Deutscher Wetterdienst
Wetter und Klima aus einer Hand

DWD

Visualisation of MTG data — Pytroll/Satpy

Gerrit Holl

Deutscher Wetterdienst (DWD)

26 June 2025

What is pytroll?

- Free and open source collection of Python packages
- Reading, processing, and visualising Earth observation satellite data
- With a strong focus on meteorological satellites

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- High-level processing for satellite data
- 124 readers for satellites in LEO, GEO, HEO, and at Lagrange 1
- Resample to any PROJ.4 projection
- Generate all standard RGB composites (and many non-standard ones)
  - And easily define more
- Fully ready for FCI (level 1 and level 2) and LI (level 2).

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Pytroll or Satpy?

- Pytroll: 40 packages, many tasks
- Image manipulation (`trollimage`), filename parsing (`trollsift`), orbit calculations (`pyorbital`)
- Automated processing (`pytroll-watchers`, `pytroll-collectors`, `trollflow2`) configurable via YAML
- And many others
- Most users will only need a handful of packages

- Satpy: single package
- Used as a Python library via Python code
- Entry-point for most users

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Satpy FCI example


```
import hdf5plugin
from satpy import Scene
from glob import glob
fci_files = glob("*FDHSI*BODY*20231001*C_0054_*.nc")
sc = Scene(filenames=fci_files, reader="fci_l1c_nc")
sc.load(["true_color"])
ls = sc.resample("eurol", resampler="gradient_search")
ls.save_datasets()
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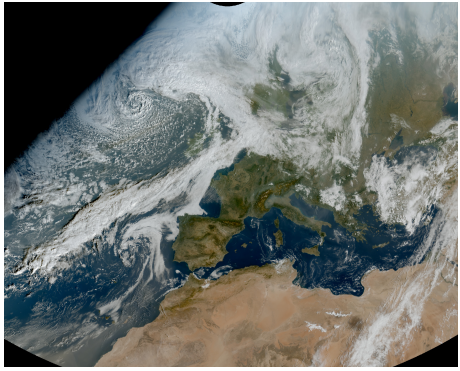

True Colour, 2023-10-01T08:50

Reading MTG data with Satpy

- Satpy can read all public MTG-I data formats:
  - FCI L1c NetCDF (FDHSI, HRFI)
  - FCI L2 NetCDF (AMV, CLM, CT, CTTH, FIR, GII, OCA, OLR, CRM, ASR)
  - FCI L2 BUFR (AMV, ASR)
  - FCI L2 GRIB (CLM)
  - LI L2 NetCDF (LEF, LGR, LFL, AF, AFR, AFA)
- Help wanted:
  - IRS L1 (if needed)
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Visualising MTG data with Satpy

- Visualise single-channel data
- Generate any predefined composite
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- 69 composites directly included
- Easy to define own composite in YAML, no coding needed

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Define your own day/night composite

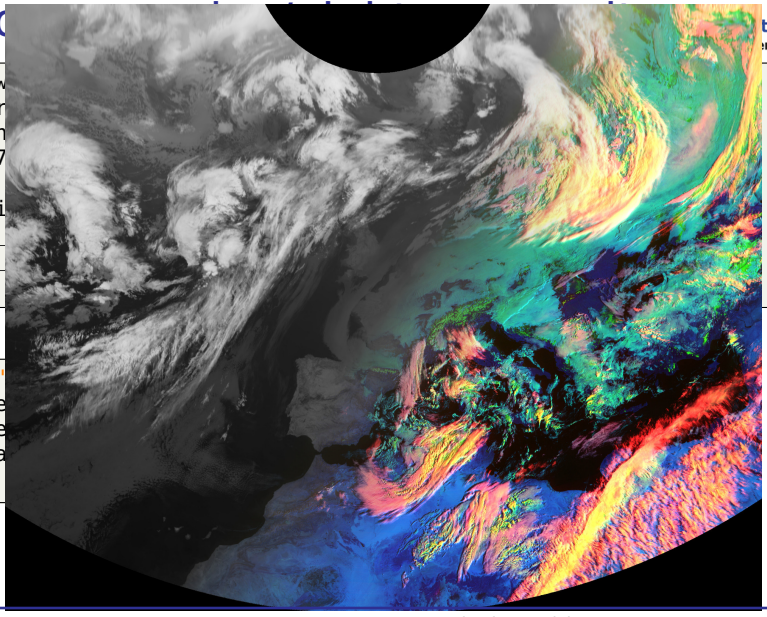

