



Committee on Earth Observation Satellites

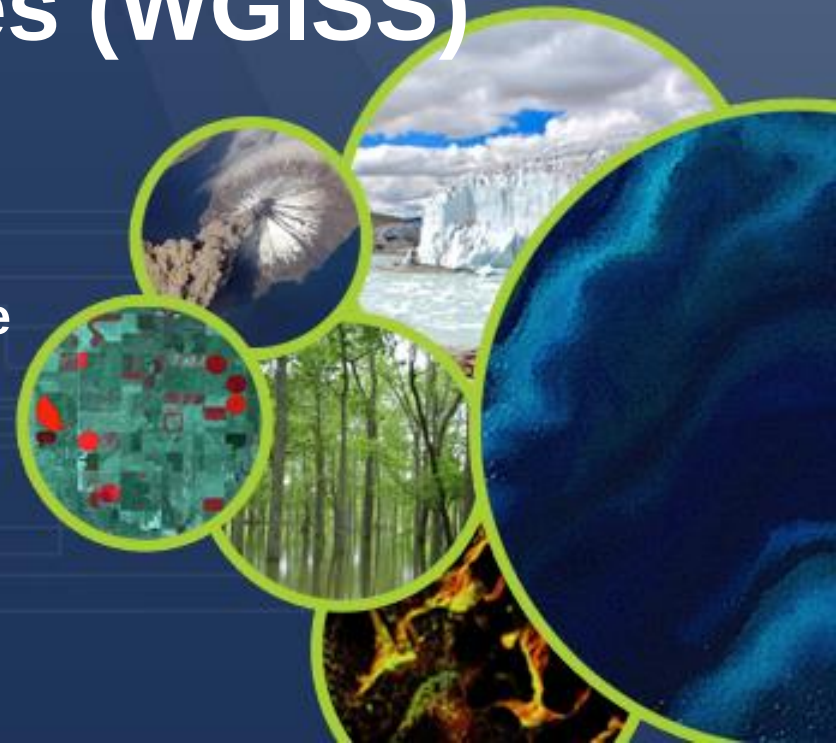
Working Group on Information Systems and Services (WGISS)

Serge RIAZANOFF, VisioTerra for ESA

WGISS#52 Virtual Meeting

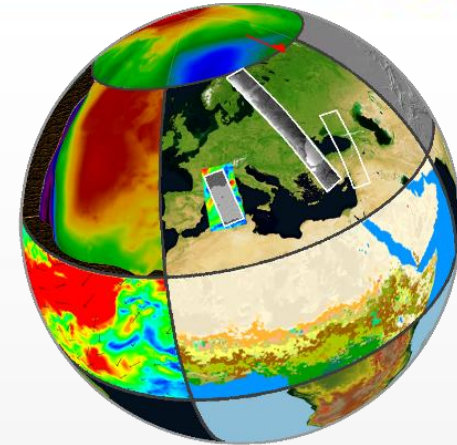
**Processing-On-the-Fly Macro-Language
(POF-ML)**

