

The Operational Cloud Products for Sentinel-5 Precursor and Sentinel-4 and comparisons with GEMS

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EGU General Assembly 2022
virtual, 27 May 2022
Session AS3.24
EGU22-9384

Wissen für Morgen



Sentinel-5 Precursor and Sentinel-4

Sentinel-5 Precursor



Orbit

sun-synchronous polar / geostationary

Temporal resolution and coverage

daily global / hourly Europe

Instrument name

TROPOMI / UVN

Spatial resolution

$3.5 \times 5.5 \text{ km}^2$ / $8 \times 8 \text{ km}^2$

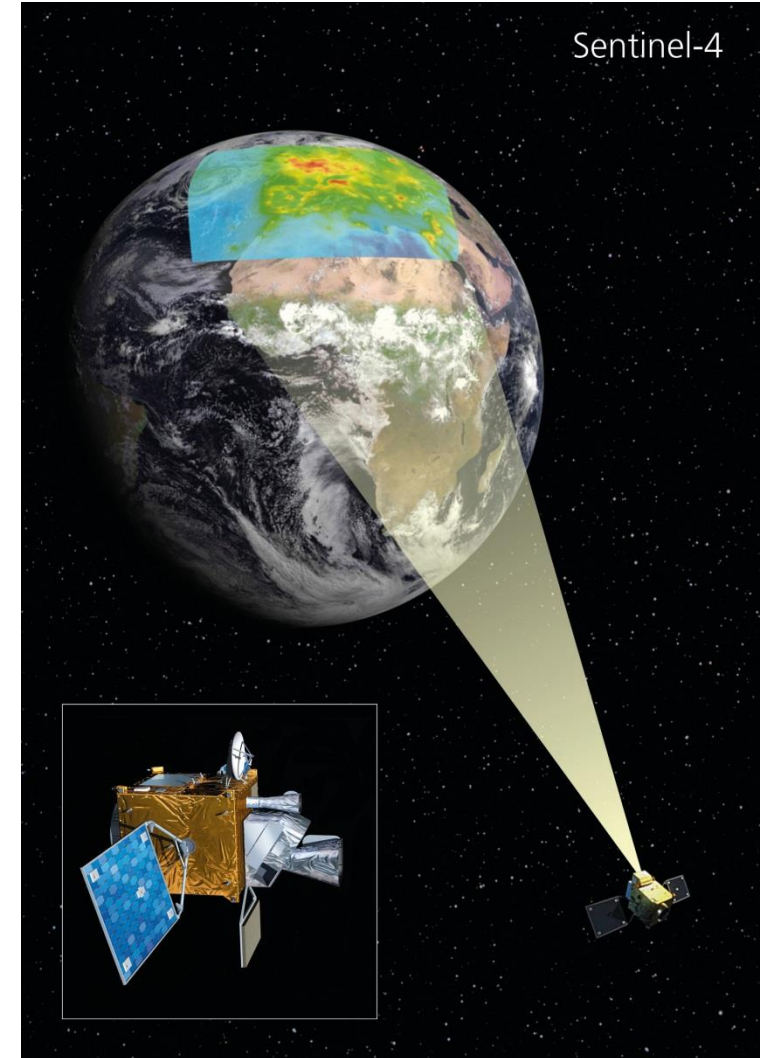
Spectral coverage

UV-VIS-NIR-SWIR / UV-VIS-NIR

Spectral resolution in the UVN

0.25-0.5 nm / 0.12-0.5 nm

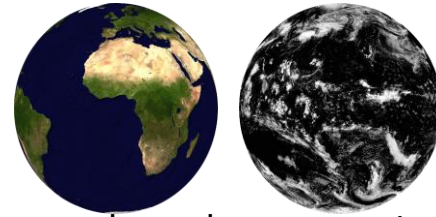
Sentinel-4



The operational S₅P and S₄ CLOUD products - OCRA & ROCINN algorithms

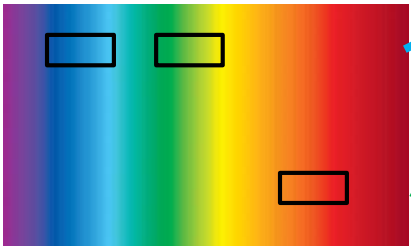


OCRA & ROCINN – Algorithm Overview



clear-sky composite

OCRA
Optical Cloud
Recognition Algorithm



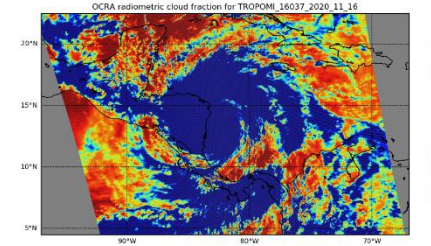
