AIRS Applications Status

Sharon Ray JPL

October 2015

Tom Pagano, Eric Fetzer, Bjorn Lambrigtsen, Joao Teixeira
Ed Olsen, Steve Licata, Jeff Hall, Charles Thompson



Level 4 Applications

NASA EOS L4:
Modeled output or variables derived from multiple measurements

Drought	S. Granger/A. Behrangi, JPL *drought indicator based on VPD* AghaKouchak/Farahmand, UCI *drought prediction using SRHI* J. Roundy, U of Kansas *drought monitoring/prediction using Coupling Drought Index*
Dengue Fever	D. Drewry, JPL *assess outbreak risk*
Volcanic Ash & Dust	Sergio DeSouza Machado, UMBC *volcanic ash burden, distinguish from dust*
Volcanic SO2	Sergio DeSouza Machado, UMBC *SO2 retrieval based on L3 climatology (Scott Hannon UMBC)*

NASA Applied Sciences Workshop, June 2015

"Defining the Success in the Future for the Health and Air Quality Program"

Sue Estes – NASA Applied Sciences Public Health Deputy Program Manager under John Haynes, MSFC Applied Science Team

- HAQ program also focuses on climate change on health and air quality
- HAQ will examine these health grand challenges: malaria, vector-borne disease, cyanobacterial blooms
- HAQ will examine these air quality grand challenges: accurate ground-level measurements from total column values; ozone levels
- capacity building goals: HAQ will be a "go-to" program for vector-borne disease/infectious disease/environmental health risks, and dangerous pollution events
- Internally, ESD will rely on HAQ for leadership during development phase of all new missions

Map Development Infrastructure & Pipeline

Great Team

& more of their time for FY16

- Data Visualization, Programming Support, Climatologies (L3), Stats, Problem Solving: Ed Olsen, Steve Licata
- GIRI, GIBS Prep & Data Visualization: Jeff Hall
- GIBS & Data Visualization Advisor: Charles Thompson
- Management & Science Advisors: Tom Pagano, Eric Fetzer, Bjorn Lambrigtsen, Joao Teixeira

Plus additional programming and science support at JPL and outside

Map Creation Pipeline

1. rapid color table prototyping

- create grayscale RGB map with L3 data
- stats from climatologies for initial scaling/thresholding values
- Photoshop gradient tool to paint color on grayscale RGB maps
- Iterate until Project approves

2. create 1 years worth of maps

- internal development server
- multiple smoothing approaches

3. review

- use simply display client tool customized for quick review
- verify color table holds across seasons
- select smoothing approach

4. approve

- AIRS Project sign-off
- Determine if public or private, and if NRT

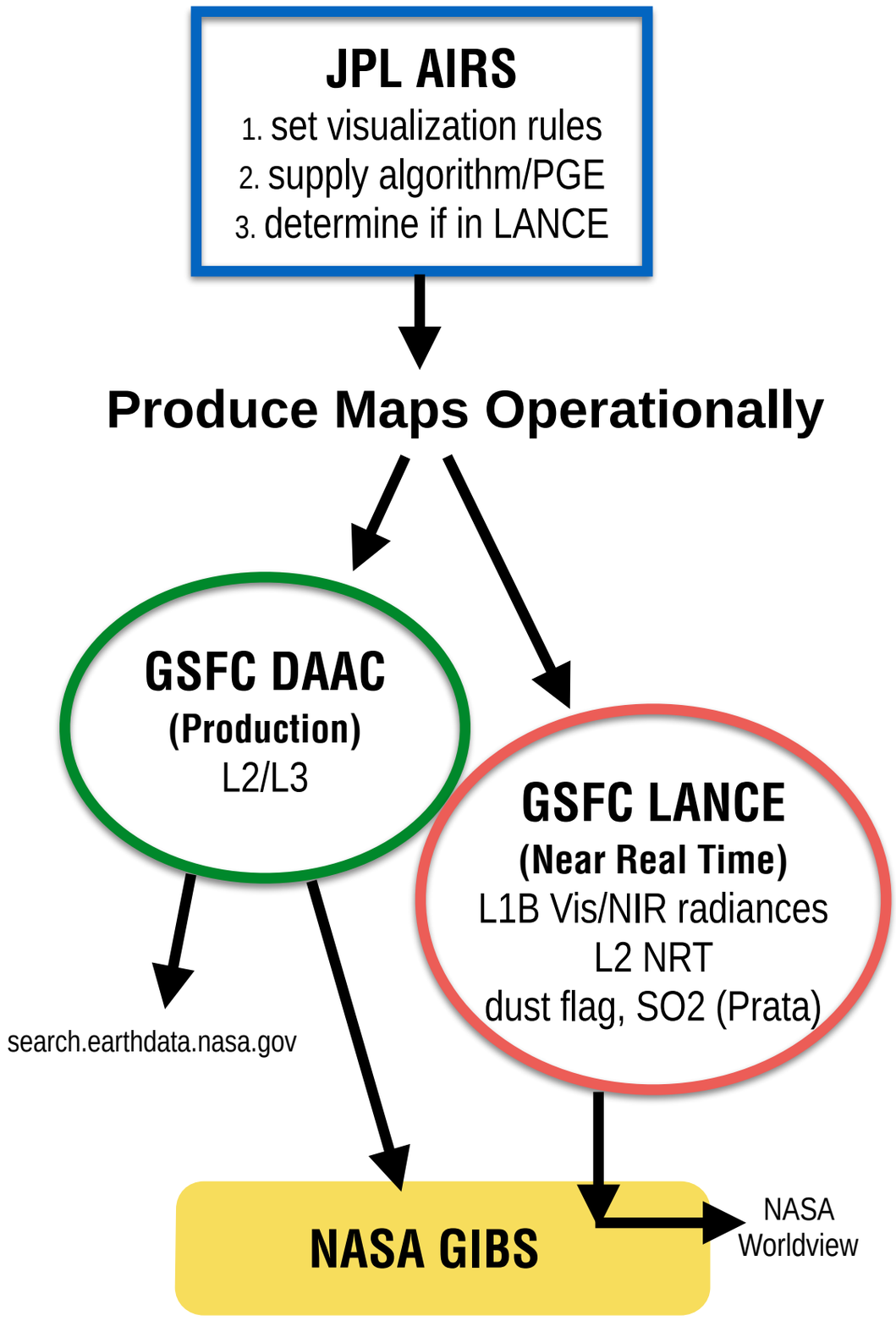
5. operational map production

a) public: LANCE/GES DAAC
b) private: JPL internal server only

6. integrate into AIRS browse tool

Operational Production - Publicly Accessible:

AIRS Maps to GIBS *via LANCE & DAAC*



JPL AIRS Project

- establish visualization rules
- transition long-term routine processing to GSFC after trial period
- determine if should be available via LANCE NRT
- supplies PGE or Image Generation Algorithms to LANCE/DAAC for use in their routine production system
- sign off on all products destined for GIBS

GSFC Production (DAAC)

- produce AIRS L2 and L3 imagery according to JPL visualization rules
- Giovanni used to automate map production of L3
- deliver images to GIBS
- (in the future, details are being worked) supply browse images to *search.earthdata.nasa.gov*
- run unique PGEs (ex. Juying Warner's CO, SO2 burden)

GSFC Near Real-Time (LANCE)

- produce L1B NRT Vis/NIR radiances, dust flag, SO2 Prata algorithm
- produce L2 NRT imagery according to JPL visualization rules
- produce AIRS/MODIS NRT products
- send imagery to GIBS

  Note the following:
  - AIRS Project will determine which products are available via LANCE
  - LANCE's ability to produce maps will be affected by resource availability
  - When a product is in LANCE it is automatically transitioned into WorldView
  - Level 4 data files are not required to be publicly available for a map

Tools

1 – AIRS Applications Browse Tool

Purpose:

1) allow quick access to AIRS imagery
2) overlay 4 layers
3) pulls from NASA GIBS archive

CREDIT:
MOOREBOECK

Status:

Almost done! Waiting to complete final piece after new maps in GIBS

But wait there's more:

NASA GIBS publicly available imagery

– *But what about imagery in development?*

AIRS BROWSE TOOL

Pulls maps from 2 sources

PUBLIC MAPS

- NASA GIBS Facility
- Publicly accessible Earth imagery from NASA missions

PRIVATE MAPS

- For applications in development
- JPL internal access only
- Local AIRS GIBS Clone @ JPL

NASA Satellite Data Shows | AIRS: Map

https://airs-dev.jpl.nasa.gov/map

Apps | JPL/NASA | AIRS | CCS | AWS S3 | Weather/Hazards | My Climate Talk | Total Ozone Climatol | snowy night | Image Galleries | Resources | DVA+ | Kids | Other Bookmarks

Jet Propulsion Laboratory
California Institute of Technology

EMMA
Earth Maps for Applications

Imagery for decision makers from the Atmospheric Infrared Sounder Project at NASA's Jet Propulsion Laboratory

CREATE YOUR MAP | ABOUT THE TOOL

Featured Datamap

January 14, 2015

Scelerisque ac! Magnis arcu porttitor ultrices a etiam, a odio sed natoque augue sagittis proin, tincidunt, aliquet dapibus.

ADD LAYER | ?

AIRS: Map

https://airs-dev.jpl.nasa.gov/map

Apps | JPL/NASA | AIRS | CCS | AWS S3 | Weather/Hazards | My Climate Talk | Total Ozone Climatol | Image Galleries | Resources | DVA+ | Kids | Radio | Other Bookmarks

Projection

- Geographic
- South Polar
- North Polar
- Mercator

Select up to 4 layers

all theme | all product | search

Carbon Monoxide

- Carbon Monoxide (CO) Total Column (Day)
- Carbon Monoxide (CO) Total Column (Night)

Sulfur Dioxide

- Sulfur Dioxide (SO2) Index (Day)
- Sulfur Dioxide (SO2) Index

Dust Score

- Dust Score

Relative Humidity

- *Relhum Day 11s*
- *Relhum Night 3d 9s*

CREATE MAP | CANCEL

ADD LAYER

October 5, 2015

Carbon Monoxide (CO) Tc

Placeholder color bar (200x50)

365 370 375 380

NASA Satellite Data Show | AIRS: Map

https://airs-dev.jpl.nasa.gov/map

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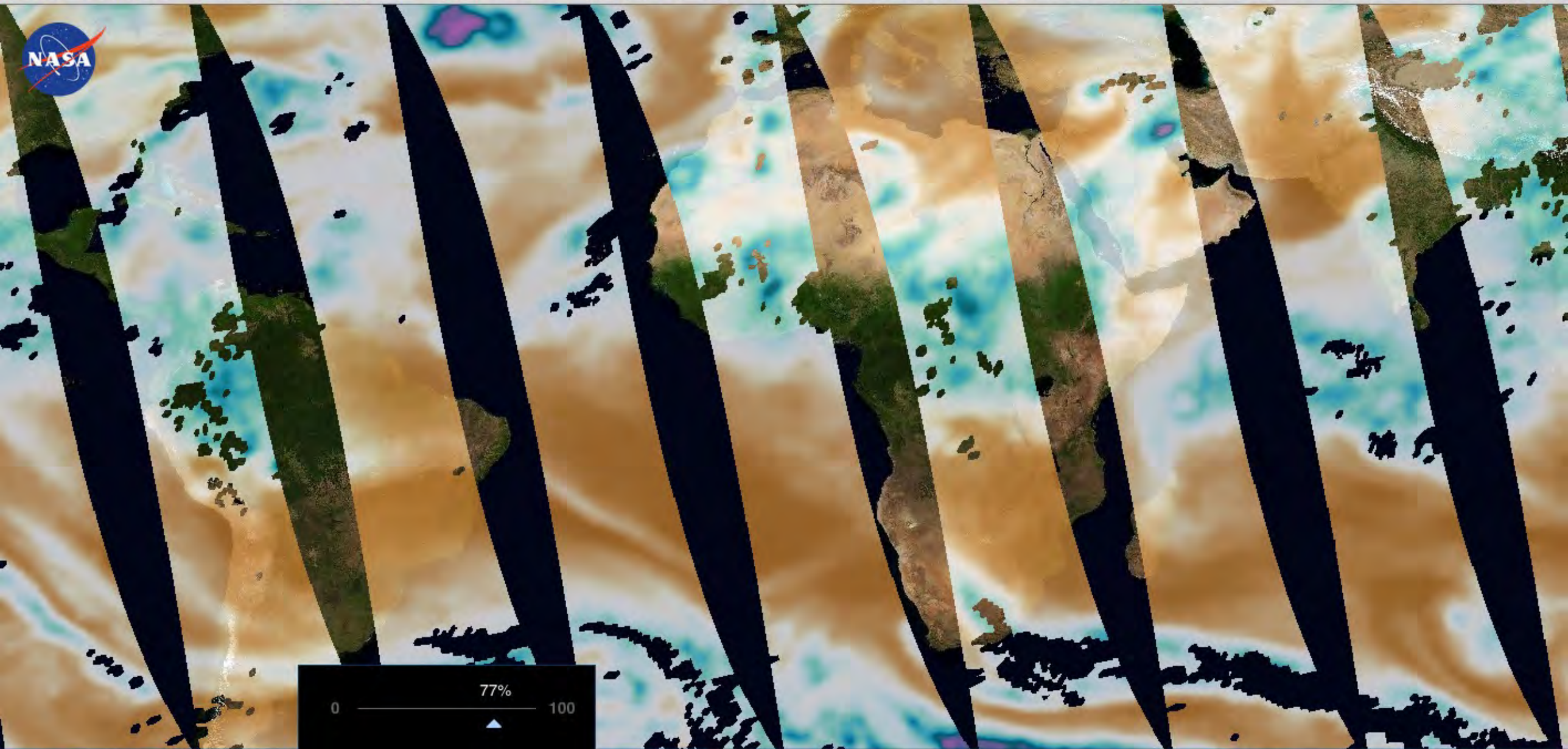