```
cloud_type_with_night_ir105:
  compositor: python/name:satpy.composites.DayNightCompositor
  standard_name: image_ready
  lim_low: 78
  lim_high: 88
  prerequisites:
    - cloud_type
    - night_ir105
```

```
sc.load(["cloud_type_with_night_ir105"])
ls = sc.resample("eurol",
  resampler="gradient_search")
ls.save_datasets()
```

Define yo


```
cloud_type_w
  compositor
  standard_n
  lim_low: 7
  lim_high:
  prerequisi
    - cloud_
    - night_
```

```
sc.load(["
ls = sc.re
  resample
ls.save_da
```



cloud type/night IR, 2025-01-06 08:00

Define own day/night composite


```
day_microphysics_with_night_microphysics:
  compositor: python/name:satpy.composites.DayNightCompositor
  standard_name: image_ready
  lim_low: 85
  lim_high: 90
  prerequisites:
    - day_microphysics
    - night_microphysics
```

```
sc.load(["day_microphysics_with_night_microphysics"])
ls = sc.resample("eurol",
  resampler="gradient_search")
ls.save_datasets()
```

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```
day_microphy
  compositor
  standard_n
  lim_low: 8
  lim_high:
  prerequisi
    - day_mi
    - night_
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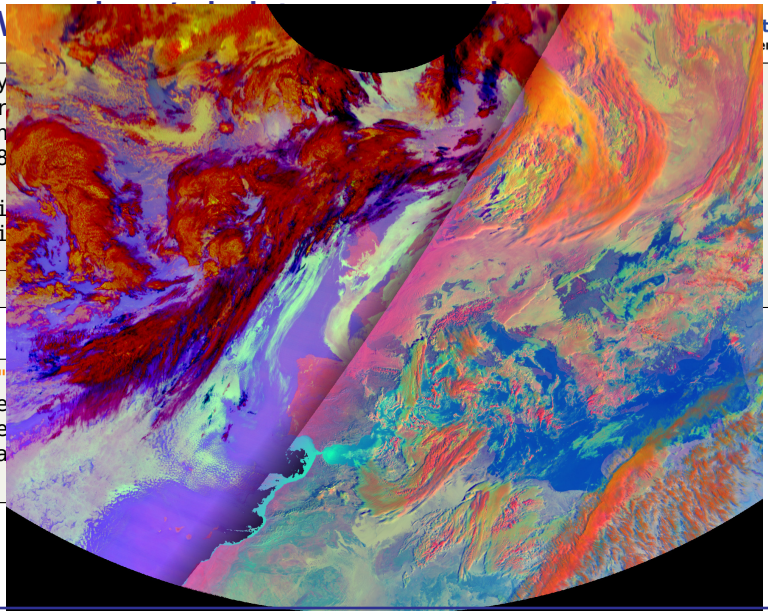

day/night microphysics, 2025-01-06 08:00

FCI + LI


