ISCCP and VIIRS: Adapting new instruments to extend historical climate data records - VGAC

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Request

- ***Are you interested in the VGAC product?***
- ***<u>Contact us</u> so we can partner on a solution!***

Summary

The challenges of working with VIIRS data hinder users, so we have developed a version of VIIRS for ISCCP called VGAC *[VIIRS Global Area Coverage]*, which re-projects and reformats the data in a way that might be useful to others.

Challenges of VIIRS

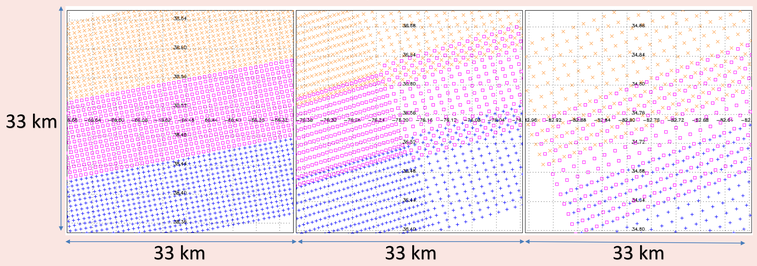
- Swaths overlap by as much as 50%. Thus, adjacent pixels are not adjacent in space.
- Spatial resolution changes with scan angle.
- Scans not perpendicular to satellite path.
- Numerous files needed to process just 1 orbit.
- Resolution too fine for most large-scale global processing.
- File sizes are burdensome.
- Breaks the climate data record processing by:
  - Requiring new algorithms.
  - Significantly changing resolution.

Next steps…

- Determine best source for VIIRS input data
  - NOAA CLASS?
    - *Lots of files, lots of orders, …*
  - NASA/SSEC Atmosphere SIPS?
    - *All online, web accessible folder!*
- Begin large-scale VGAC data production
- Create ingest algorithms for ISCCP
- Work with partners to share data

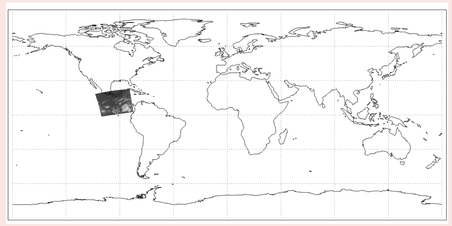
Working with VIIRS …

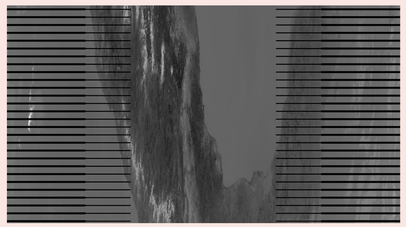
3 swaths (orange, magenta, blue) from a VIIRS granule: each swath has 16 lines of data



The push-broom design of each swath results in scanlines diverging at swatch edge (the "bow tie" effect). This results in pixels between swaths overlapping to a large degree, even after satellite providers trim certain portions of lines. This spatial pattern diverges from AVHRR-like simpler data.
Are adjacent pixels really adjacent? … rarely
Are two separate pixels really measuring a different location? … not always

… data by SDR granule …





SDR (Sensor Data Record) granules are generally 6-minute segments of data. The images above provide a sample of how large that is (left) and the raw image of the data swaths (with trimmed portions of swath in black). Data for each channel are stored separately as is the geolocation information.
This results in hundreds of files per orbit to process. NOAA CLASS limits orders by the number of files … generally < 2000. So one can't order a week without submitting multiple orders. This limits the ability of many to process large amounts of VIIRS data.

… is challenging.

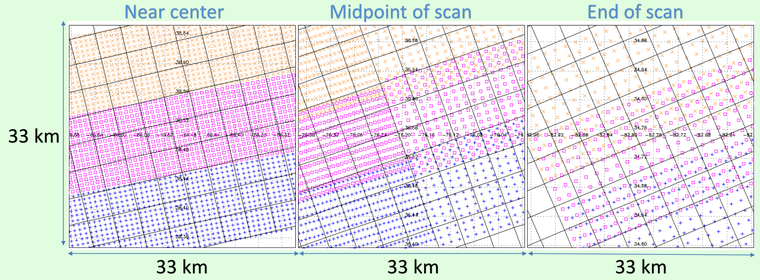
Most users can't …
… process VIIRS with historic algorithms.
… order more than a week's worth of data at a time.
… store much VIIRS data.

Considering just 2 channels

	# of files	Size (TB)
1 day	750	0.03
1 month	~23,000	1
1 year	~270,000	12

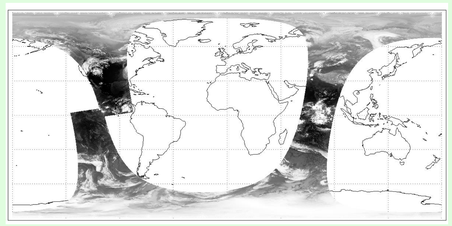
Working with VGAC …

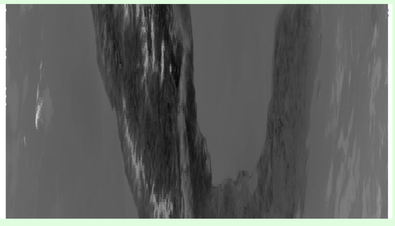
Black lines represent grid cells of the VGAC with nearly constant 3.9 km spacing



An equal area grid is defined parallel and perpendicular to the satellite track.
Grid size remains constant for the entire scan length.
Provide same geolocation data as current SDR (lat, lon, solar and viewing angles).
For IR and VIS channel, will also store sub-grid cell variability.
Can map a position to satellite grid cell using equations (allows forward and backward mapping).

… data by orbit …





Data are stored by orbit.

No missing data in trimmed swaths.

About 14 orbits per day.

VGAC = VIIRS Global Area Coverage

… is easier.

Designed for large-scale, global climatological use.
Not everyone needs 750-m resolution of the entire Earth.
This is VIIRS data for the rest of us.

Considering just 2 channels

	# of files	Size (TB)
1 day	14	0.001 (1.1GB)
1 month	440	0.03 (34 GB)
1 year	5,300	0.40 (413 GB)

1 month of VGAC < 1 day of VIIRS SDR