NASA Satellite Data Show | AIRS: Map

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Apps | JPL/NASA | AIRS | CCS | AWS S3 | Weather/Hazards | My Climate Talk | Total Ozone Climato | snowy night | Image Galleries | Resources | DVA+ | Kids | Other Bookmarks

Carbon Monoxide (CO)
Total Column (Night)

Placeholder color bar (200x50)
365 370 375 380

Carbon Monoxide (CO)
Total Column (Day)

Placeholder color bar (200x50)
365 370 375 380

Sulfur Dioxide (SO2)
Index (Day)

Placeholder color bar (200x50)
365 370 375 380

Relhum Day 11s

(No color bar provided)

ADD LAYER

August 31, 2015

2 – AIRS Data Explorer Simple Display Tool

Purpose:

1) verify local GIBS clone working
2) customize to allow efficient review of new color tables
   - reviewers verify color table holds across all seasons
   - reviewers select smoothing level, if any

Within the tool:

1. select a date using calendar feature
2. For each date, available imagery:
   - single day, ascending and descending
   - 3-day average
   - 6 smoothing levels (boxcar averaging, none to 11px)

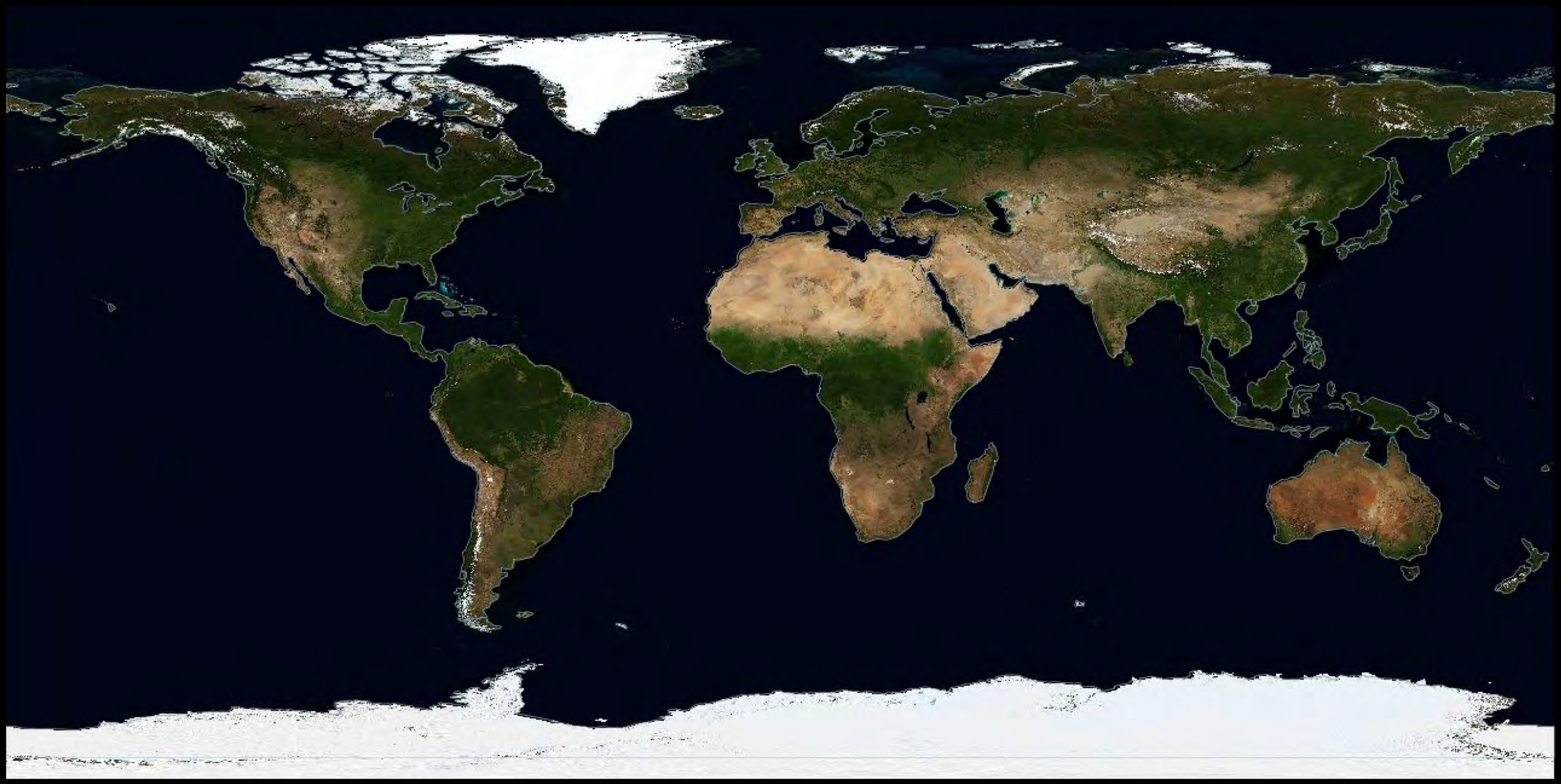
CREDIT:
JEFF HALL
GEORGE CHANG
JOHN GIESELMAN
JOE ROBERTS

AIRS Data Explorer

datamaps.jpl.nasa.gov/airs-20150928/#v=0.1&x=-2.2150628&y=3.2380063&z=1&p=EPSG%3A4326&d=2015-05-13T19%3A30%3A00&l=Coastlin…

