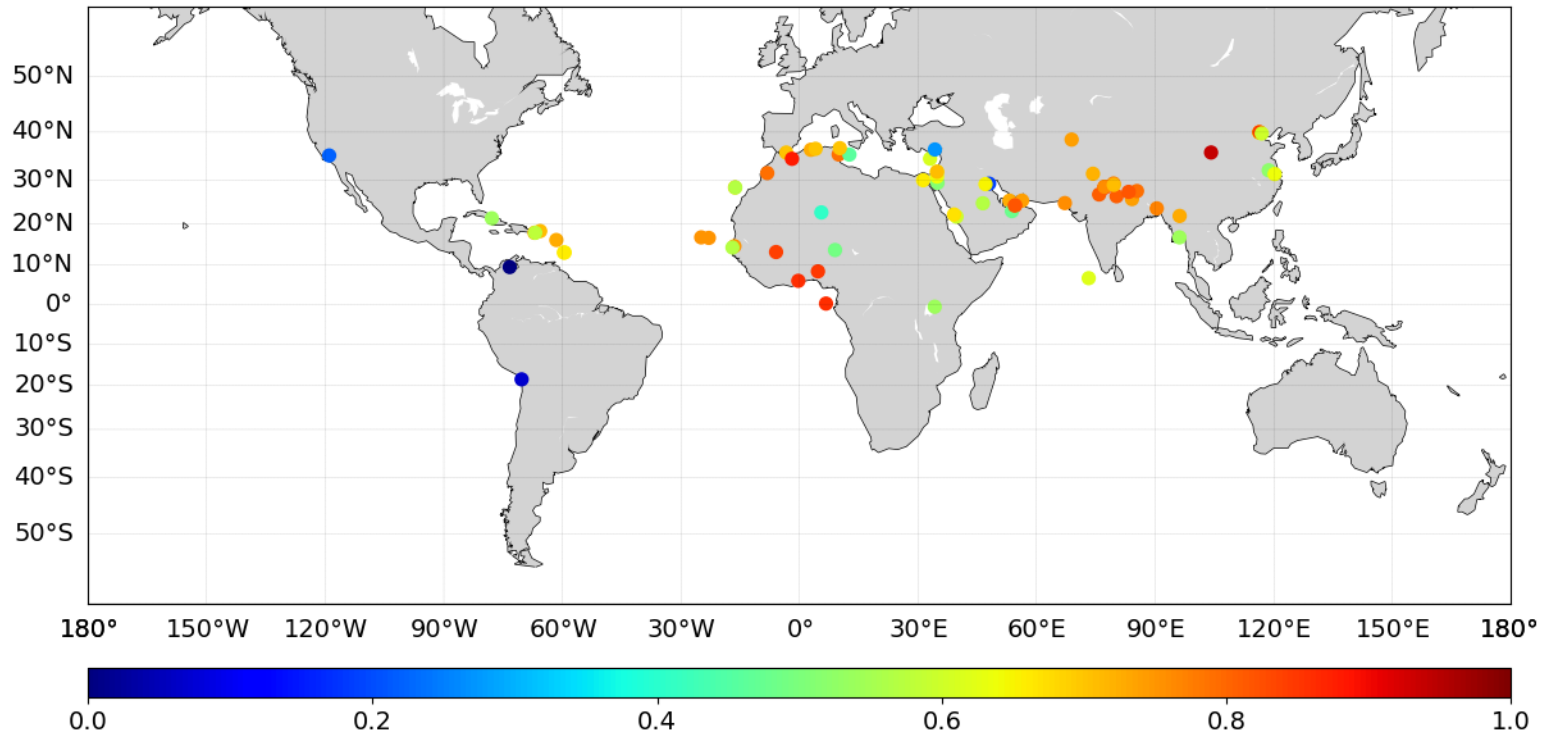




Quality control

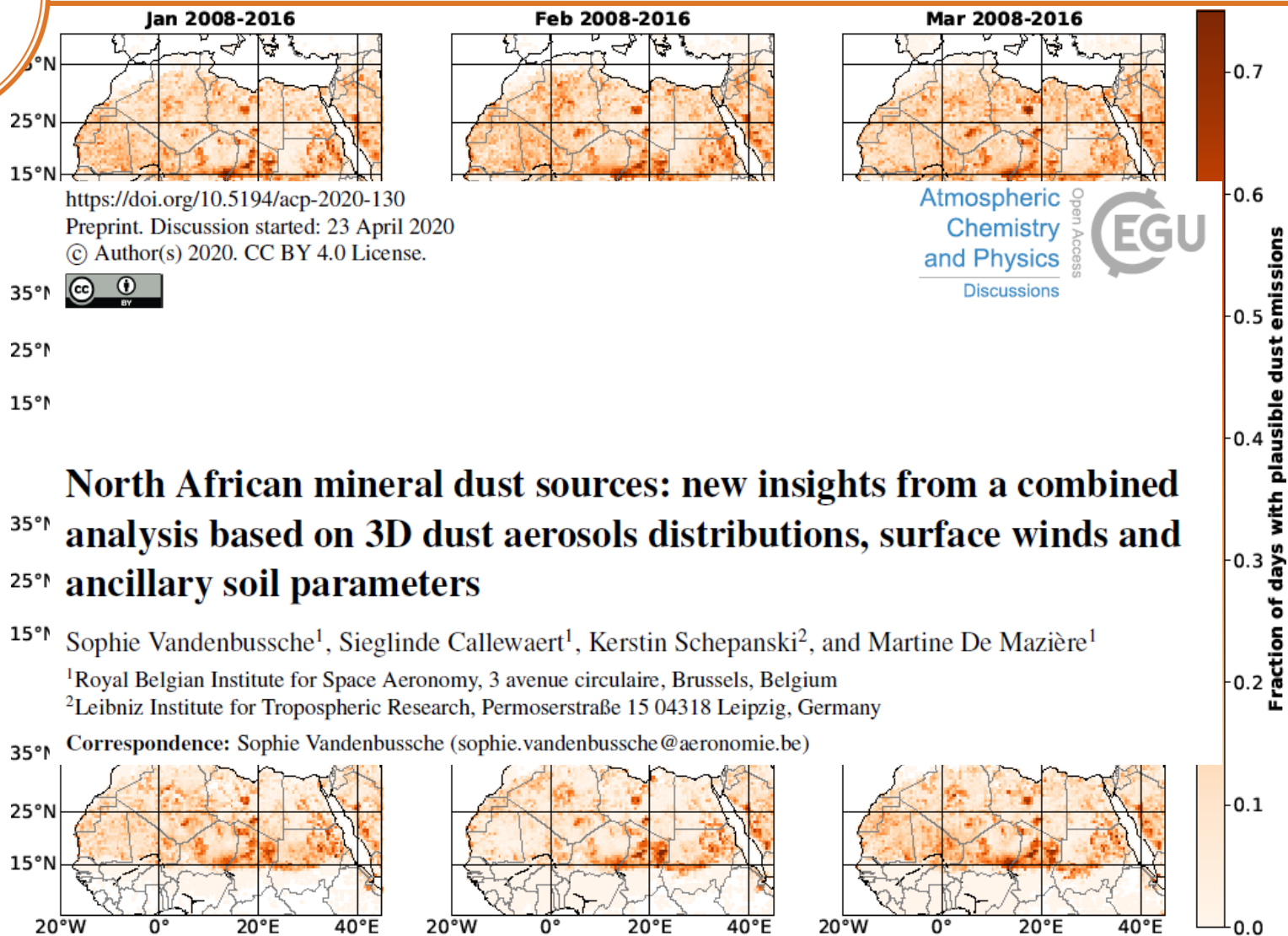
dust

Pearson correlation coefficient between AERONET SDA coarse mode AOD and MAPIR AOD at 550 nm



Example application of dust 3D

dust



North African mineral dust sources: new insights from a combined analysis based on 3D dust aerosols distributions, surface winds and ancillary soil parameters

Sophie Vandenbussche¹, Sieglinde Callewaert¹, Kerstin Schepanski², and Martine De Mazière¹

¹Royal Belgian Institute for Space Aeronomy, 3 avenue circulaire, Brussels, Belgium

²Leibniz Institute for Tropospheric Research, Permoserstraße 15 04318 Leipzig, Germany

Correspondence: Sophie Vandenbussche (sophie.vandenbussche@aeronomie.be)



How to get the dust data?

Dust AOD and mean altitude level 3 data

Welcome to the Climate Data Store

Dive into this wealth of information about the Earth's past, present and future climate.

It is freely available and functions as a one-stop shop to explore climate data. [Register for free](#) to obtain access to the CDS and its Toolbox.

We are constantly improving the services and adding new datasets. For more information, please consult the [catalogue](#), our [FAQ](#) or the [C3S forum](#).

Enter search term(s)

aerosol

All



Search



Aerosol properties gridded data from 1

mode aerosol optical depth, **dust** aerosol optical depth, single scat

Overview

Download data

Documentation



How to get the dust data?

Dust AOD and mean altitude level 3 data

Algorithm ?

