Yori: a new, highly customizable set of tools for Level-3 data production

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Yori provides a set of tools to grid geophysical variables into Level-3 products regardless of the sensor used. The wide variety of options available within the software allows the users to customize the Level-3 products to meet their needs.
This software package has been developed under the NASA Atmosphere SIPS to support the various science teams.

How Yori Works

The gridding workflow with Yori is structured in three steps:

a. the user prepares the configuration and input files
b. the granules are gridded according to the user's instructions by `yori-grid`
c. the gridded granules are aggregated into the Level-3 products for the desired time period using `yori-aggr`.
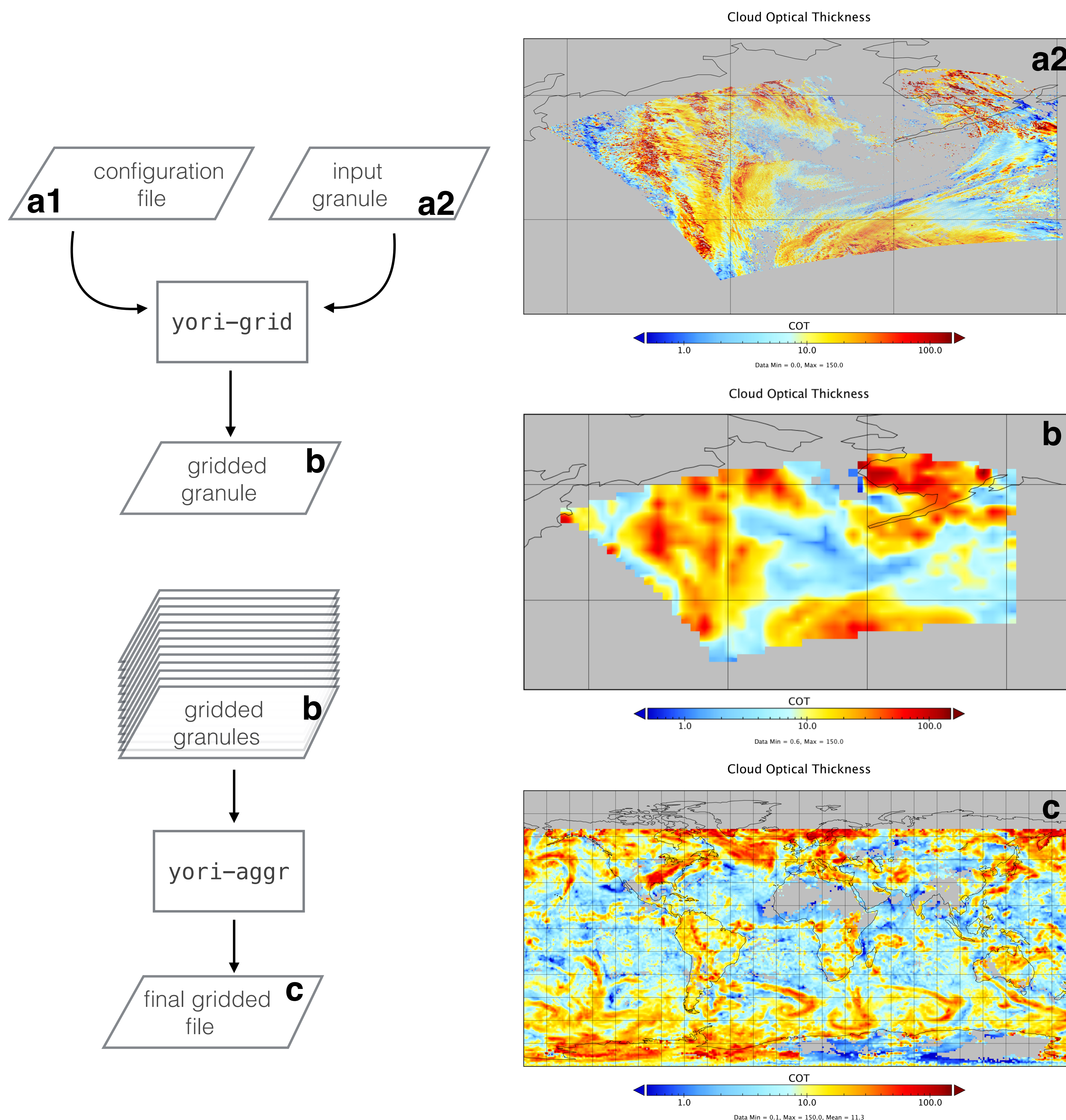
Setting up Yori