Apps | JPL/NASA | AIRS | CCS | AWS S3 | Weather/Hazards | My Climate Talk | Total Ozone Climatol | Image Galleries | Resources | DVA+ | Kids | Radio | Other Bookmarks

AIRS Data Explorer



3000 km

Position: -108.51°, 23.23°

AIRS Data Explorer

datamaps.jpl.nasa.gov/airs-20150928/#v=0.1&x=-2.2150628&y=3.2380063&z=1&p=EPSG%3A4326&d=2015-05-13T19%3A30%3A00&l=Coastlin…

Apps | JPL/NASA | AIRS | CCS | AWS S3 | Weather/Hazards | My Climate Talk | Total Ozone Climatol | Image Galleries | Resources | DVA+ | Kids | Radio | Other Bookmarks

25

13 May 2015

May 2015

26	27	28	29	30	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	1	2	3	4	5	6

June 2015

31	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	1	2	3	4

July 2015

28	29	30	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	1

August 2015

26	27	28	29	30	31	1

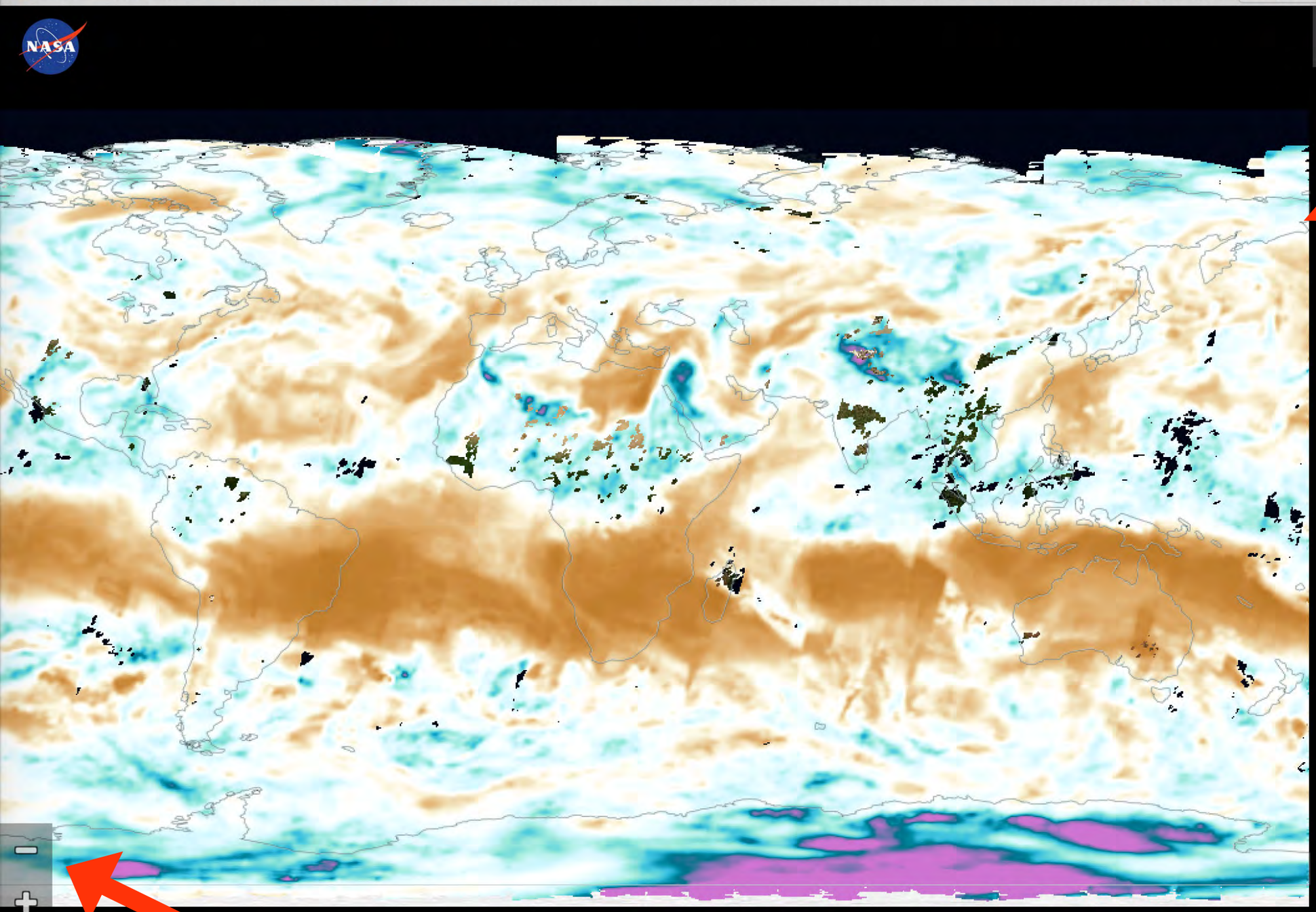
3000 km

Position: 146.59°, 90°

AIRS Data Explorer

datamaps.jpl.nasa.gov/airs-20150928/#v=0.1&x=-2.2150628&y=3.2380063&z=1&p=EPSG%3A4326&d=2015-08-04T19%3A30%3A00&l=Coastlin…

Apps | JPL/NASA | AIRS | CCS | AWS S3 | Weather/Hazards | My Climate Talk | Total Ozone Climatol | Image Galleries | Resources | DVA+ | Kids | Radio | Other Bookmarks



3000 km

Position: 158.42°, 90°

My Data

Select data to overlay. Expanding each item allows you to change transparency and view legends for the data.