19th October 2021



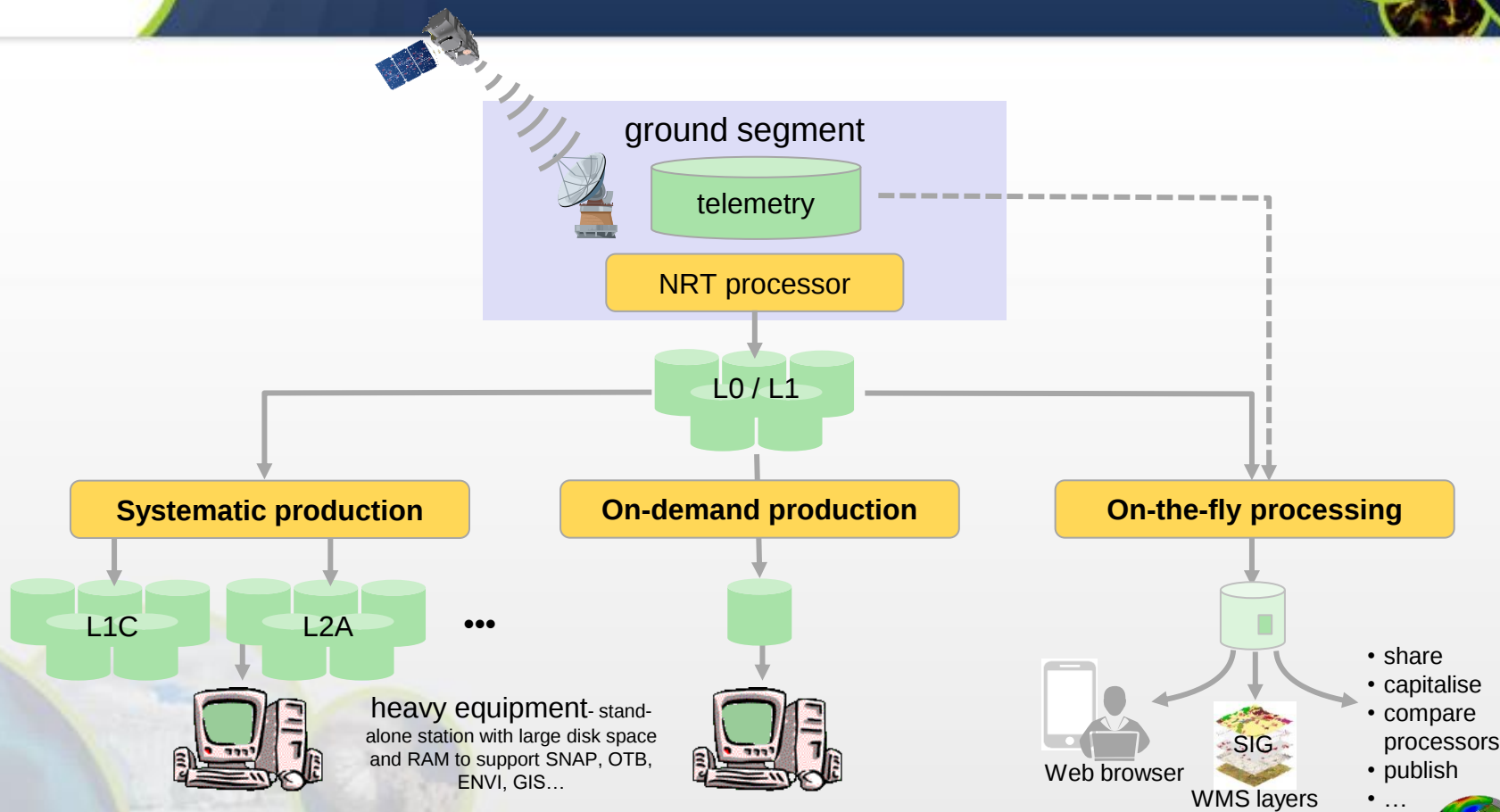


- Systematic / on-demand / on-the-fly processing
- VtWeb – From high-level requirements up to design
- VtWeb – Design principles
- VtWeb – Data Processing Relay
- VtWeb – Generic platform for customized platforms
- VtWeb for geoservices
- Hello World of NDVI POF-ML
- Indicator for monitoring deforestation in Cameroon
- Radar Cross Section Equalization (RCSE) applied to Sentinel-1
- Pan-sharpening of Sentinel-2 SWIR bands by its 10m bands
- Use of VtWeb POF-ML in CEOS / WGCV / TMSG / DEMIX

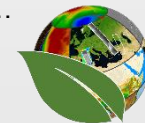


VtWeb

Systematic / on-demand / on-the-fly processing



Ecological !
Process only that is required



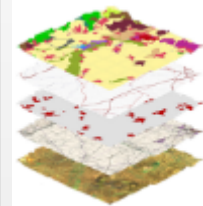
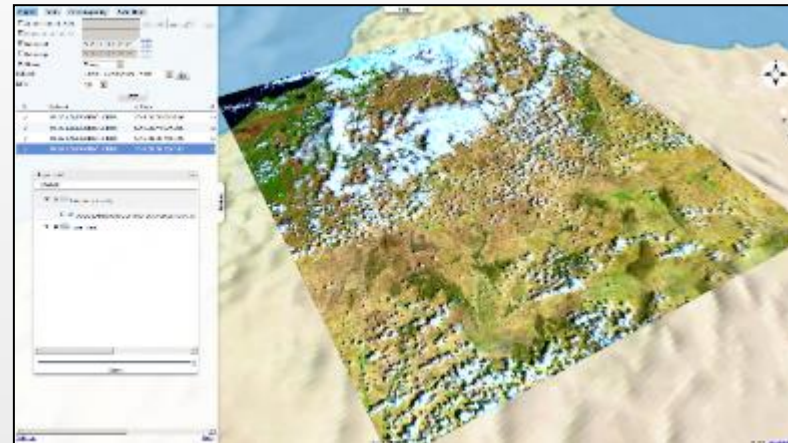
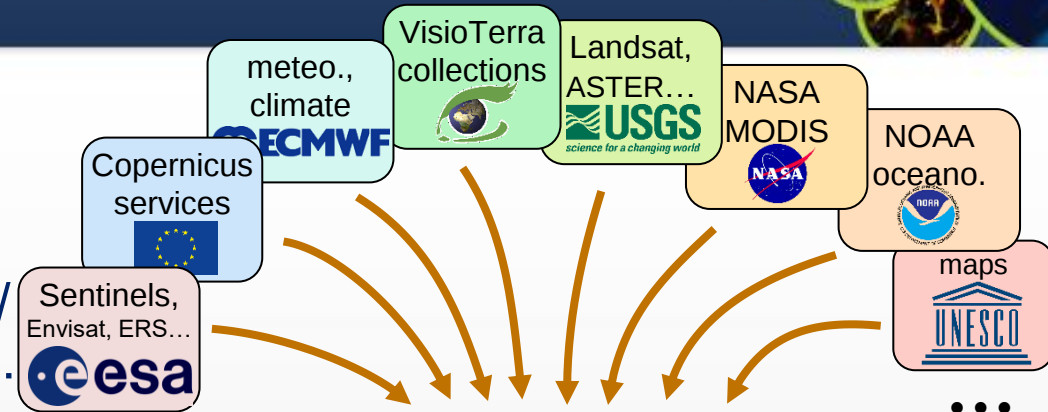
heavy production (peta-bytes)	light (one whole product)	very light (area at scale of interest)
new version of the processor ⇒ reprocess the whole archive	<i>no impact</i>	<i>no impact</i>
download with high bandwidth	download high large bandwidth	<i>very low bandwidth</i>



High-level requirements	Design concepts	VtWeb features
Better exploit EO data	Hide the complexity of data access, representation, processing levels, projection... Enable user to only check	Dataset modules Near real-time access Time series
Bring users to data	Enable users to focus on his/her core business / skill Provide a wide range of data types and time-series	Worldwide free data 2D / 3D display in their classical Web navigators without any installation
Extract information from big data	Enable users to interactively browse / transform / merge data Compare / aggregate products Compute indicators	Processing on-the-fly (POF) Get associated data Change tracker Layer stack of mixed data
Share this information	Very low bandwidth (streaming) Enable users to share the custom processed “product”: ○ for a view ○ for their GIS	Smart dissemination: ○ “hyperlook” ○ - KML script ○ - GeoTIFF ○ - WMTS

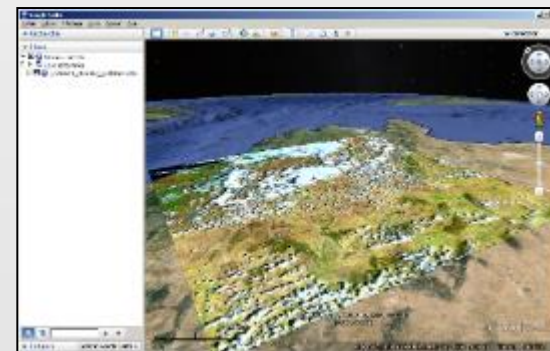


- www.visioterra.fr/?VtWeb
- global / free data
- data retrieval / data mining
- satellites / meteo / ECV / Geol. / hydro./ alti./ LULC / populations.
- Near Real-Time access
- automated processing
 - *for citizen*
 - default style
 - predefined styles
 - *for scientists*
 - parameter tuning
 - POF-ML editor
- collaborative infrastructure(s)
- 2D webmapping / 3D virtual globe
- on user's area of interest
- archives to analyse changes
- value-added geoservices, recurring monitoring, alarms...