At least one selection must be made

- ☐ ADV (AATSR dual view)
- ☐ GRASP (General Retrieval of Aerosol and Surface Properties)
- ☐ ORAC (Optimal Retrieval of Aerosols and Clouds)
- ☐ SDV (SLSTR dual view)
- ☐ SWANSEA (Swansea University)
- ☐ S4M (SeaWiFS algorithm for MERIS sensor)
- ☐ ULB (Universite Libre de Bruxelles)
- Our data → ☐ MAPIR (Mineral Aerosol Profiling from thermal Infrared Radiances)
- ☐ AERGOM (Algorithm for stratospheric Aerosol extinction retrieval from GOMOS observations)
- ☐ XBAER (Extensible Bremen Aerosol Retrieval)
- ☐ S4O (SeaWiFS algorithm for OLCI sensor)
- ☐ IMARS (Infrared Mineral Aerosol Retrieval Scheme)
- ☒ LMD (Laboratoire de Météorologie Dynamique)
- ☐ ENS (Product based on an ensemble of algorithms)



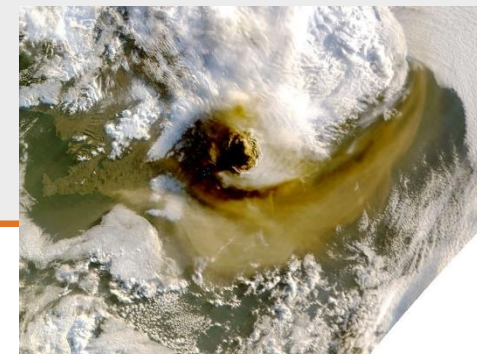
How to get the dust data?

Dust AOD and mean altitude level 3 data

All other: upon request



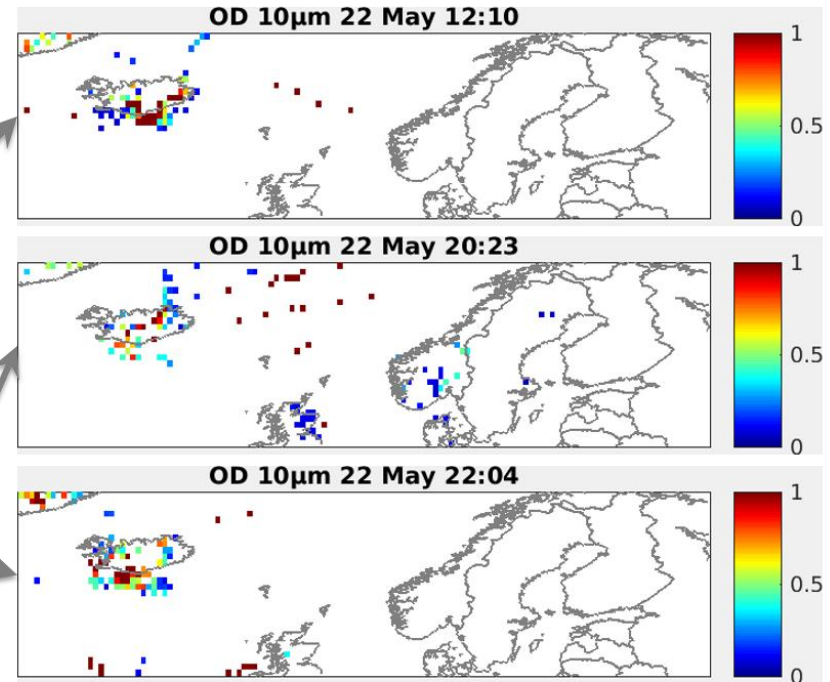
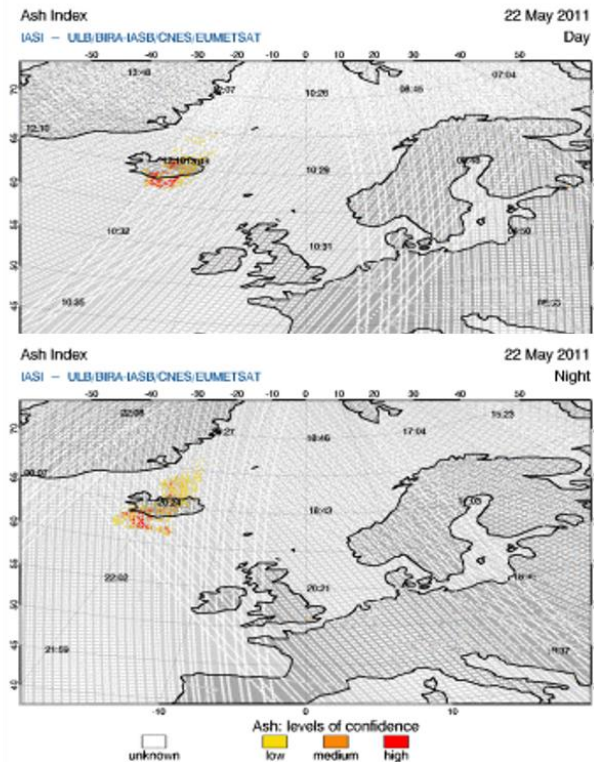
Example of ash retrievals