```
sc = Scene(filenames=
  {"fci_l1c_nc": glob("*FCI*FDHSI*003?.nc"),
   "li_l2_nc": "glob("*LI*AFA*0015.nc"")})
sc.load(["true_color_with_night_ir105_acc_flash_area"])
ls = sc.resample("tyrrhenian", resampler="gradient_search")
ls.save_datasets()
```

FCI + LI


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sc = Scene(filenam
  {"fci_l1c_nc": g
   "li_l2_nc": "gl
sc.load(["true_col
ls = sc.resample("
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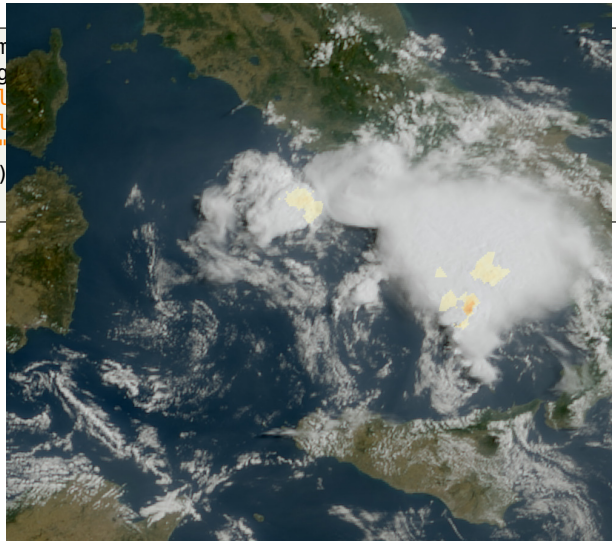

True color with AFA, 2025-06-18 07:30

Defining new FCI+LI composites


```
day_microphysics_with_night_microphysics_acc_flash_area:
  compositor: python/name:satpy.composites.BackgroundCompositor
  standard_name: image_ready
  prerequisites:
    - acc_flash_area_alpha
    - day_microphysics_with_night_microphysics
```

```
sc.load(["day_microphysics_with_night_microphysics_acc_flash_area"])
ls = sc.resample("tyrrhenian",
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```

Defining new FCI+LI composites

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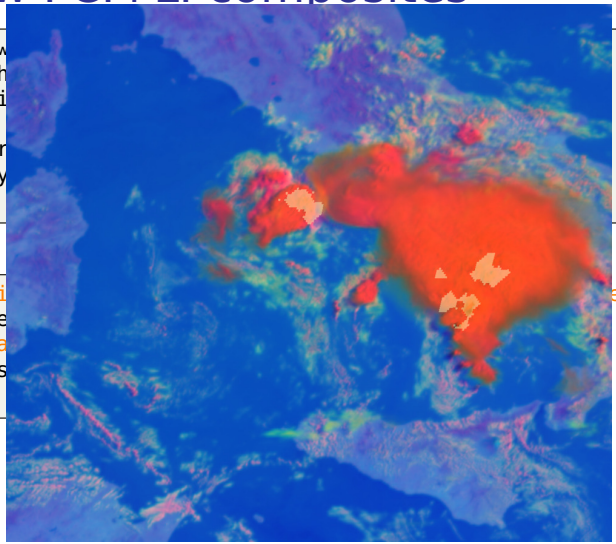
```
day_microphysics_w
  compositor: pyth
  standard_name: i
  prerequisites:
    - acc_flash_ar
    - day_microphy
```

```
sc.load(["day_mi                                    ea"])
ls = sc.resample
  resampler="gra
ls.save_datasets
```



day microphysics with LI AFA, 2025-06-18 07:30

Defining new FCI+LI composites

Deutscher Wetterdienst
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```
day_microphysics_w
  compositor: pyth
  standard_name: i
  prerequisites:
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    - day_microphy
```

```
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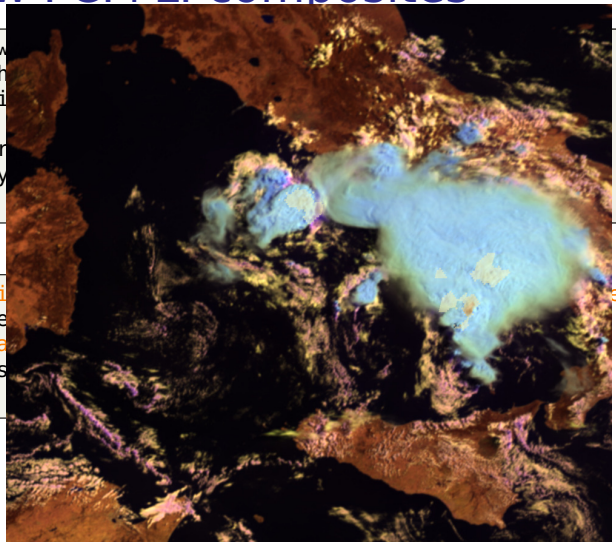