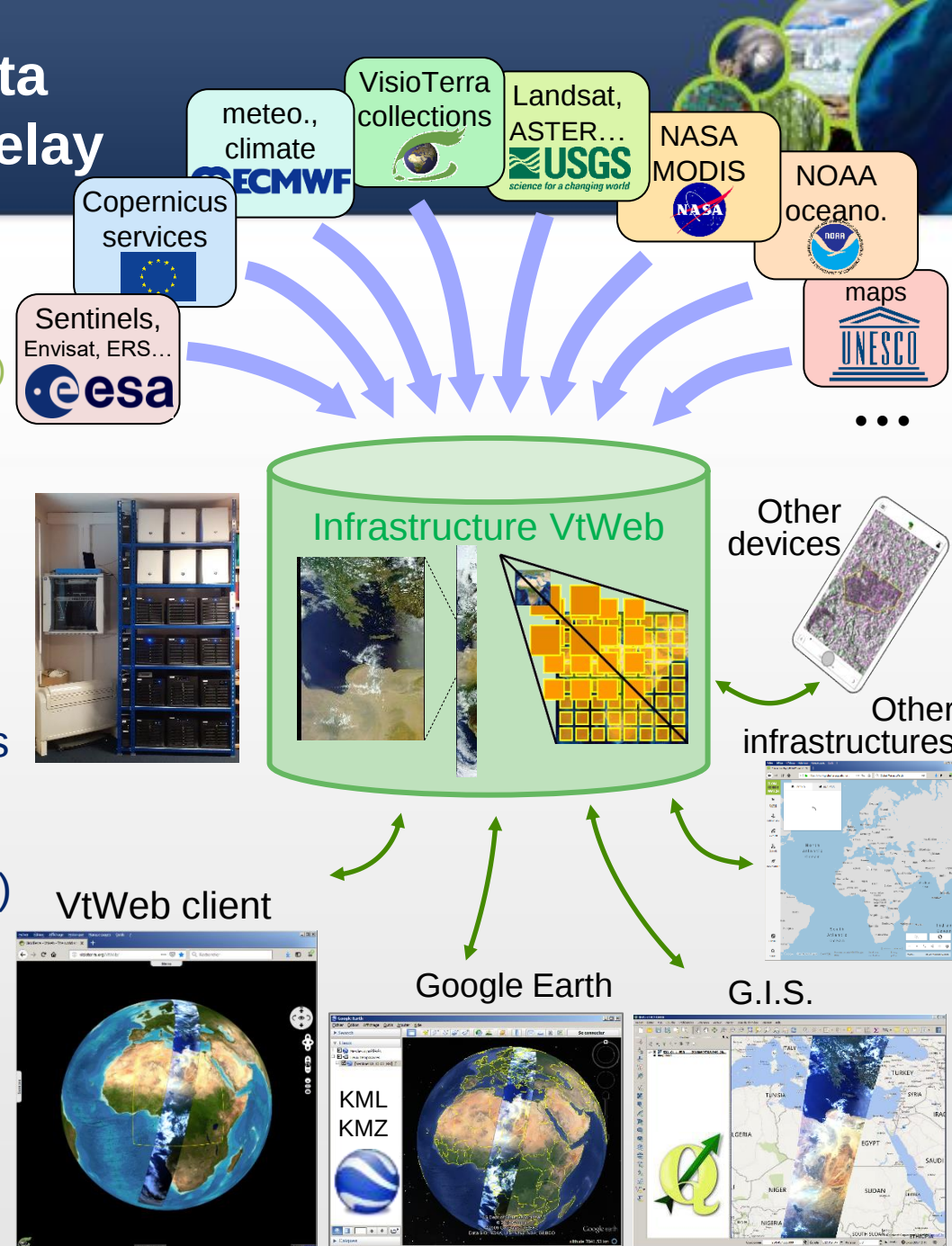
GeoTIFF, WMTS
→ G.I.S.

KML
KMZ



VtWeb – Data Processing Relay

- Our HW+SW VtWeb infrastructure
(1PB disk cache, 1 Gb/s symmetric optical fibre)
- Managing heavy products upstream
Delivering light services downstream
→ fighting against numerical divide in Africa
- “Bringing users to multi-source data”
- Synchronisation of VtWeb catalogues with many data provider catalogues
- Interactive or automatic (geoservices) selection of products in user's site
- If the product is not already in cache,
→ download and prepare it
(statistics and quadtree in native geometry / aggregation depending on the type and usage)



VtWeb – Generic platform for customized platforms



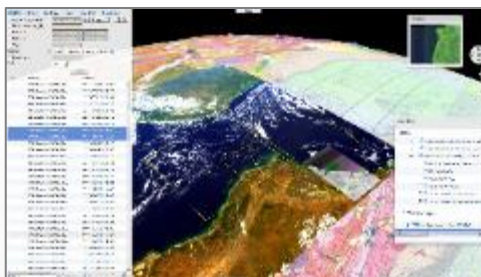
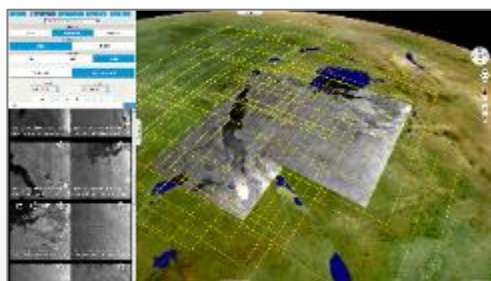
Since 2013