- the configuration file interfaces the user with Yori
- contains all the instructions to tell the software how to operate
- it is possible to define grid resolution, output variable names, attributes and more
- data can be filtered using "masks" (i.e. binary arrays that instruct the code to keep/discard a given pixel)

```
grid_settings:
  gridsize: 1
  projection: conformal
  lat_in: latitude
  lon_in: longitude
  fill_value: -999

variable_settings:

- name_in: Cloud_Optical_Thickness
  name_out: Cloud_Optical_Thickness_Combined
  attributes:
    - name: long_name
      value: Cloud Optical Thickness for Combined Phase Clouds
    - name: units
      value: none
    - name: _FillValue
      value: -999.0
    - name: valid_min
      value: 0.0
    - name: valid_max
      value: 150.0
    - name: scale_factor
      value: 1.0
    - name: add_offset
      value: 0.0
  masks:
    - Mask_Combined_Phase_Clouds

- name_in: Cloud_Effective_Radius_Liquid
  name_out: Cloud_Effective_Radius_Liquid
  attributes:
    - name: long_name
      value: Cloud Effective Radius for Liquid Water Clouds (Pri
    - name: units
      value: micron
    - name: _FillValue
      value: -999.0
    - name: valid_min
      value: 4.0
    - name: valid_max
      value: 30.0
    - name: scale_factor
      value: 1.0
    - name: add_offset
      value: 0.0
  masks:
    - Mask_Liquid_Water_Phase_Clouds
```

Cloud Optical Thickness

COT
1.0   10.0   100.0
Data Min = 0.0, Max = 150.0

Cloud Optical Thickness

COT
1.0   10.0   100.0
Data Min = 0.6, Max = 150.0

Cloud Optical Thickness

COT
1.0   10.0   100.0
Data Min = 0.1, Max = 150.0, Mean = 11.3

```
Group "Cloud_Optical_Thickness_Combined"

variables:
  double Pixel_Counts(longitude=360, latitude=180);
    :_FillValue = -999.0; // double

  double Mean(longitude=360, latitude=180);
    :long_name = "Cloud Optical Thickness for Combined Phase Clouds
    :units = "none";
    :_FillValue = -999.0; // double

  double Sum_Squares(longitude=360, latitude=180);
    :_FillValue = -999.0; // double

  double Sum(longitude=360, latitude=180);
    :_FillValue = -999.0; // double

  double Standard_Deviation(longitude=360, latitude=180);
    :long_name = "Cloud Optical Thickness for Combined Phase Clouds
    :units = "none";
    :_FillValue = -999.0; // double

// group attributes:
:long_name = "Cloud Optical Thickness for Combined Phase Clouds (Pri
:units = "none";
:_FillValue = -999.0; // double
:valid_min = 0.0; // double
:valid_max = 150.0; // double
:scale_factor = 1.0; // double
:add_offset = 0.0; // double
```

Output Data Structure:

- by default Yori computes *Mean, Standard Deviation, Pixel Count, Sum* and *Sum Squares* of each grid box for any input variable. An example is shown here on the right.
- In addition, it is possible to compute also *Histograms* and *Joint Histograms* for each grid box
- all these quantities are saved in groups to keep things clean when the number of variables increases

Features

- highly customizable by the user
- doesn't depend on a specific sensor
- output files are cf-compliant, so they can be easily visualized in tools such as Panoply
- naming is consistent with MODIS L3 to facilitate transition to VIIRS L3
- options are provided to deal with the international date line during daily aggregations
- easy data filtering using "masks"
- aggregation can be repeated on already aggregated files (e.g. from daily to monthly)

Online documentation available at: https://sips.ssec.wisc.edu/docs/yori.html

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