day cloud phase with LI AFA, 2025-06-18 07:30

Teaser: Flash geometry

Coming soon to Satpy: Flash geometry based on ESSL algorithm

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Deutscher Wetterdienst
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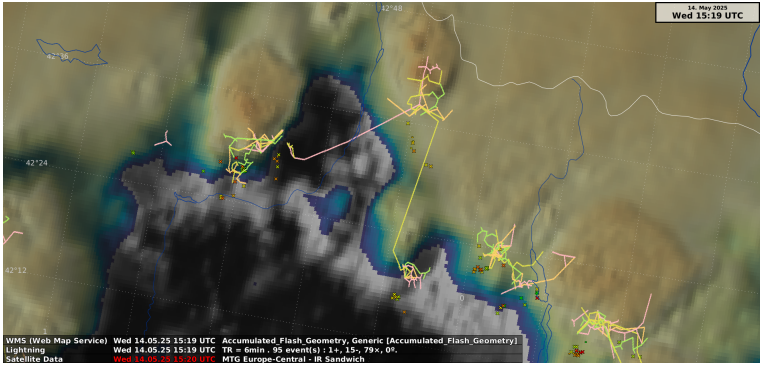

flash geometry

Automated processing

- In an operational environment, we may need automated processing
- Pytroll offers packages for event-based triggering
- Composites and areas defined in YAML config

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FCI from EUMETCAST

data source

- FCI-FDHSI-BODY-0050-0001.nc
- FCI-FDHSI-BODY-0050-0002.nc
- FCI-FDHSI-BODY-0050-0040.nc
- FCI-FDHSI-TRAIL-0050-0041.nc
- FCI-FDHSI-BODY-0051-0001.nc

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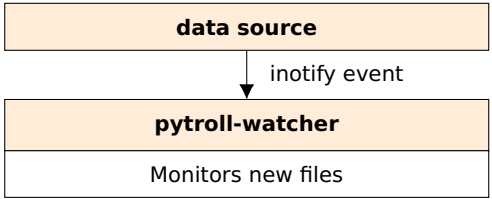

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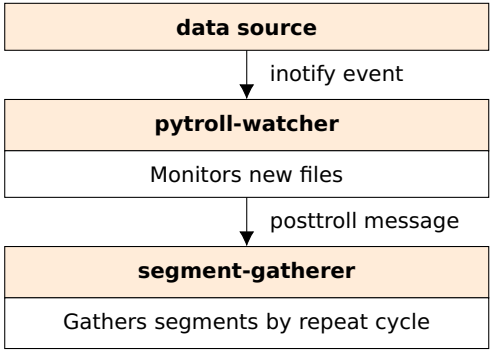

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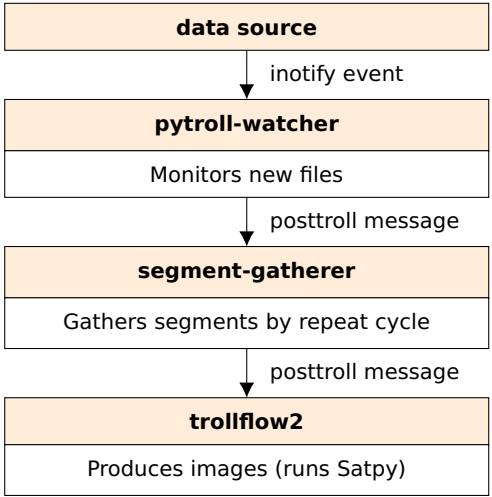