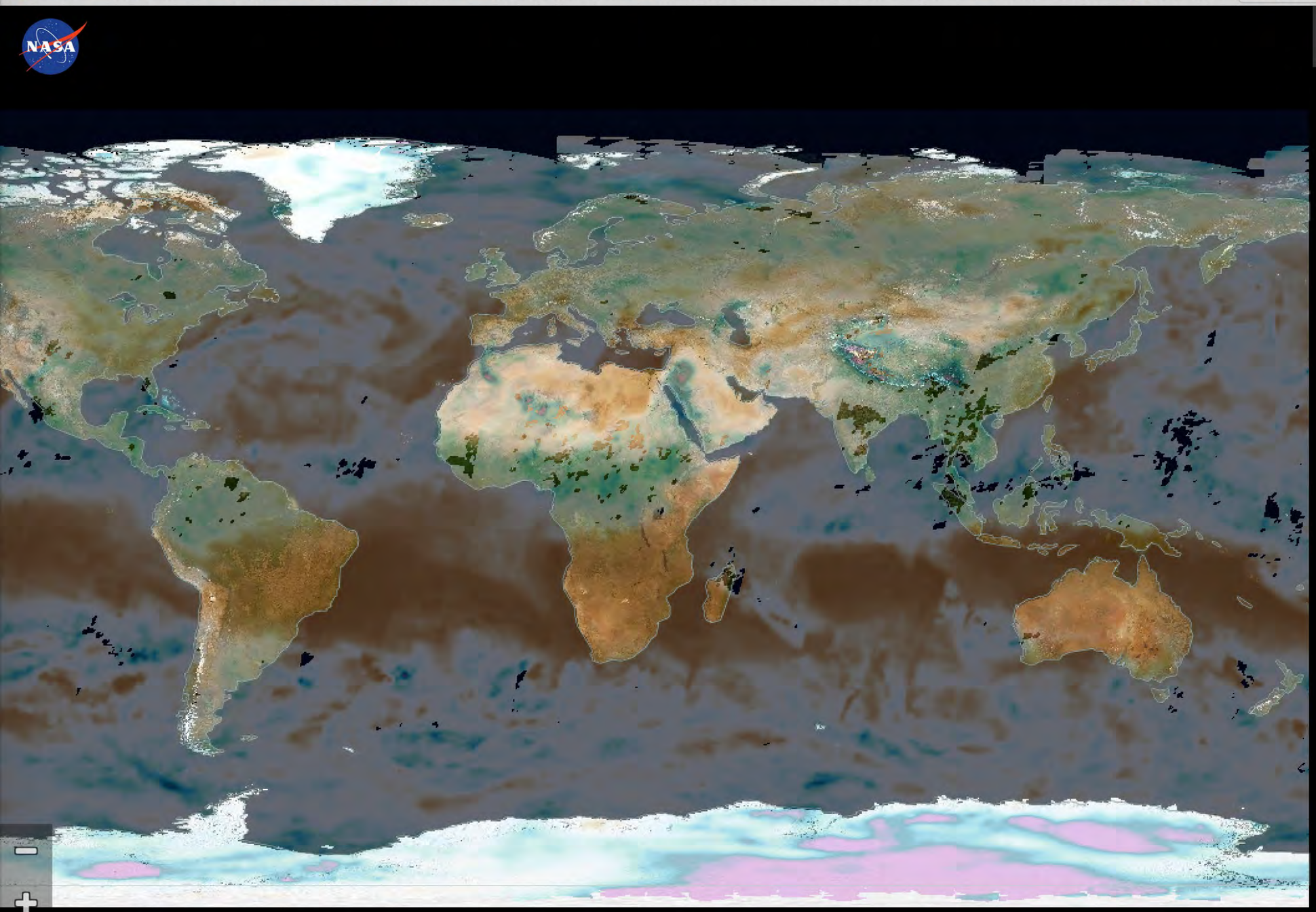
All | Active | Filter...

- Coastlines
- relhum_5[illegible]0_night_3d_9s
- relhum_500_night_3d_7s
- relhum_500_night_3d_5s
- relhum_500_night_3d_3s
- relhum_500_night_3d_1s
- relhum_500_night_3d_11s
- relhum_500_night_1d_9s
- relhum_500_night_1d_7s
- relhum_500_night_1d_5s

AIRS Data Explorer

datamaps.jpl.nasa.gov/airs-20150928/#v=0.1&x=-2.2150628&y=3.2380063&z=1&p=EPSG%3A4326&d=2015-08-04T19%3A30%3A00&l=Coastlin...

Apps | JPL/NASA | AIRS | CCS | AWS S3 | Weather/Hazards | My Climate Talk | Total Ozone Climatol | Image Galleries | Resources | DVA+ | Kids | Radio | Other Bookmarks



25

My Data

Select data to overlay. Expanding each item allows you to change transparency and view legends for the data.

All | Active | Filter...

- Coastlines
- relhum_500_night_3d_9s
  - 0% | 50% | 100%
- relhum_500_night_3d_7s
- relhum_500_night_3d_5s
- relhum_500_night_3d_3s
- relhum_500_night_3d_1s
- relhum_500_night_3d_11s
- relhum_500_night_1d_9s
- relhum_500_night_1d_7s

