Pytroll

ECMWF, November 29th 2017
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What is Pytroll?

- Collection of FOSS python packages (GPLv3)
- For EO satellite data reading/processing/writing

- SatPy
- Pyresample
- Trollflow
- Trollmoves
- Pyorbital
- Pyspectral
- TrollImage
- Pytroll-Schedule
- ...

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Usual workflow

Sensing
Satellite

Reception
Ground station

Product
generation
Server

Visualisation
Workstation
Weather Satellite Data

- Each channel covers a narrow frequency band
- Different frequencies expose different features
Satellite Data

Look at a single channel for some feature
Satellite Data

Combine channels for more features
- High level processing for satellite data
- Both GEO and LEO
- Indexing by name or wavelength
- Many built-in composites
- Imagers, SAR, sounders
from glob import glob
from satpy.scene import Scene

# Load data by filenames
files = glob("/data/viirs_data/*\.h5")
scn = Scene(reader="viirs_sdr", filenames=files)
from glob import glob
from satpy.scene import Scene

# Load data by sensor
scn = Scene(sensor="modis", base_dir="/data/terra_data/")
# Automatically load composites and their dependencies
scn.load(['true_color'])

# Resample multi-band data to a uniform grid
rs_scn = scn.resample('euron1')

# Save RGB geotiff
rs_scn.save_dataset('true_color')
SatPy example

# Load single channels
scn.load(['M15', 0.6])

# Show a channel
scn.show('M15')

# Channel arithmetics
array = scn['M15'] + scn[0.6]
How does it work?

- Unified reader interface across sensors
- Default (usable) configuration files included
- Default RGB combinations included
- Integrated resampling features
- Replaced the base data structure with xarray and dask support in the github repo (feature-xarray branch)
Satellite data formats

- HDF4 - MODIS L1B
- HDF5 - VIIRS (SDR, Compact, L1B)
- HDF5 - FY3
- NetCDF - NWCSAF
- NetCDF - Sentinel & GOES
- AAPP
- NOAA GAC
- Metop PDF
- HRIT/LRIT
- SAR
- Add your own reader!
SatPy built-in composites
Pyresample for resampling

- Unprojected & Grid
- Proj.4, more than 130 different projections
- NN, bilinear, EWA, gaussian averaging methods
Satpy and Metadata

<xarray.DataArray 'astype-e3d8a3ed181f81e4a0296bd6fe458299' (y: 3712, x: 3712)
dask.array<concatenate, shape=(3712, 3712), dtype=float64, chunksize=(53, 3712)>

Coordinates:
* x (x) float64 -5.569e+06 -5.569e+06 -5.569e+06 -5.569e+06 ...
* y (y) float64 5.566e+06 5.566e+06 5.566e+06 5.566e+06 5.566e+06 ...

Attributes:
  units:                %
  wavelength:           (0.56, 0.635, 0.71)
  standard_name:        toa_bidirectional_reflectance
  platform_name:        Meteosat-10
  sensor:               seviri
  satellite_longitude:  0.0
  satellite_latitude:   0.0
  satellite_altitude:   35785831.0
  start_time:           2017-01-19 09:30:10.553000
  end_time:             2017-01-19 09:42:41.403000
  area:                 Area ID: some_area_name
  name:                 VIS006
  resolution:           3000.40316582
  calibration:          reflectance
  polarization:         None
  modifiers:            ()
  ancillary_variables:  []

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Results

- Common image formats
- Geotiff, Ninjo
- NetCDF/CF
Deployment and operations

- Python in operations at SMHI since 1997
- Pip with virtualenv, RPM packages on virtual server
- Running in Trollflow -> see next talk
Sharing your work

- Talk to us (Slack)
- Github is great
Background

- Small teams
- Same needs
- Same tools
Principles

- Modularity
- Reusability
- Maintainability
- KISS

Ease of use
PyTROLL

Pytroll is FOSS

Release early, release often

Packages available on
- Pypi
- Conda-Forge
- Github

> pip install satpy

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Pytroll is in the cloud

- Github
- Readthedocs
- Travis-CI
- Appveyor
- Coveralls
- Landscape.io

...
International collaboration

Pytroll Workshops

- SMHI
- DMI
- FMI
- SSEC
- DWD
- MeteoSwiss
- KNMI
- Met.No
- ...

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Thank you!

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nbviewer.jupyter.org/github/pytroll/pytroll-examples