Grimsvotn (Iceland) 22 May 2011

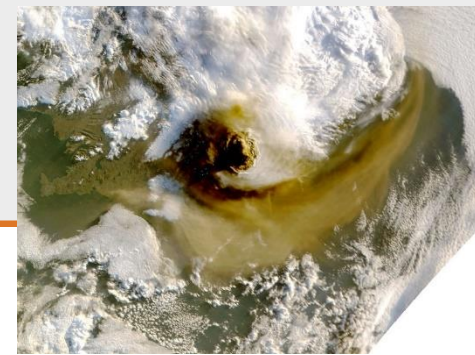
SACS / IASI ash index

MAPIR 10 μ m AOD

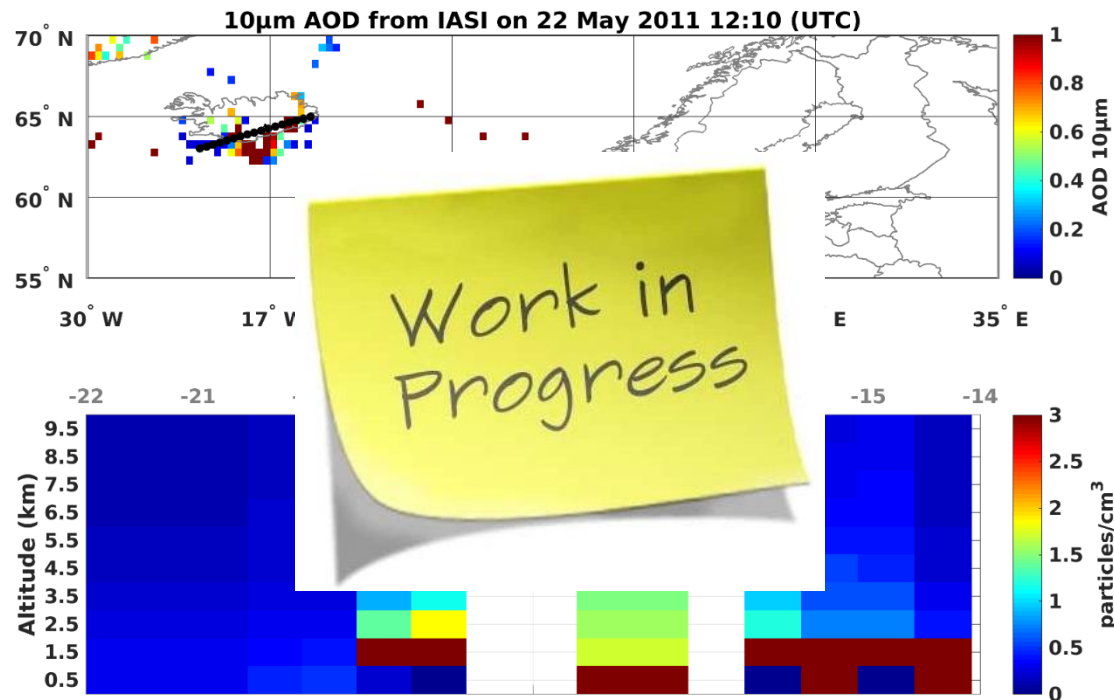




Example of ash retrievals

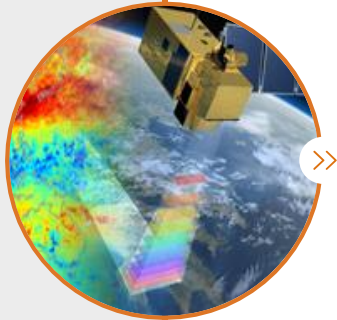


22 May 2011 12h



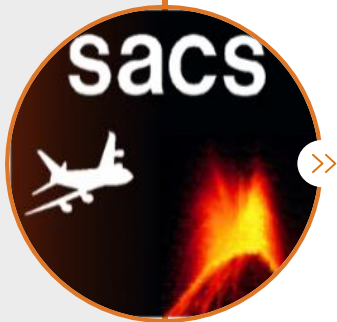


Presentation plan



CH₄, dust and volcanic ash

- Us as data user
- Us as data provider



Service applications

Early Warning System of volcanic emissions



Support to Aviation Control Service (**SACS**): Early Warning System (**EWS**) of natural airborne hazard



<http://sacs.aeronomie.be>

EWS aimed at **ATM** and **key users**



NRT images



Email notifications



Data files transfer

**260
users!**

SACS / SACS+ / SACS2
2006 – 2014



www.eunadics.eu



2016/09 – 2019/09



OPAS
2019/07 – 2020/07





SACS portal

<http://sacs.aeronomie.be>



SACS home > Nrt > near real-time

NEAR REAL-TIME

NOTIFICATIONS

PRODUCTS

info latest SO₂ notification info latest ASH notification
subscription SACS notif.