3000 km

Position: 153.91°, 90°

JPL Section 398

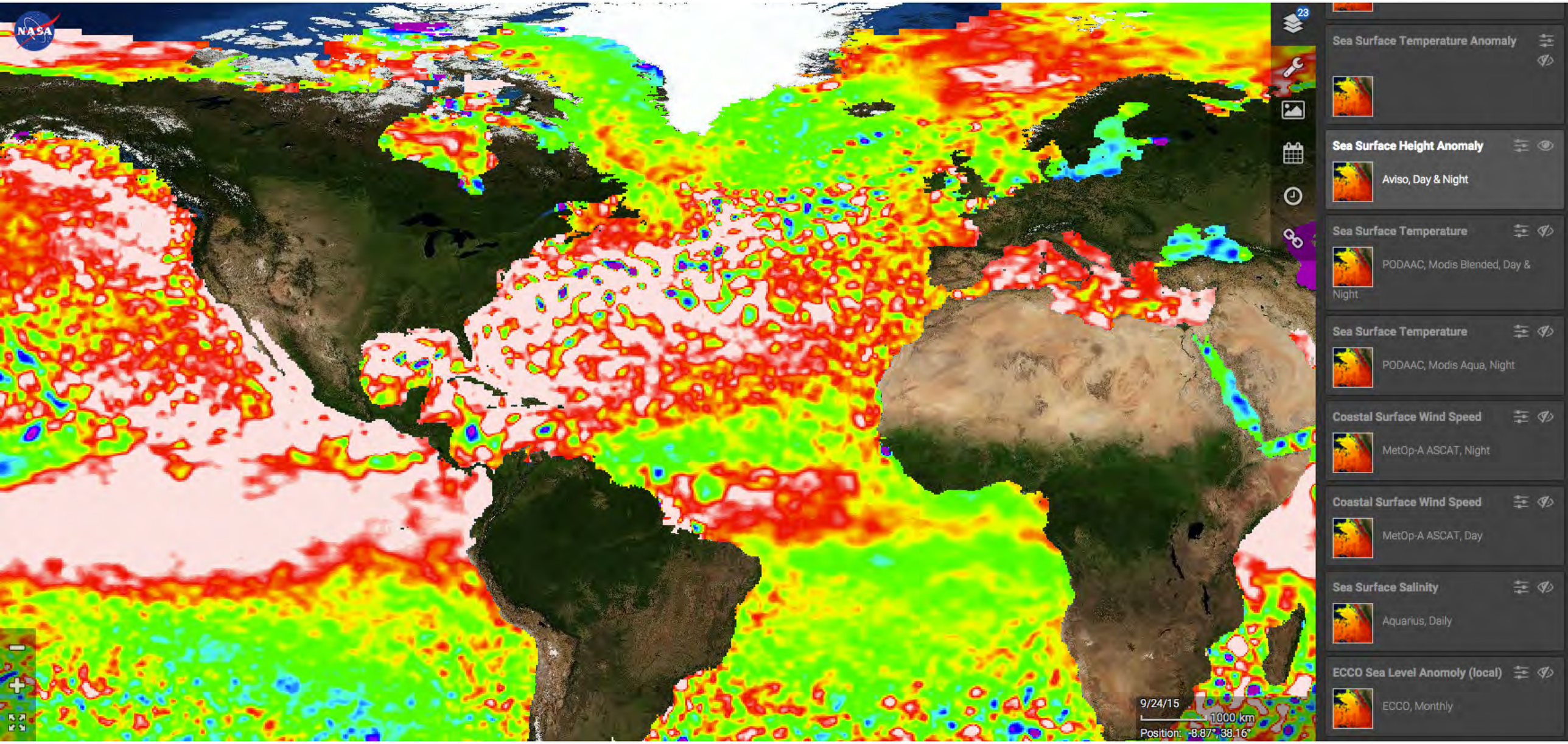
3 – Common Mapping Client

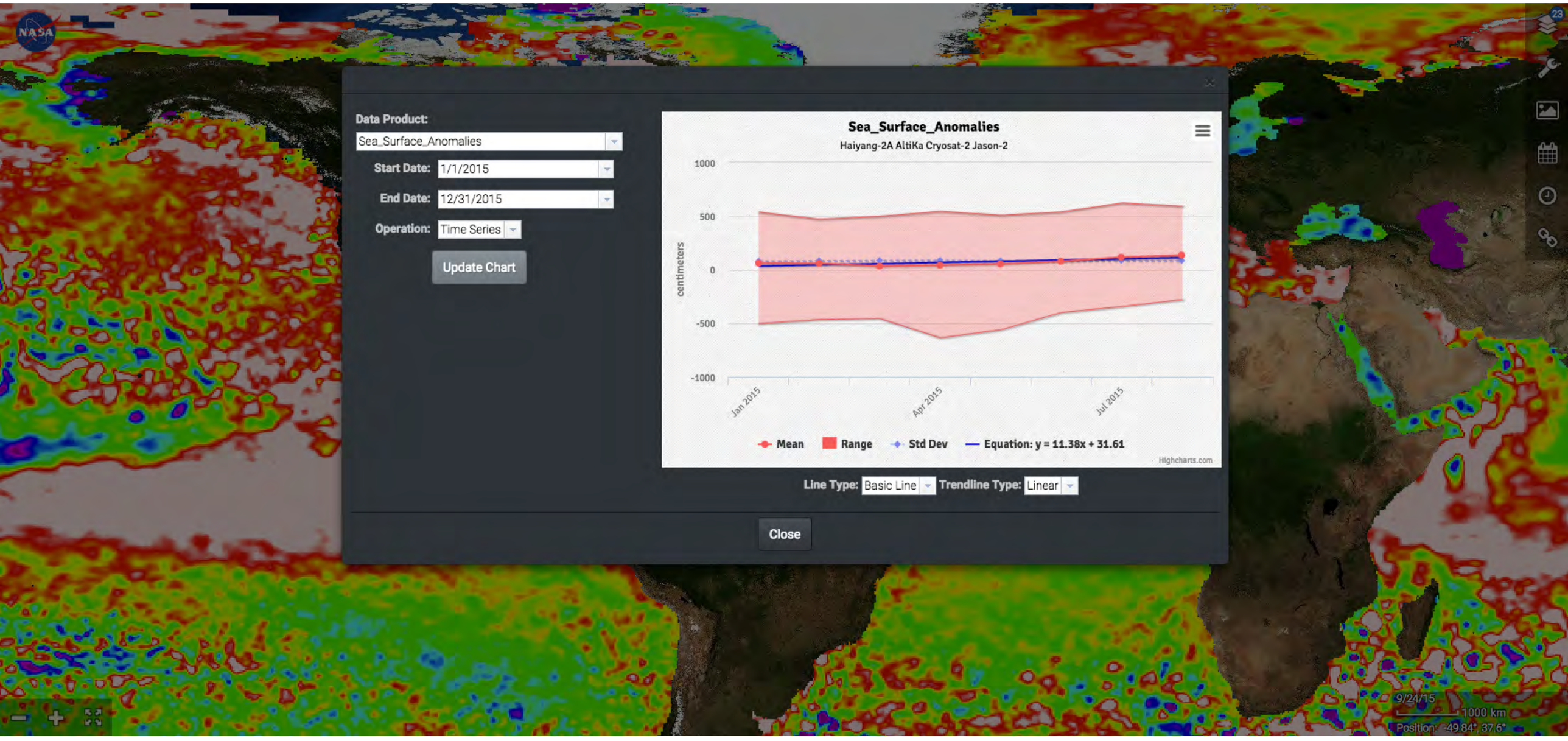
Data Analysis Tool

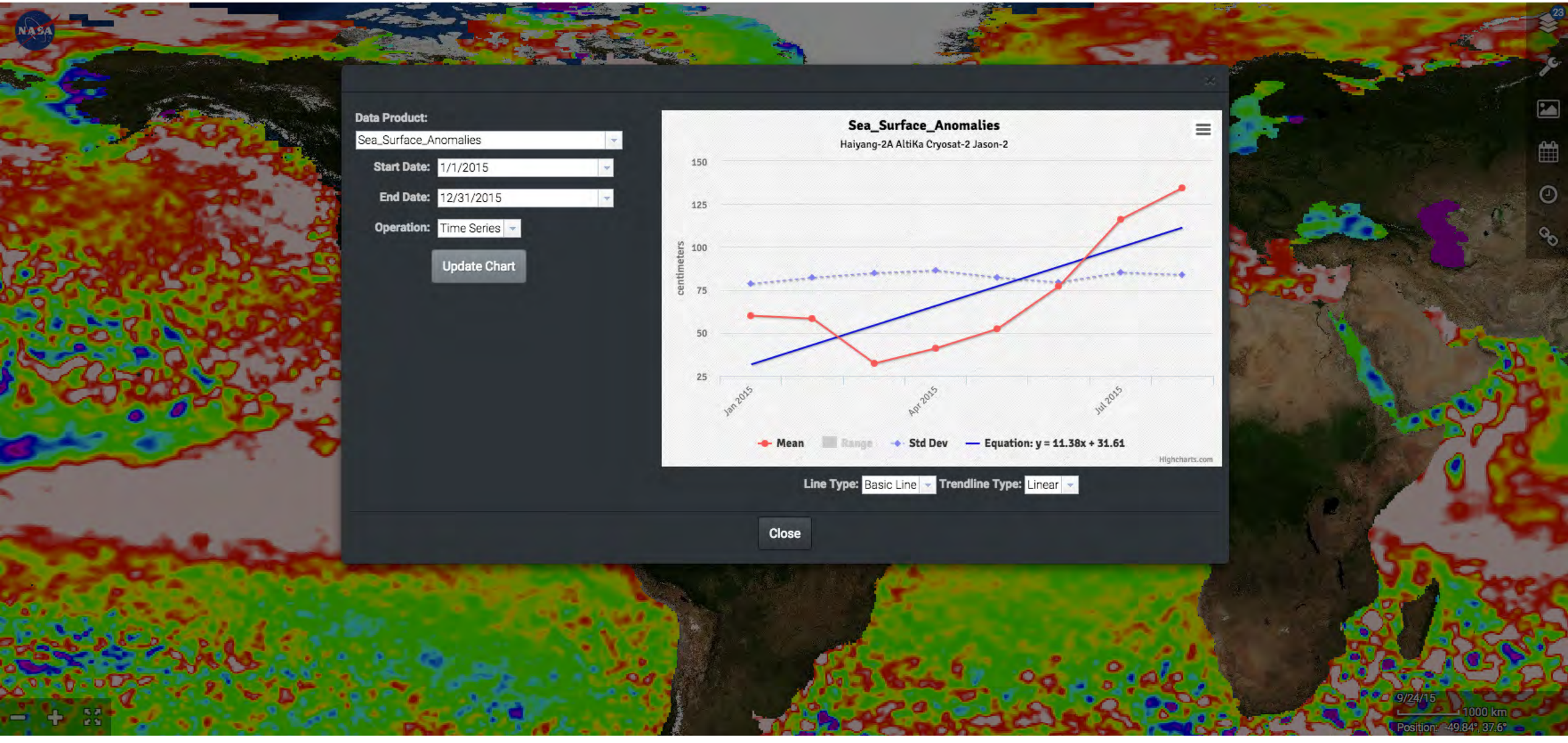
A “universal” analysis tool that allows for customization

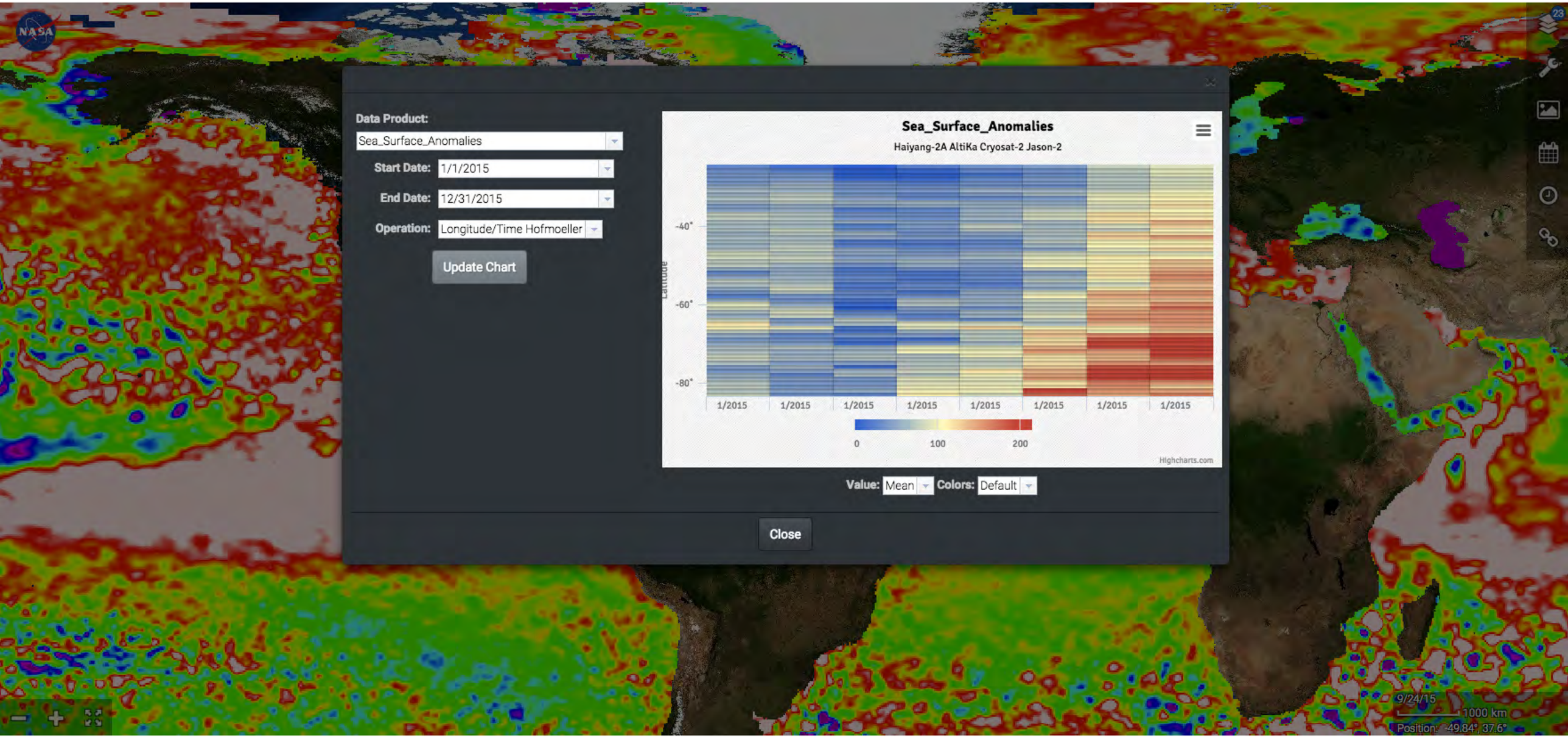
- Browser-based framework to interact with GIS (geographical information systems) and science data systems to display, visualize, and analyze science data
- Cross-platform compatible with modern browsers
- Operational tool for both Earth and Planetary data (SMAP, Mars, Vesta, etc)
- Provides both 2D maps and 3D globe views
- Uses OGC (Open Geospatial Consortium) protocols for retrieving images and map tiles
- Designed to be extensible and adaptable to project needs