An advanced one-stop-shop model

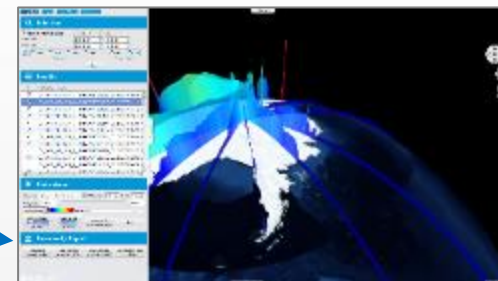
visioterra.org/VtWeb

A showcase capitalising VisioTerra know-how

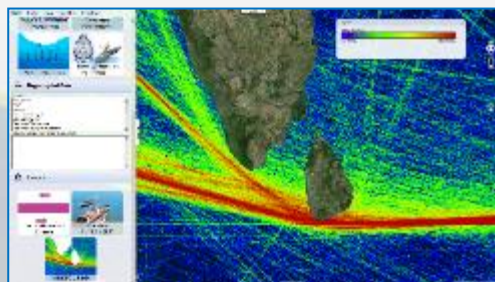
hedavi.esa.int



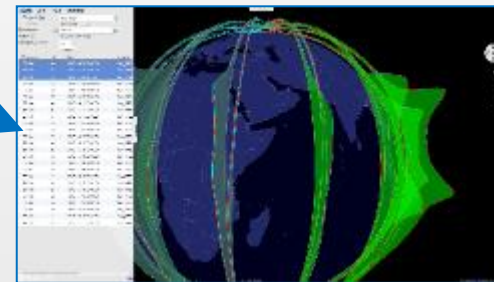
visioterra.net/VtCryoSat



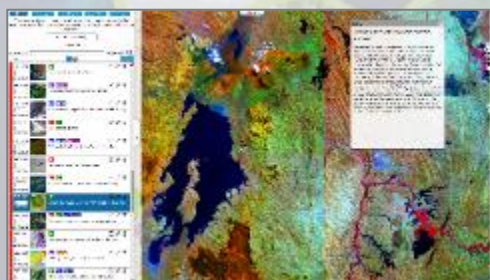
visioterra.net/VtPace



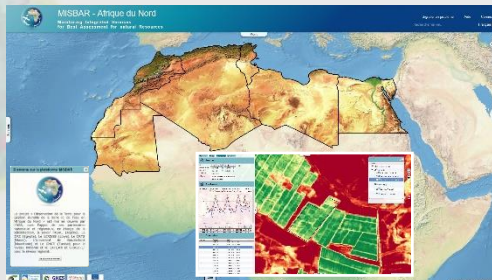
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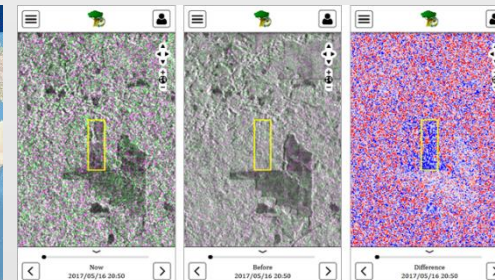
www.sentinelvision.eu



visioterra.org/misbar

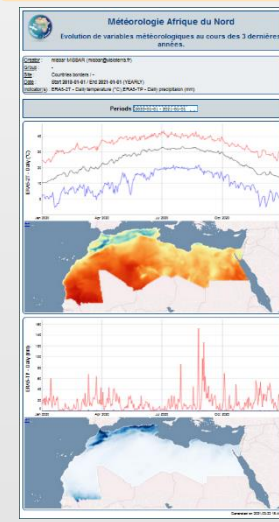
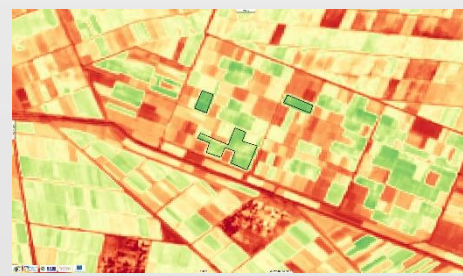
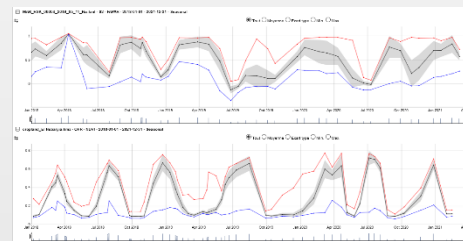
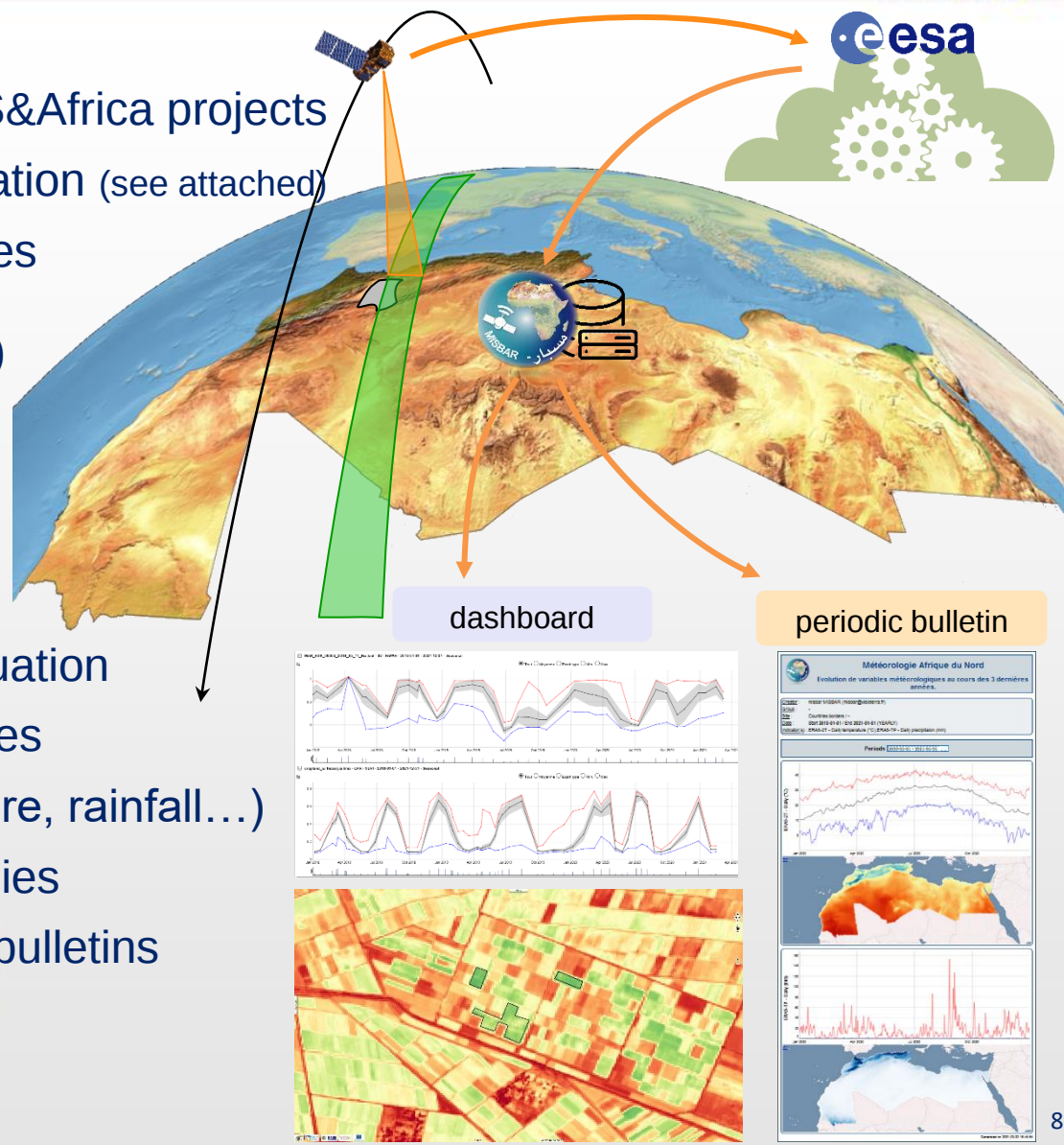