color space approach

neural network approach

ROCINN
Retrieval of Cloud Information
using Neural Networks

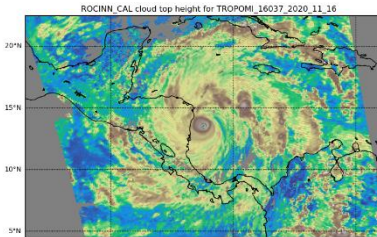


Hurricane Iota
©NASA worldview

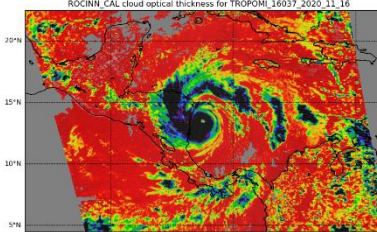


Radiometric
cloud fraction

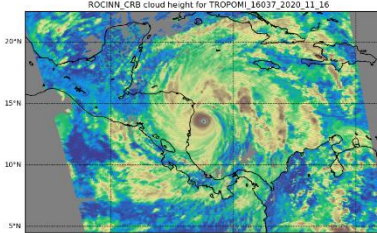
CAL
Clouds as
layers



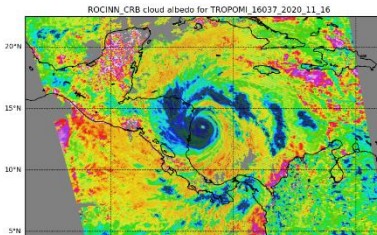
cloud top
height



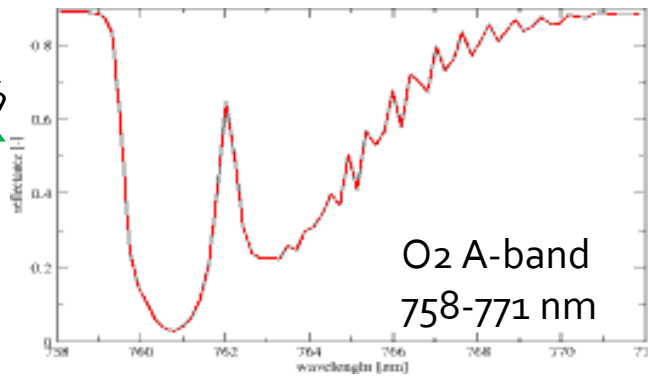
cloud opt.
thickness



eff. cloud
height



cloud albedo



CRB
Clouds as
reflecting
boundaries



OCRA & ROCINN – documentation

<https://sentinel.esa.int/web/sentinel/technical-guides/sentinel-5p/products-algorithms>

<https://mpc-vdaf.tropomi.eu/index.php/clouds>

DLR Deutsches Zentrum für Luft- und Raumfahrt e.V. In der Helmholtz-Gemeinschaft

S5P/TROPOMI ATBD Cloud Products

document number : SSP-DLR-L2-ATBD-4001
 authors : Diego Loyola, Ronny Lutz, Atsine Aggrawal, Rob Spurr
 CI identification : CI-4001-ATBD
 issue : 2.3
 date : 2021-06-25
 status : Released