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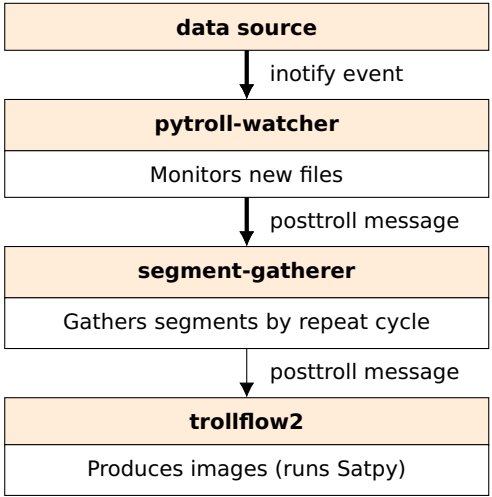

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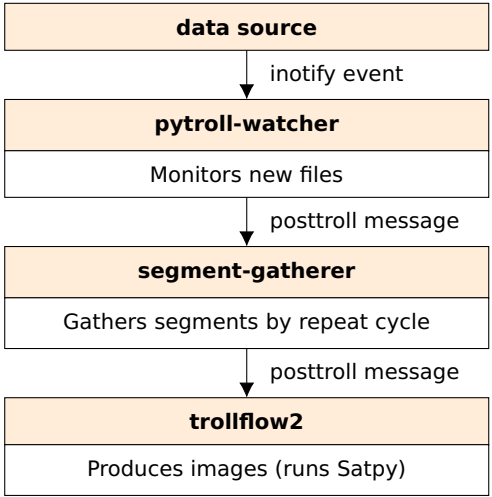

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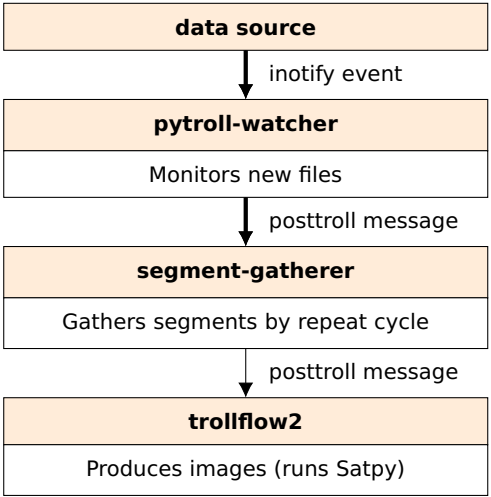

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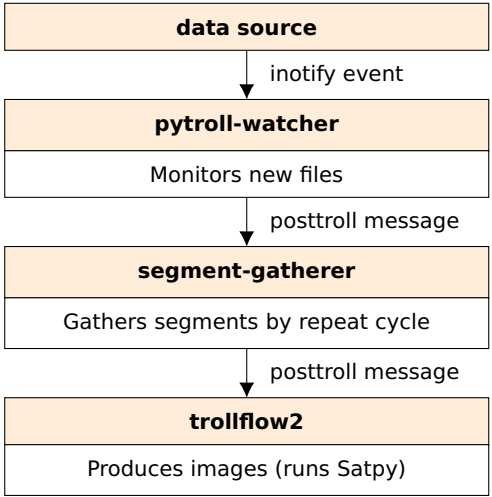

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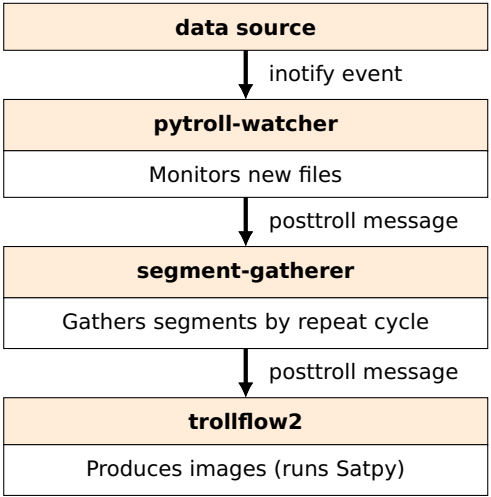