visioterra.org/FlegtWatch





- VtWeb / POF-ML applied to GMES&Africa projects
 - **MISBAR** – Agriculture & irrigation (see attached)
 - **CAFWS** – Deforestation & fires
- HW+SW installed at OSS (Tunisia) and AGEOS (Gabon)
- Interactive functions for citizen, students, researchers...
- **Geoservices** for monitoring / evaluation
 - Management of users and sites
 - Indicators (vegetation, moisture, rainfall...)
 - Dashboards to detect anomalies
 - Automatic edition of periodic bulletins
 - ...





- Hyperlook: rich URL describing a layer stack and the POF-ML script of each layer $\approx$ data cube
<https://visioterra.org/VtWeb/hyperlook/13ed0cd072bb41d38ce69829fbd4d287>
- POF-ML: Processing-On-the-Fly Macro-Language
- PU: Processing Unit

Interactive mode

POF-ML edition mode

Dataset rendering

Style name: NDVI 1

Module Ids: VtSentinelMsi

Dataset Ids: Sentinel2A/MSI

Granule Ids: S2A_MSIL1C_20160330T101022_N0201_R022_T329

Style

```
lut(
  ndi(
    QT_B08,
    QT_B04,
    0,
    0.8
  ),
  redyellowgreen,
  0,
  255,
  0,
  0,
  -,
  10
)
```

WCS ODC (points to the ndi function)

computation PU (points to the ndi function)

Rendering PU (points to the color palette)

WMTS (points to the lut function)

Buttons: Ok, Apply, Cancel, Help

Dataset rendering

Style name: NDVI 1

Greyscale: NDI

Red: -

Green: -

Blue: -

Same processing for R,G,B

Same preprocessing

Buttons: Parameters (for each channel)

Buttons: Ok, Apply, Cancel, Delete, Help

NDI parameters (A - B) / (A + B)

A: B08 (842 nm, 10 m)

B: B04 (665 nm, 10 m)