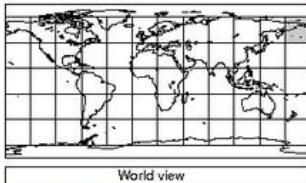
obs. of SO₂ SO₂ height Ash / AAI Cloud

Instruments
UV-Vis GOME 2 OMI OMPs TROPOMI
InfraRed IASI [A] IASI [B] AIRS

Time of observations

< day >
< month > 23 June 2019 < day >
< year > month > year >

today 2019 Jun 23 NRT



World view

Either click on a region in the map to submit or select a region from the list-menu and click 'submit'

submit

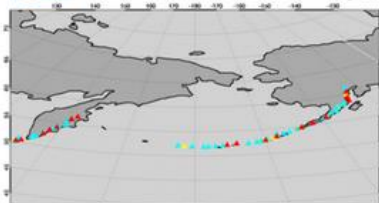
112 == 180.0 60.0

(region defined by the centre longitude and latitude)

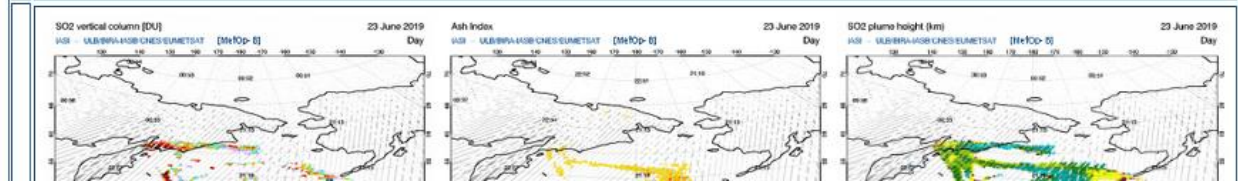
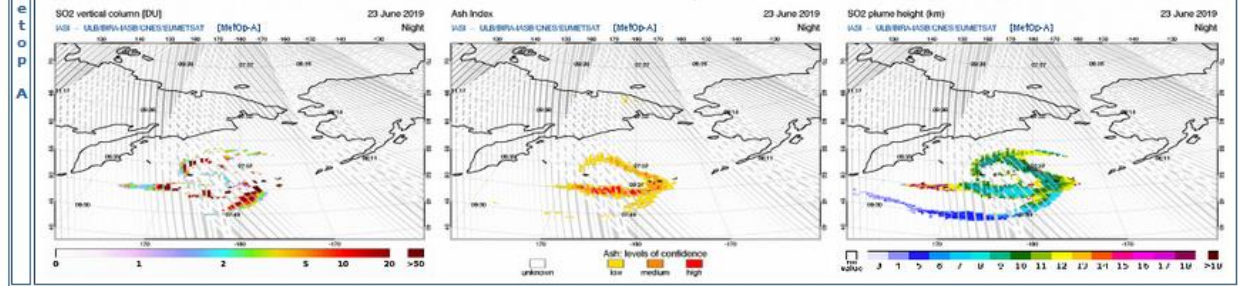
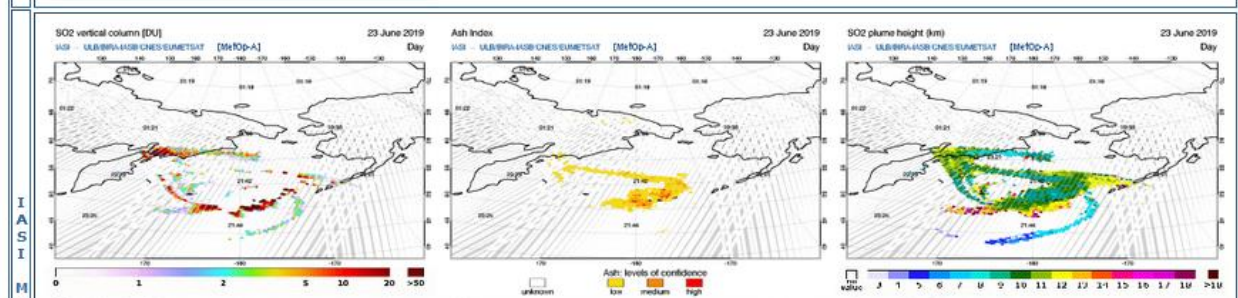
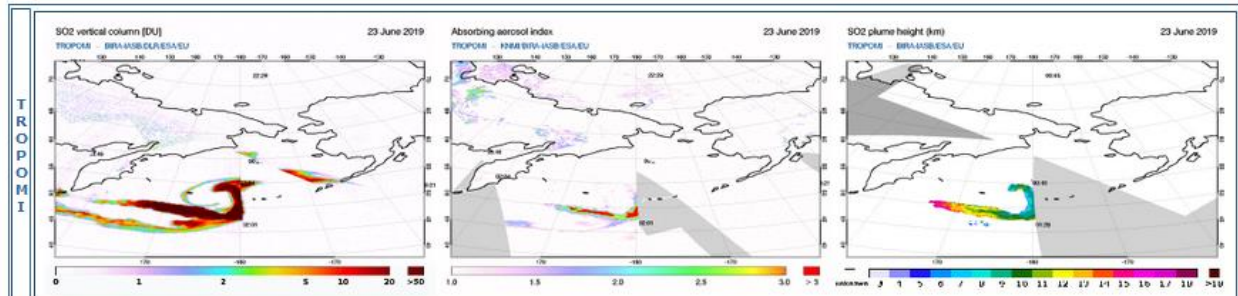