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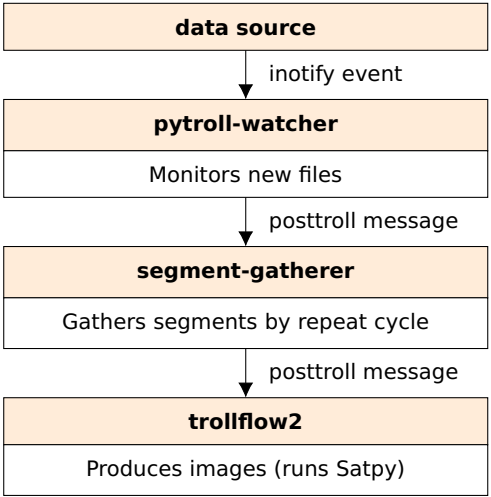
FCI from EUMETCAST



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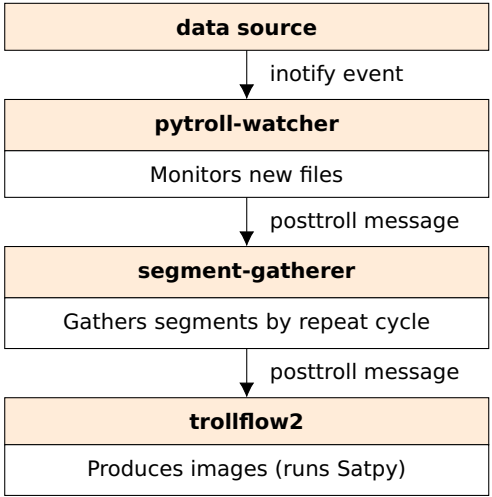

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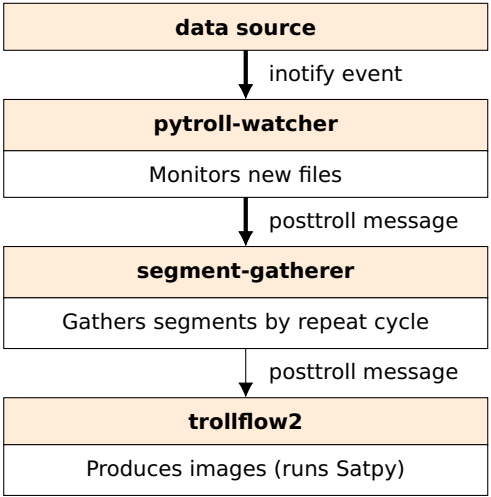

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  - Upgrade machine
  - Change `DASK_NUM_WORKERS` (check Satpy FAQ)
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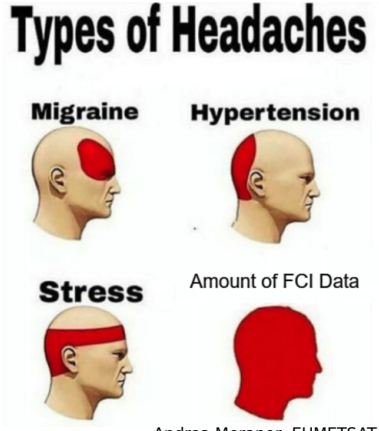

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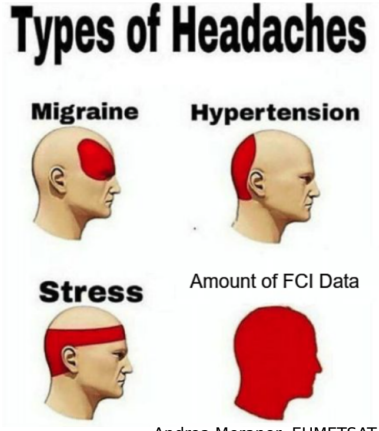