min: 0

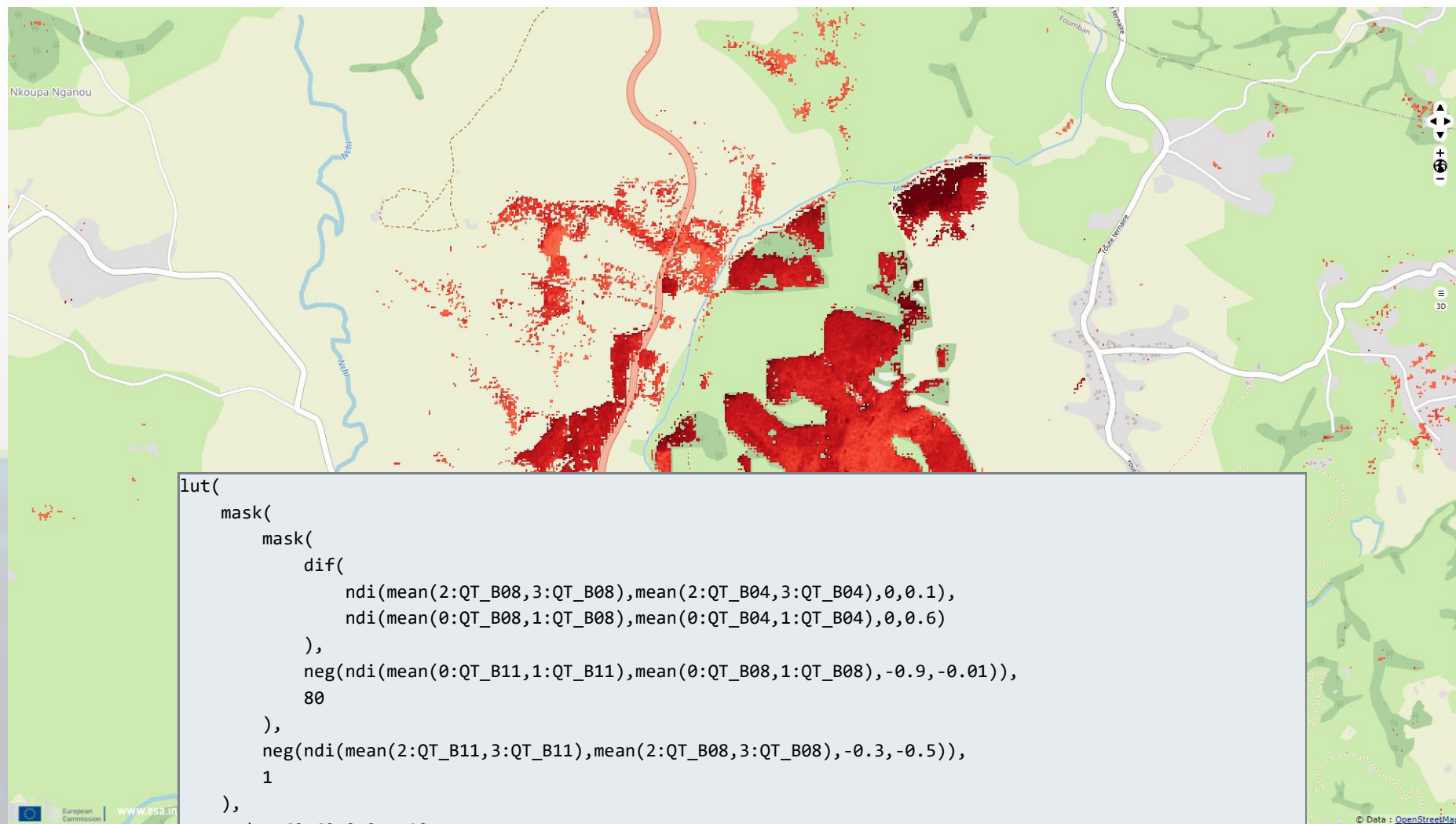
max: 0.8

Buttons: Ok, Apply, Cancel, Reset, Help

Map view showing NDVI results with a 2 km scale bar and coordinates 7.53250, 36.75948.

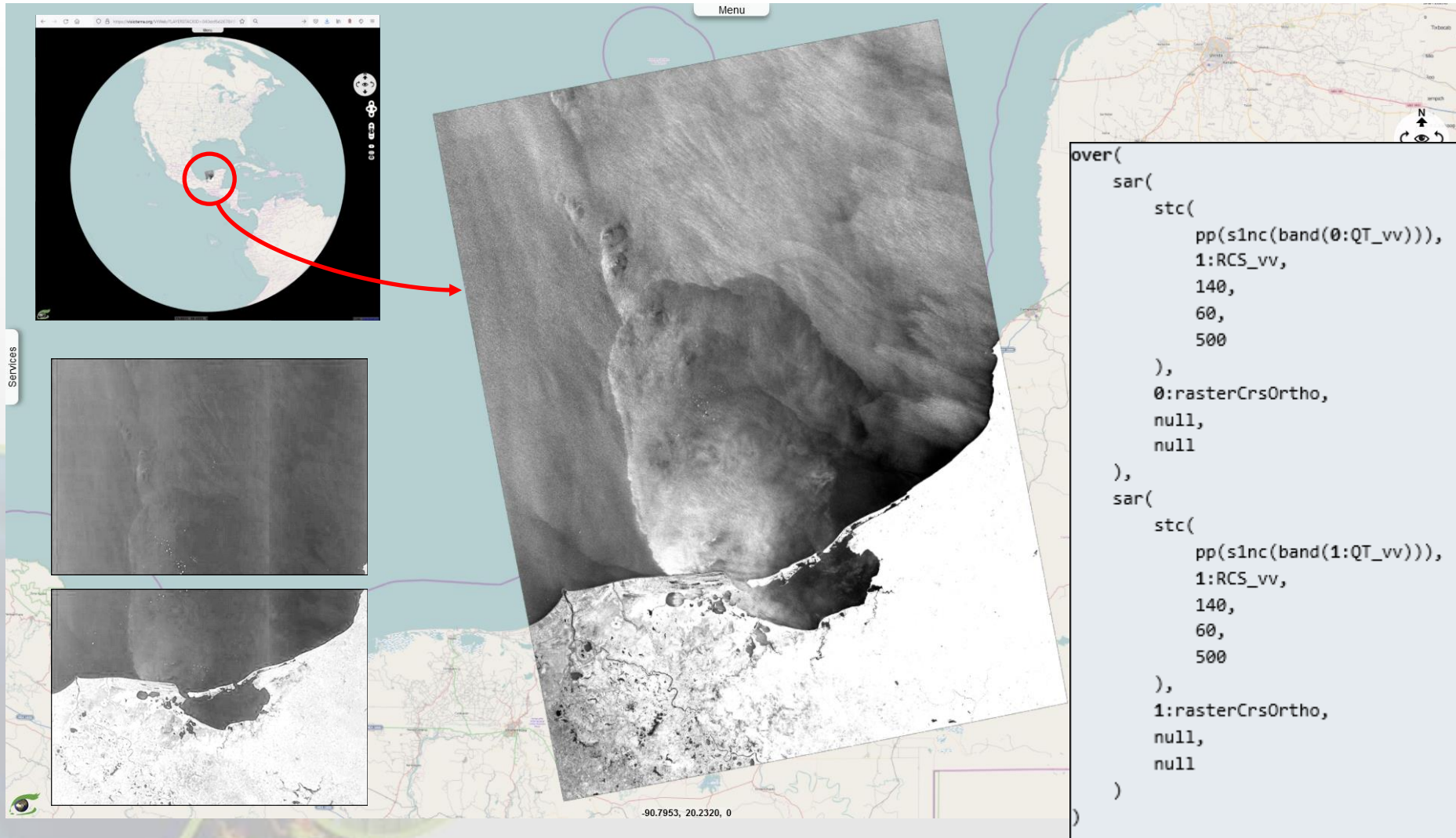


Hyperlook: <https://www.sentinelvision.eu/hyperlook/64bf1c8fbefa4d6fa9b08cdb500a15df>