ATBD

DLR

Sentinel-5 precursor/TROPOMI Level 2 Product User Manual Cloud Properties

document number : SSP-L2-DLR-PUM-4001
 authors : Fabian Romahn, Mattia Padregliana, Diego Loyola, Arnoud Aptsisley, Marian Snep, J. Pieter Veefkind
 CI identification : CI-4001-PUM
 issue : 02.03.00
 date : 2021-05-04
 status : released

PUM

TROPOMI ESA Copernicus

S5P Mission Performance Centre CLOUD [L2_CLOUD_] Readme

Document number	SSP-MPC-DLR-PRF-CLOUD
Issue	2.3
Date	2022-03-09
Product version	V02.03.00
Status	Released
Prepared by	R. Lutz (DLR) MPC ESIL-L2 Product Lead F. Romahn (DLR) MPC ESIL-L2 Processor Lead S. Compagnolo (BIRA-IASB) MPC Validation Coordinator J.-C. Lambert (BIRA-IASB) MPC ESIL-VAL Lead J.-C. Lambert (BIRA-IASB) MPC ESIL-VAL Lead D. Loyola (DLR) MPC ESIL-L2 Lead J. P. Veefkind (NOMI) MPC Technical Manager
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TROPOMI ESA Copernicus

Sentinel-5 Precursor Mission Performance Centre

Quarterly Validation Report of the Copernicus Sentinel-5 Precursor Operational Data Products #14: April 2018 – March 2022

Prepared by: Sentinel-5 Precursor Mission Performance Centre
 Reference: SSP-MPC-ASB-ROCVR-14.01.01-20220408
 CI identification: DS-MPC-ROCVR
 Document update: #14
 Issue: 14.01.01
 Date of issue: 2022-04-08
 Status: Final
 Distribution: Public

ROCVR



OCRA & ROCINN – recent improvements (I)

- OCRA clear-sky maps have been generated based on EPIC/DSCOVR data as preparation for Sentinel-4
- ROCINN surface albedo climatology is replaced by daily surface albedo retrieval (GE_LER) using TROPOMI measurements and surface albedo map is updated on a daily basis (G3_LER)

- ROCINN ice cloud parameterisation is under development

EGU22-9552 | Presentations | [AS3.3](#) ★

[Retrieval of Ice Cloud Properties from Sentinel-5 Precursor and Sentinel-4 Measurements](#) ▶

Ana del Águila, Ronny Lutz, Víctor Molina García, Fabian Romahn, and Diego Loyola

Fri, 27 May, 08:35–08:45 ■ Room M1

- ROCINN neural networks have been updated

EGU22-11043 | Presentations | [ITS2.6/AS5.1](#) ★

[Framework for the deployment of DNNs in remote sensing inversion algorithms applied to Copernicus Sentinel-4 \(S4\) and TROPOMI/Sentinel-5 Precursor \(S5P\)](#) ▶

Fabian Romahn, Victor Molina Garcia, Ana del Aguila, Ronny Lutz, and Diego Loyola