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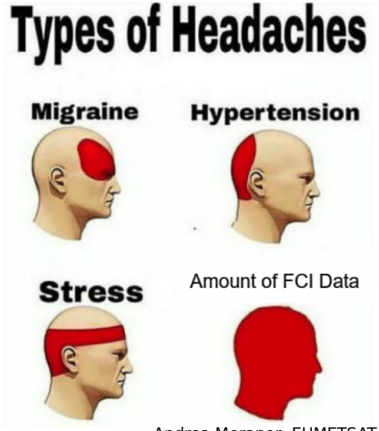

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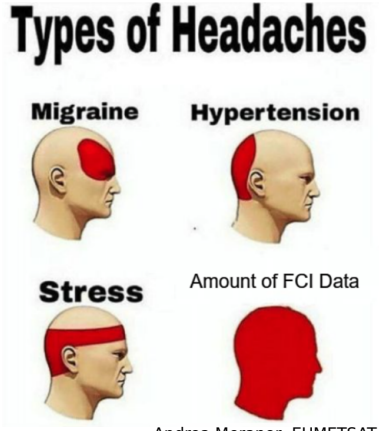

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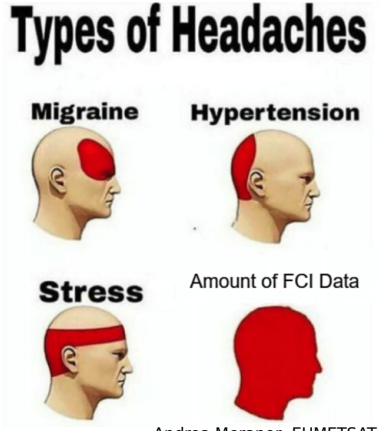

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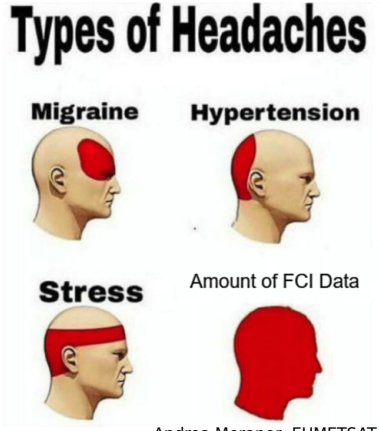

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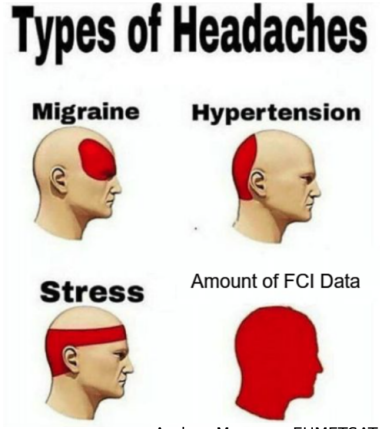

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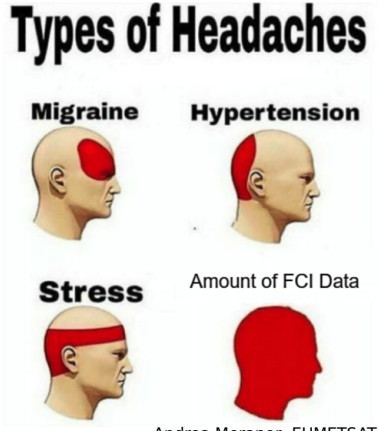

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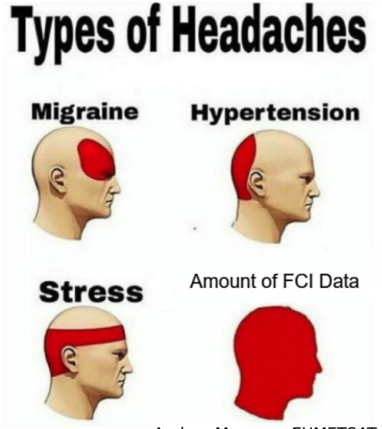

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Acknowledgements

Deutscher Wetterdienst
Wetter und Klima aus einer Hand

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