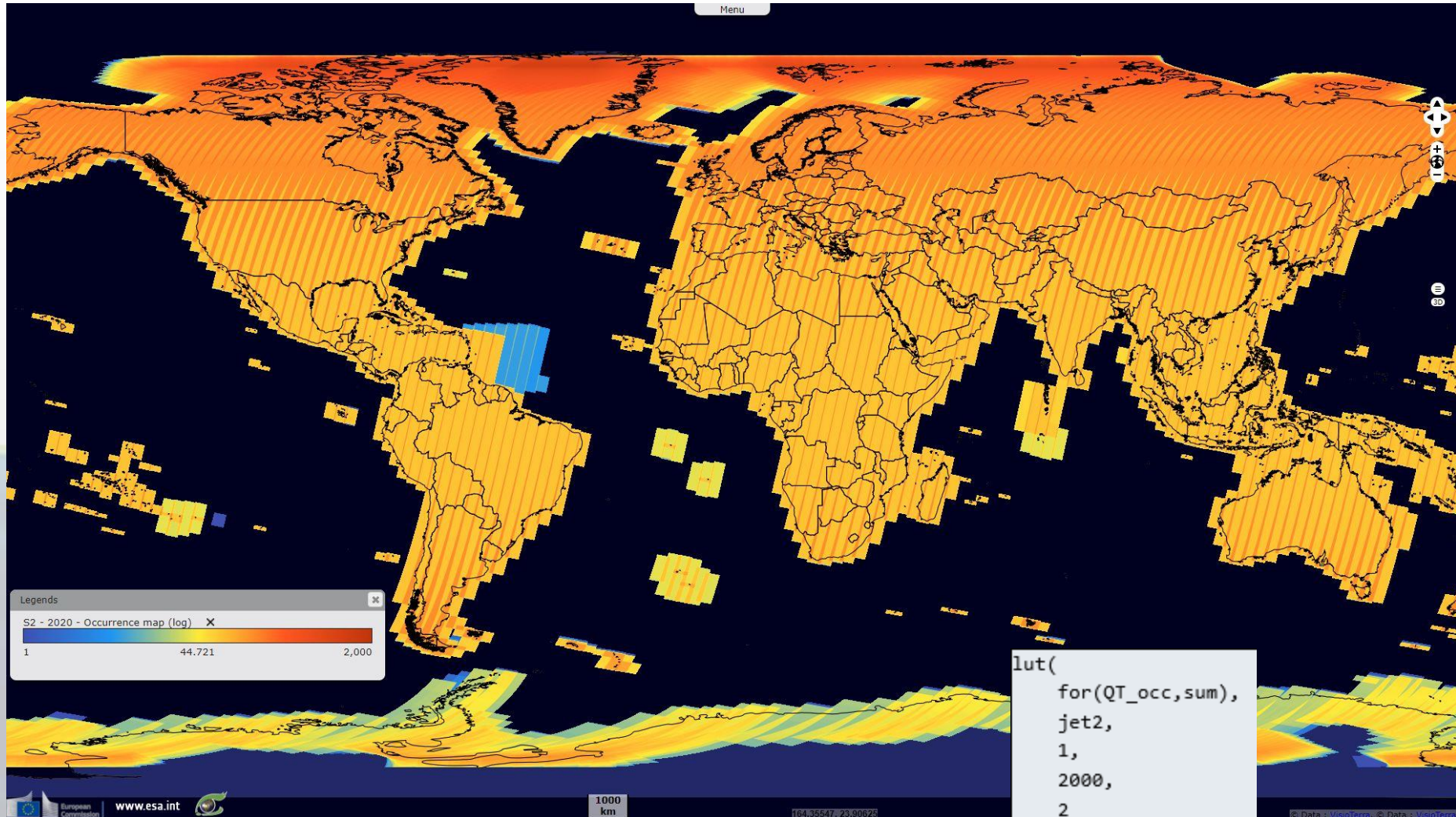
Radar Cross Section Equalization (RCSE) applied to Sentinel-1

Hyperlook: <https://visioterra.org/VtWeb/hyperlook/040dcf6d26784930be91f3e898ffb144>



Observation occurrences of Sentinel-2 in 2020

Hyperlook: <https://www.sentinelvision.eu/hyperlook/5d50cdfb95af4a0ea84eaf7bbaf1af1b>



Pan-sharpening of Sentinel-2 SWIR bands by NIR band 8



Animation: <https://visioterra.org/VtWeb/hyperlook/553c0c495c7f4cacb1720c8eeffcad66>



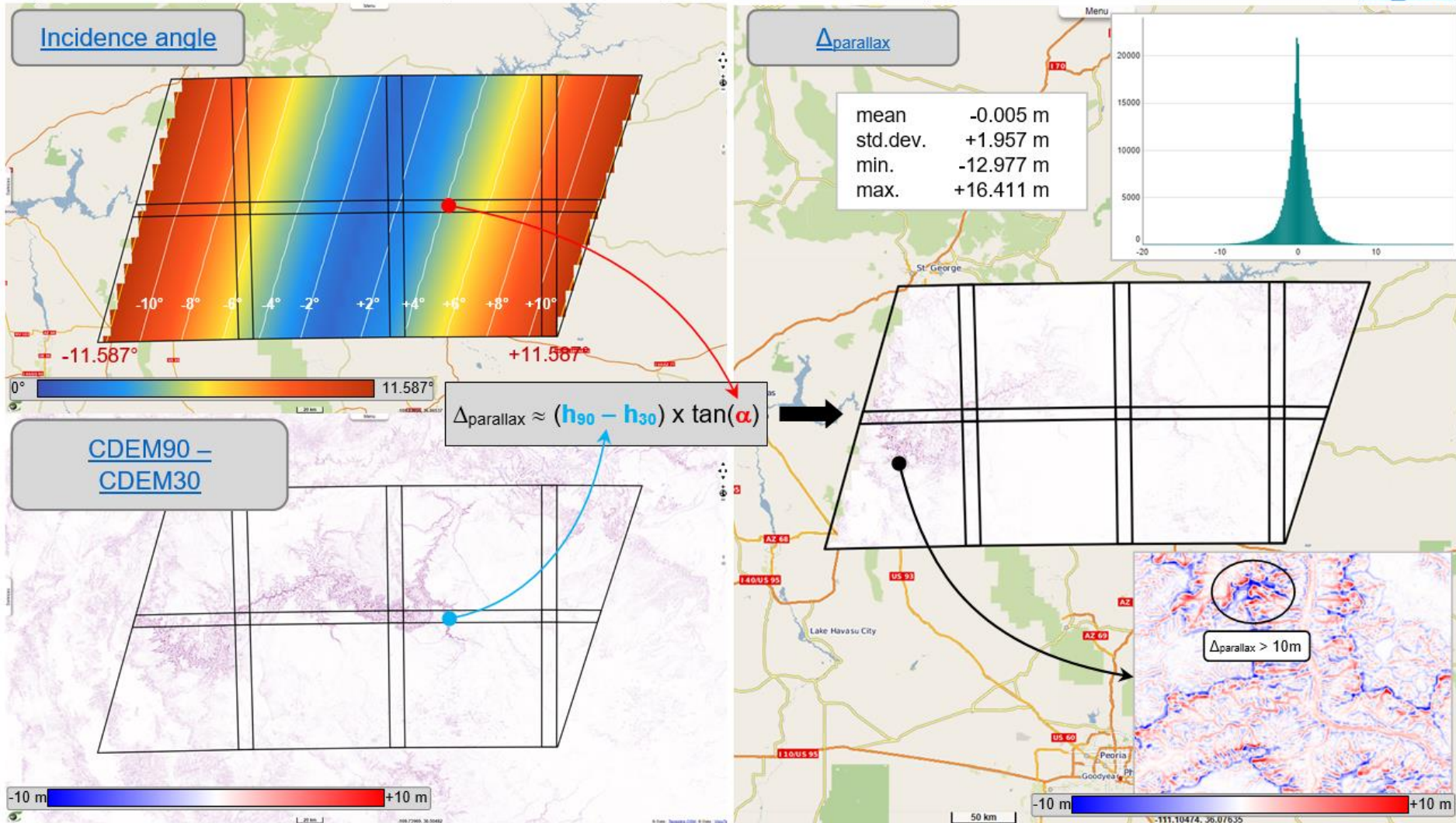
Use of VtWeb POF-ML in CEOS / WGCV / TMSG / DEMIX