Tue, 24 May, 14:08–14:14 ■ Room N1

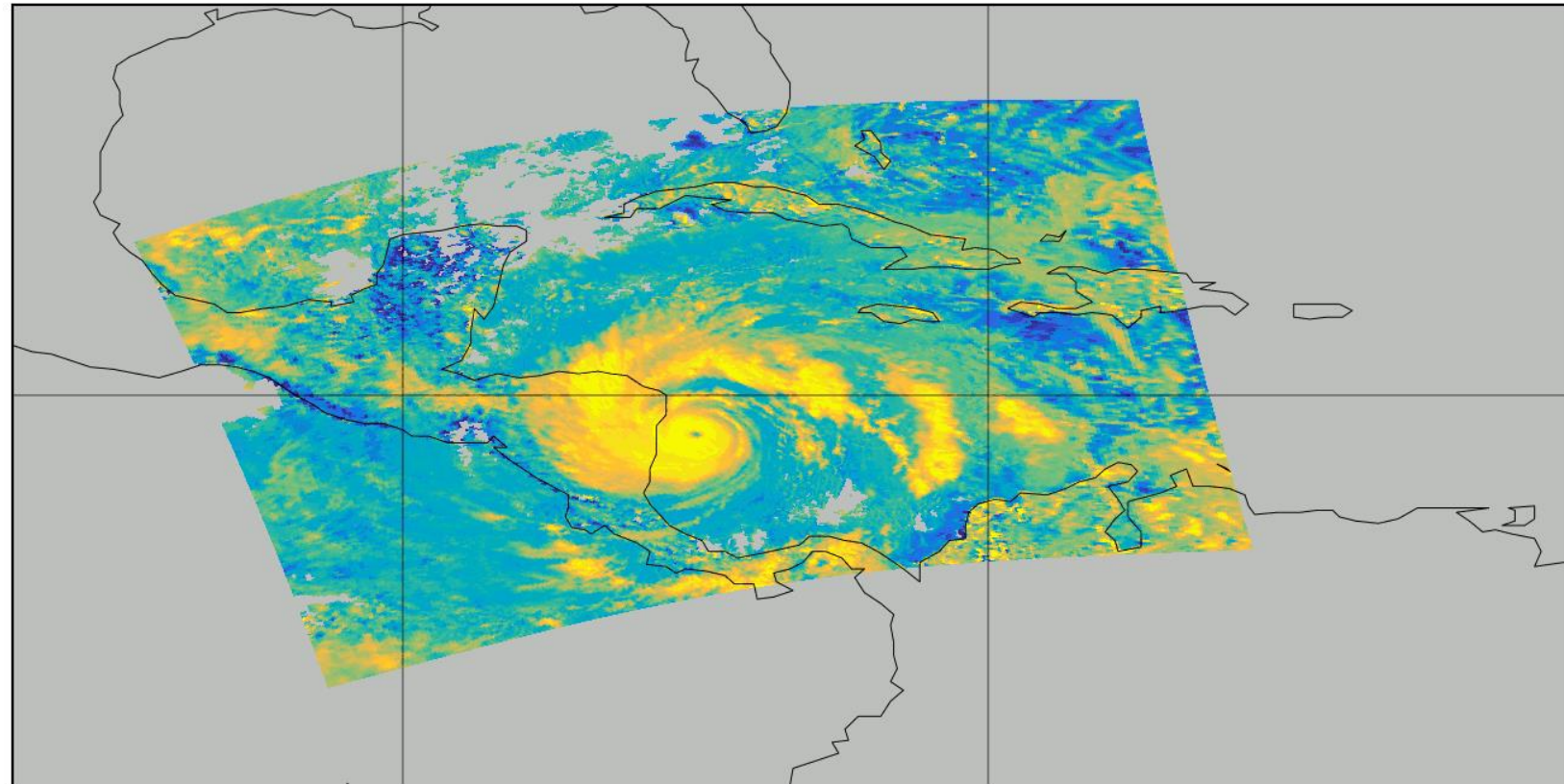


S5P L2_CLOUD product examples

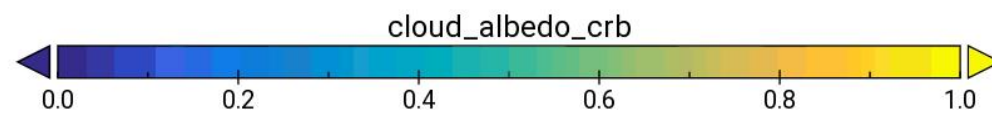


S5P – operational cloud products

Hurricane Iota, 2020-11-16, orbit 16037



Hurricane Iota
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OCRA application to GEMS