VOLCANOES in this region

Location of volcanoes
BIRA-IASB/ESA



Volcanoes with last known eruption after 1800 Submarine volcanoes



Piton de la Fournaise: 6 April 2020



SO₂ vertical column [DU]

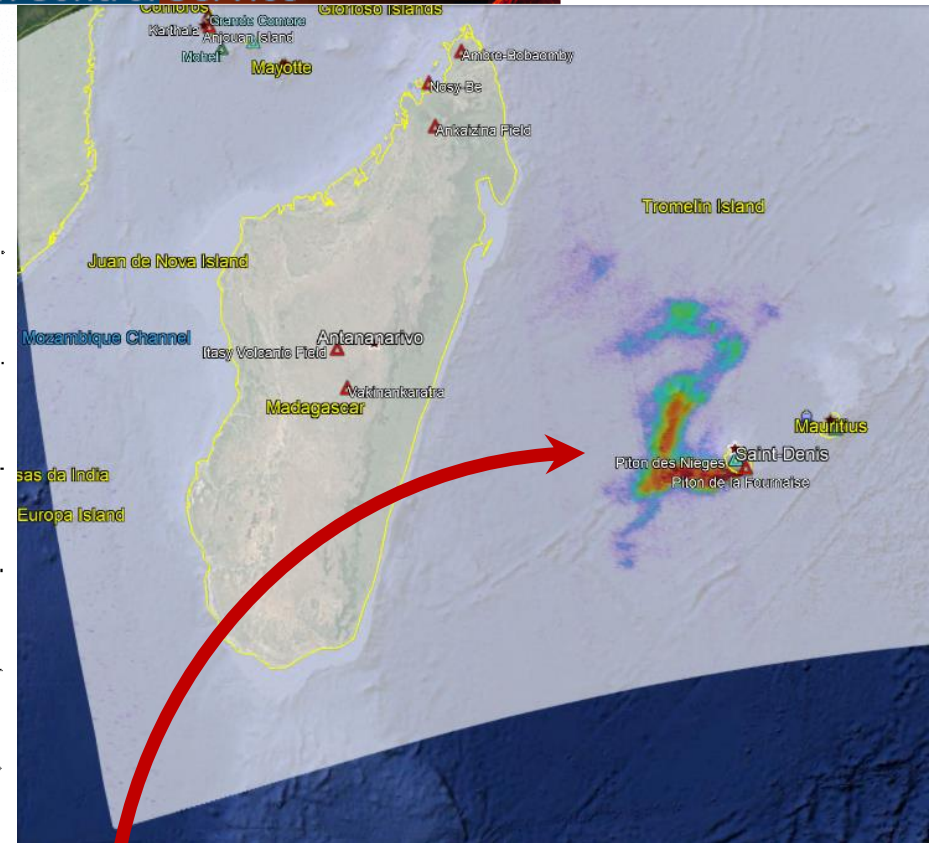
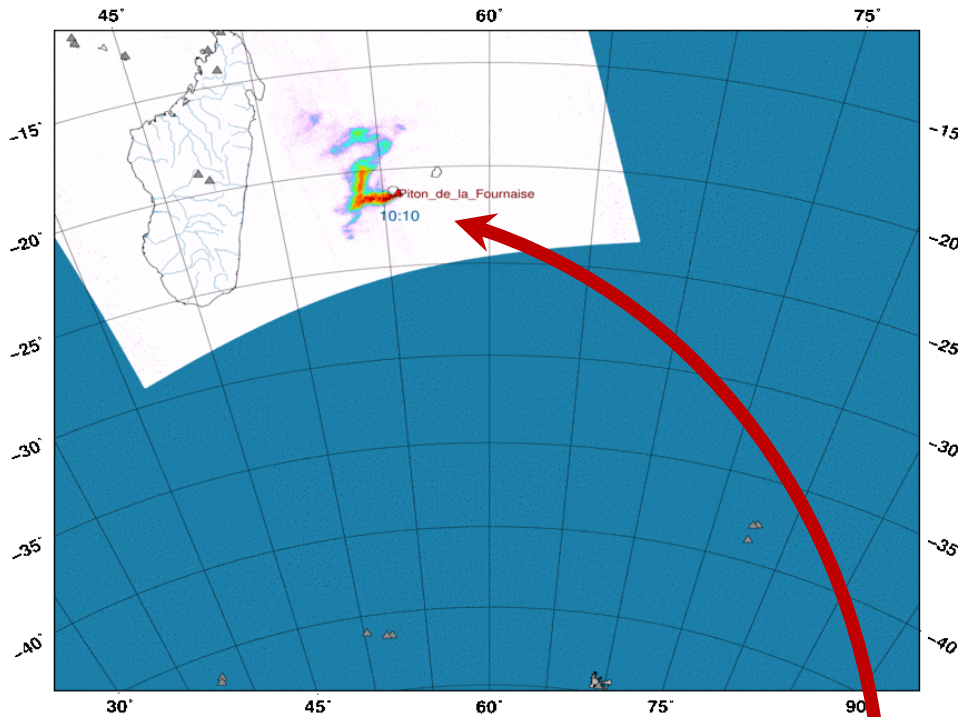
TROPOMI - BIRA-IASB/DLR/ESA/EU