See [HYP-099-VtWeb-E COP-DEM GLO-90 vs GLO-30 for Sentinel-2 orthorectification.pdf](#)

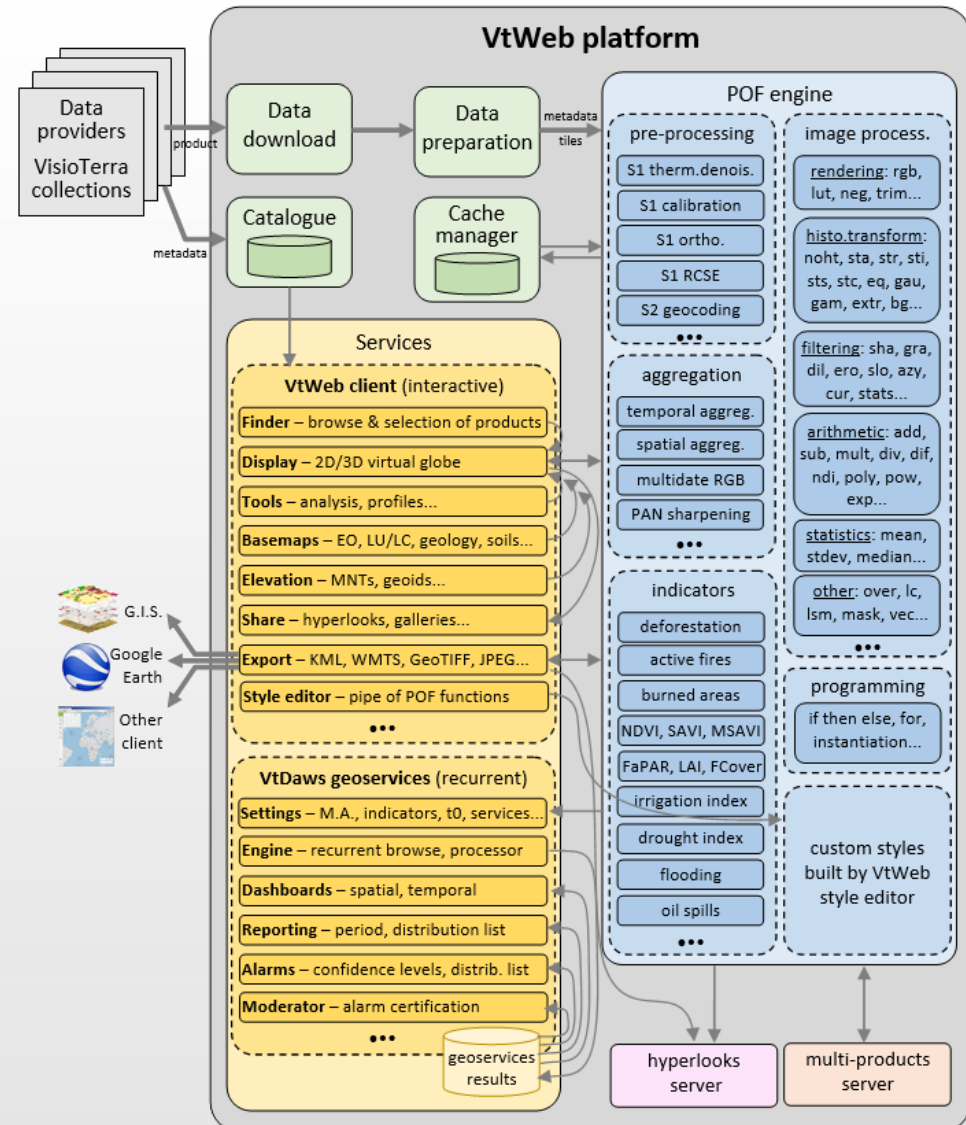
Fig.3: Grand Canyon - S2 incidence angle, DEMs delta height and estimated delta parallax.

[2D view](#)





- Pre-processing
 - Orthorectifications
 - Calibrations...
- Aggregations
 - Temporal
 - Spatial...
- Image processing
 - Global radiometry transforms
 - Filtering
 - Arithmetic
 - Rendering...
- Indicators
 - Pixel based
 - Combined...



[illegible]

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VisioTerra