OCRA clear-sky maps based on EPIC/DSCOVR

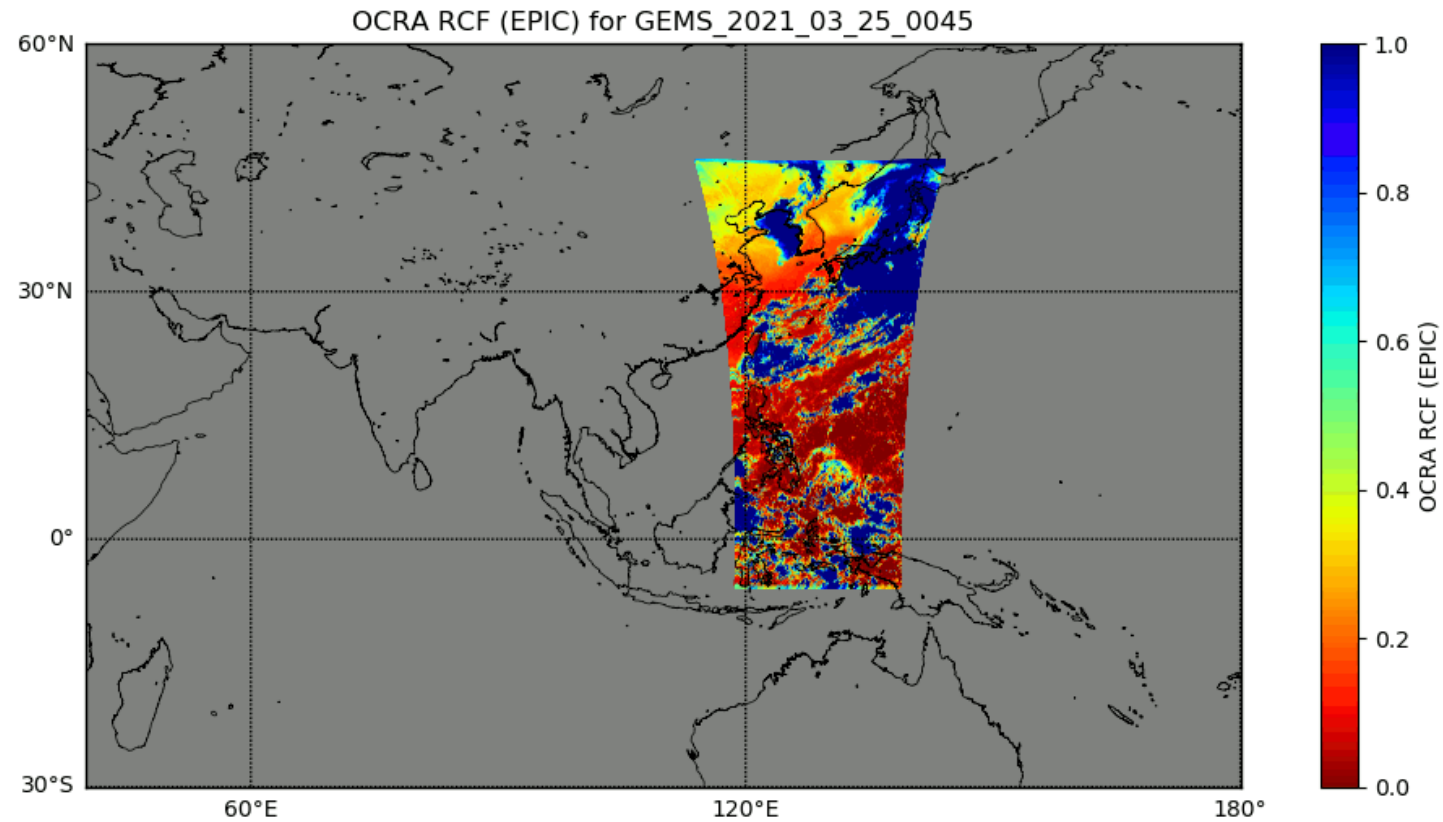
- Aggregation of daily maps in intervals of +/- 14 days with 0.2 deg resolution