Notification level: HIGH
 SO₂ mass loading: 10.742 kt
 SO₂ plume area: 464393 km²
 max SO₂: 36.2 DU (-21.3°N, 55.7°E)

06 April 2020

SACS

Name data source: S5P_NRTI_L2_SO2_20200406T100946_20200406T101448_12854_01_010108_20200406T105737.nc



links: [NCAP SO₂](#)

























other plots: [SO₂ alert](#)

[google Earth SO₂](#)

[google Earth AAI](#)

[google Earth CCF](#)

NetCDF Alert Products (NCAP)

Platform <small>Satellite / Ground-based / In-situ</small>	Instrument	Observation	Type of detection	Source alert	Time delivery / Time resolution	Notification
Sat.: MetOp-A & -B	IASI	SO ₂ / SO ₂ height / Ash index	Selective	Volcano	2h / 2 (20) per day	 
Sat.: Aqua	AIRS	SO ₂ / Ash index	Selective	Volcano	3h / 2 (20) per day	 
Sat.: MetOp-A & -B	GOME-2	SO ₂	Selective	Volcano	2h / 1 (10) per day	 
Sat.: Aura	OMI	SO ₂	Selective	Volcano	3h / 1 (10) per day	 
Sat.: Suomi-NPP	OMPS	SO ₂	Selective	Volcano	3h / 1 (10) per day	 
Sat.: Sentinel 5p	TROPOMI	SO ₂	Selective	Volcano	2h / 1 (10) per day	 
Sat.: Sentinel 3-A & -B	SLSTR	Aerosol index / Aerosol height	Selective	Volcano & Dust & Smoke	2h / 1 (10) per day	
Sat.: MSG-10	SEVIRI <i>(geostationary)</i>	Ash / Ash height <i>(over EU only)</i>	Selective	Volcano	45min / every 15min	
Sat.: MetOp-A & -B & -C	IASI	Aerosol optical depth	Selective	Dust	24h / 6 (30) per day	
Sat.: Terra & Aqua Sat.: Suomi-NPP	MODIS VIIRS	Fire radiative power (NASA/FIRMS)	Selective	Smoke	3h / 4 (40) per day	
Sat.: Suomi-NPP	OMPS	Aerosol index	Triggered	Dust & Smoke	3h / 1 (10) per day	 
Sat.: Terra & Aqua	MODIS	Aerosol optical depth	Triggered	Smoke	3h / 1 (10) per day	
GB: EARLINET	Network Lidar	Vol. depolarisation ratio	Selective / Link quicklook	Volcano & Dust	1h / every 1min	
GB: E-PROFILE	Network auto. Lidar & Ceilo.	Wind prof. / Att. backs. coeff.	Link quicklook	Volcano & Dust & Smoke	15min / every 1min	
GB: Iceland	Weather Radar	Reflectivity / height plume	Link quicklook	Volcano	1h / every 5min	 
In-situ: VONA (IMO, INGV)	Sismo. / Camera / others	Message (obs.)	Selective	Volcano	Few minute / crisis	
In-situ: EURDEP	Network sensors	Gamma radiation	Selective	Nuclear	15min / every 1min	