Clear-sky maps for EPIC channels (780, 551, 388) nm



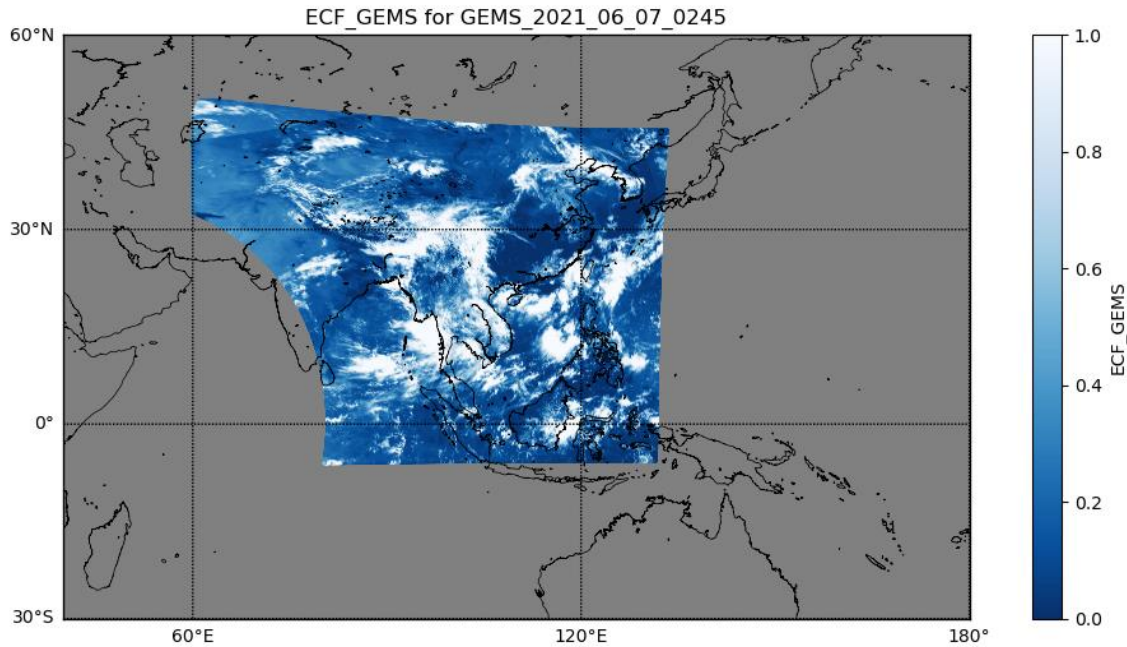
OCRA adaptation to GEMS using the EPIC clear-sky maps