NRT images



Email notifications

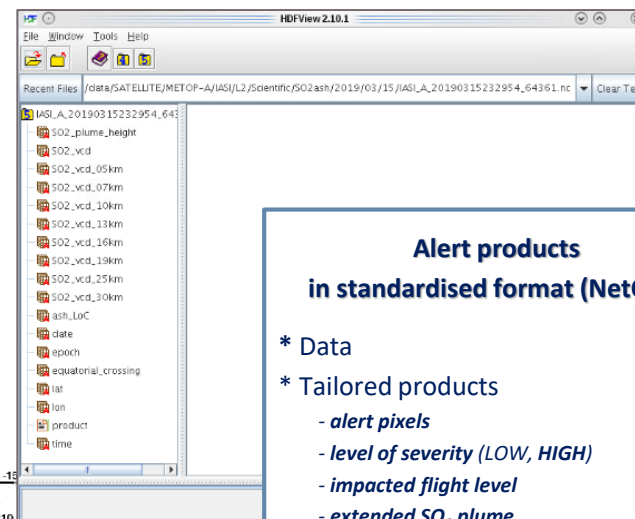
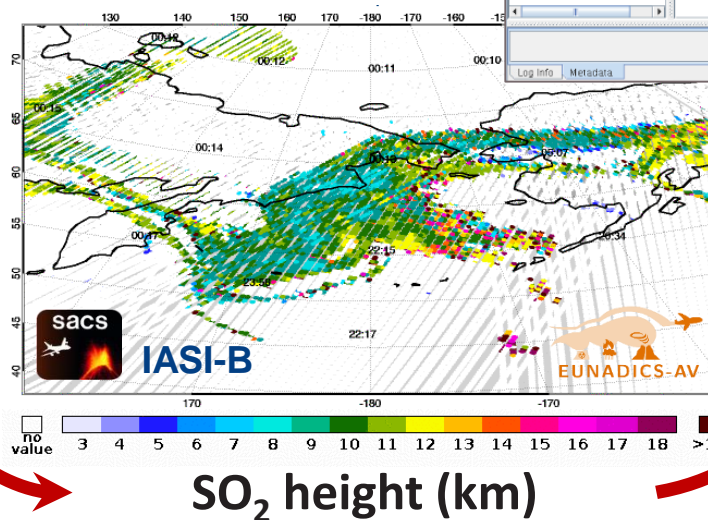


Data files transfer

off-line or restricted access

NetCDF Alert Products (NCAP)

Raikoke eruption in June 2019



Alert products in standardised format (NetCDF)

- * Data
- * Tailored products
 - alert pixels
 - level of severity (LOW, HIGH)
 - impacted flight level
 - extended SO₂ plume
 - surface and mass loading
 - gridded data
 - contours (surface, mean, max, mass)
 - info. source, region, max values
 - traceability of event (START → END)
 - links images and email notification
 - links images other instruments

Transfer to users / SWIM





SACS alert product

Work in Progress

→ provide NRT alert products
from our EWS to SDS-WAS



inDust

International Network to Encourage the Use of
Monitoring and Forecasting Dust Products
COST Action CA16202
Period: 14 Nov 2017 – 14 Nov 2021



User requests for aviation services

**Aerosol
plume height**

Aerosol mass

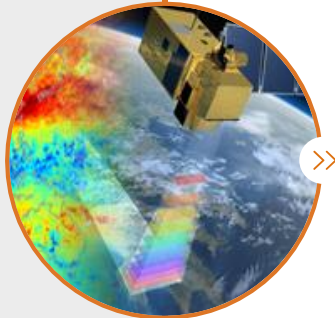
**Aerosol
selectivity
(TIR)**

NRT

**SEVIRI ash in
NRT**

**Synergistic
SEVIRI - IASI**

Where to find ...



iasi.aeronomie.be

Contact: charles.robert@aeronomie.be



In the Climate Data Store: L3 dust AOD and mean altitude with 2 to 8 months delay

Upon request: dust L2 full profiles and averaging kernels, volcanic ash studies on a case-by-case

In the future: maybe via EUMETSAT in NRT...

Contact: sophie.vandenbussche@aeronomie.be



sacs.aeronomie.be

Contact: hugues.brenot@aeronomie.be



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charles.robert@aeronomie.be
hugues.brenot@aeronomie.be