2021-03-25

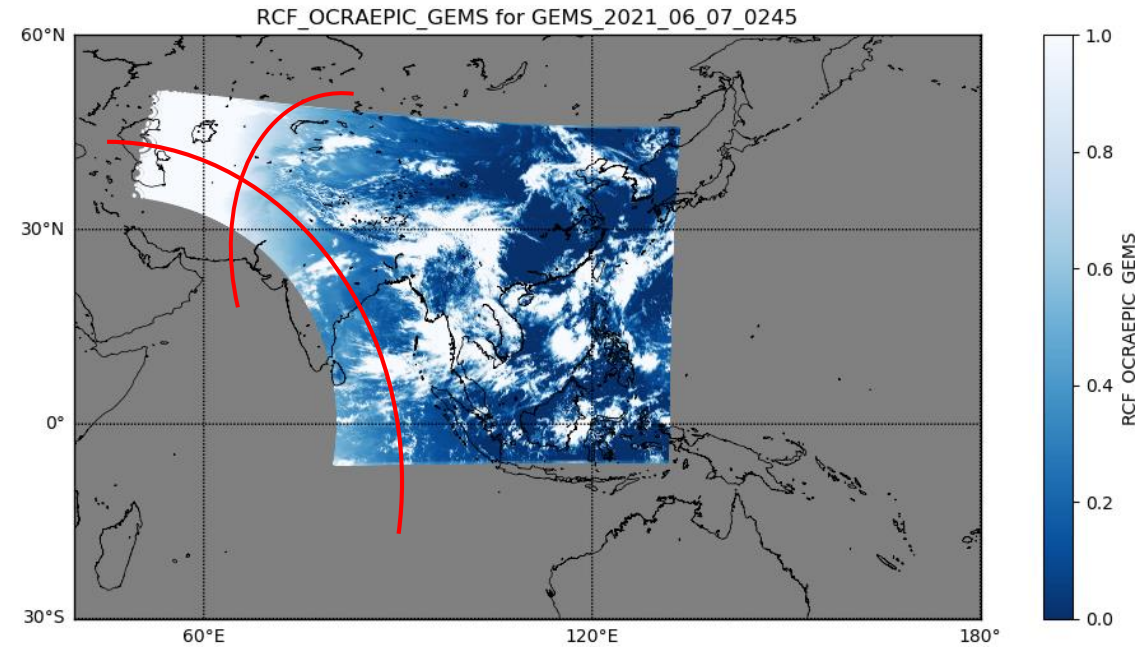


Intercomparisons of cloud fraction – GEMS L2 versus OCRA application

GEMS L2 Cloud product



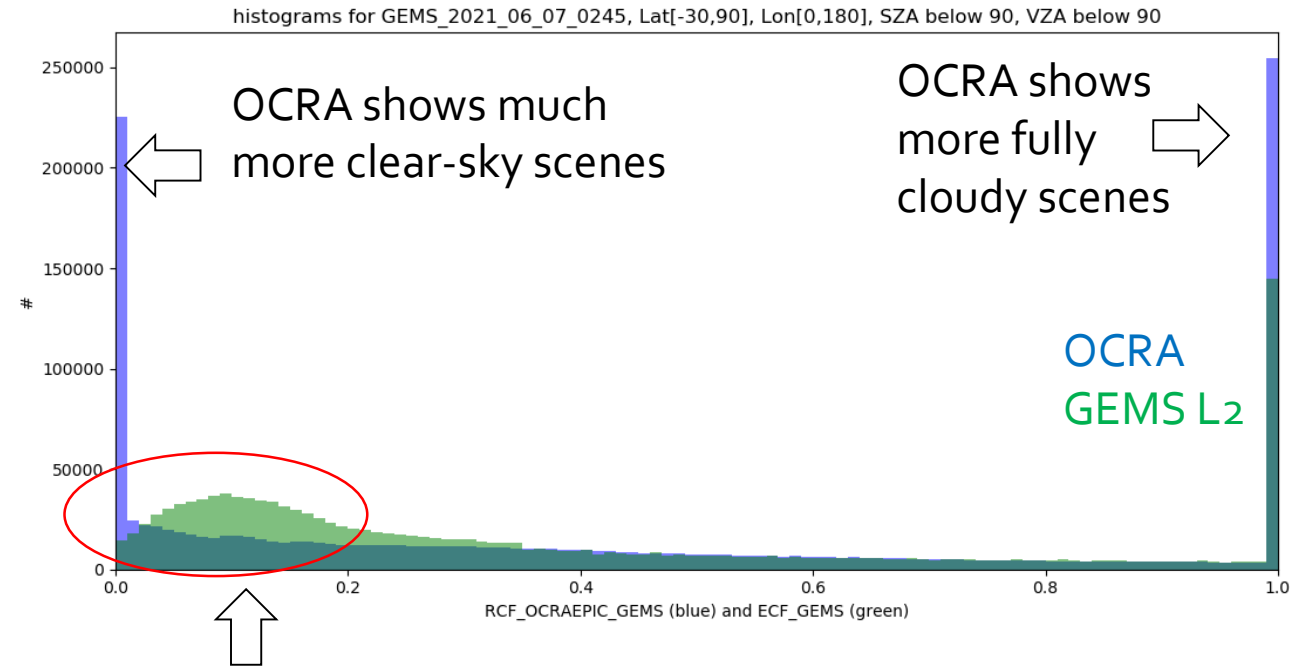
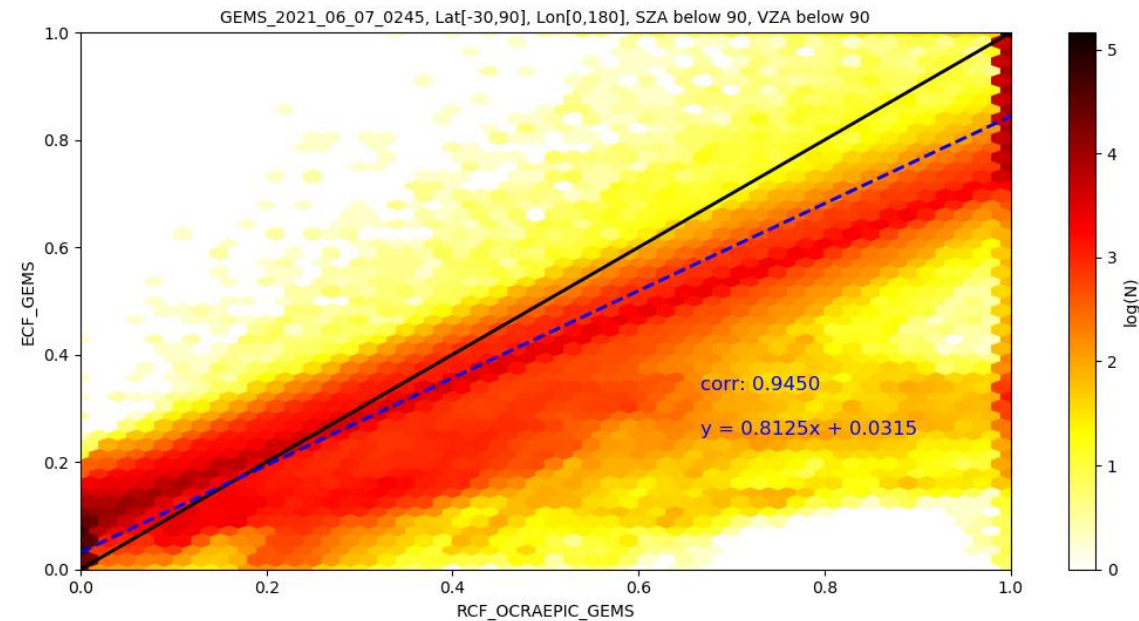
OCRA adapted to GEMS L1



enhanced CFs appear only at high SZA/VZA, which are outside of the applicable scenario constraints



Intercomparisons of cloud fraction – GEMS L2 versus OCRA application



- correlation coefficient 0.95
- mean difference 0.047

GEMS L2 shows very few clear scenes, but a pronounced peak around 0.1



Summary and Conclusion

- Operational S₅P and S₄ Cloud products
 - Based on the well established OCRA & ROCINN algorithms
 - S₅P products are well documented and validated routinely
 - Improvements including ice cloud parameterization are under development

- Application of OCRA to GEMS L₁C data looks very promising
 - Good agreement between OCRA and GEMS L₂ CLOUD product for most scenes
 - Future work includes generation of clear-sky maps based on GEMS data and improvements at high SZA/VZA

Thank you for your attention!

DLR-Atmos:

<https://atmos.eoc.dlr.de/calendar>

Interested in quicklooks and L₃ data?

Check the INPULS project:

<https://atmos.eoc.dlr.de/inpuls/>