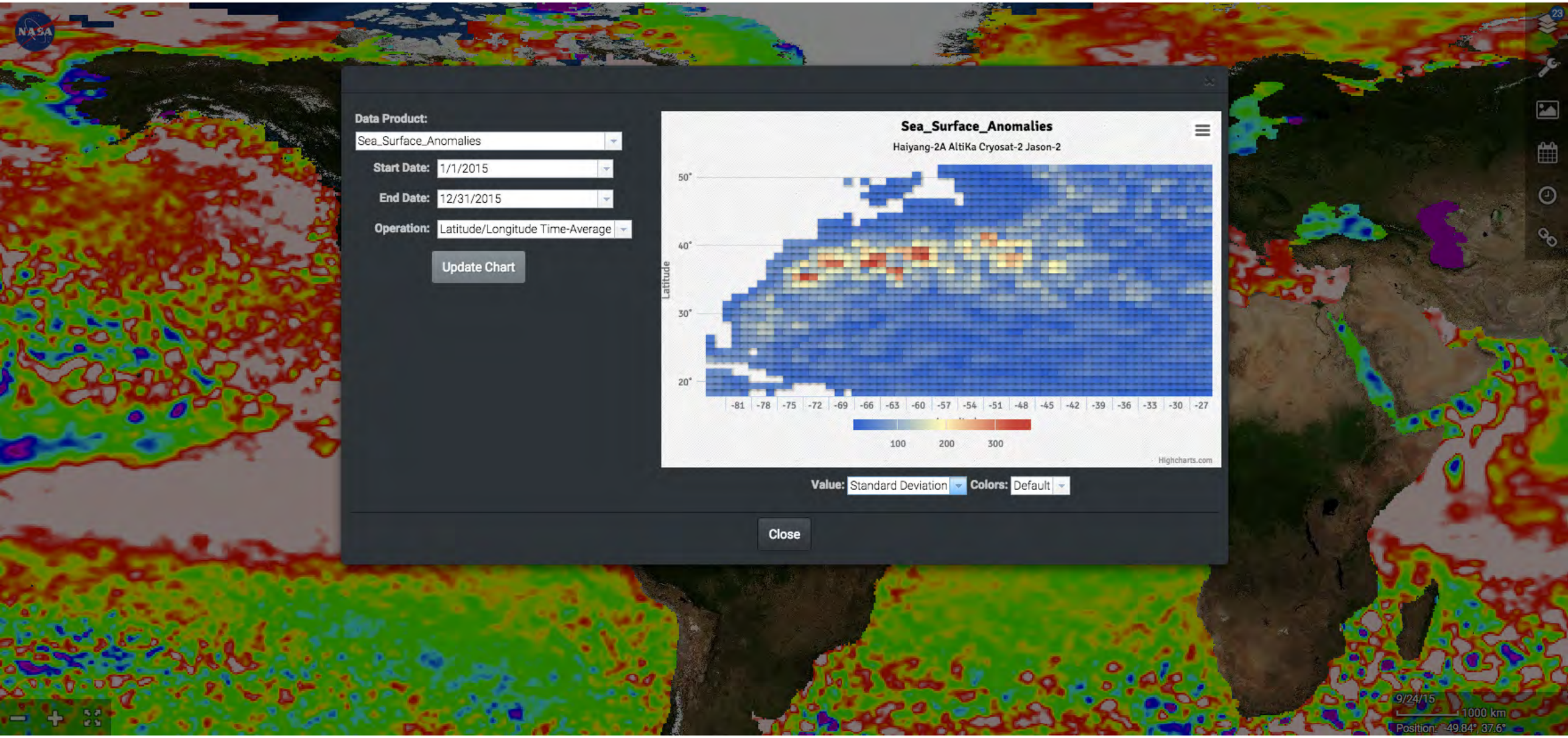
Leverage development & customize for AIRS


NASA
23
Sea Surface Temperature Anomaly
Sea Surface Height Anomaly
Aviso, Day & Night
Sea Surface Temperature
PODAAC, Modis Blended, Day & Night
Sea Surface Temperature
PODAAC, Modis Aqua, Night
Coastal Surface Wind Speed
MetOp-A ASCAT, Night
Coastal Surface Wind Speed
MetOp-A ASCAT, Day
Sea Surface Salinity
Aquarius, Daily
ECCO Sea Level Anomoly (local)
ECCO, Monthly
9/24/15
1000 km
Position: -8.87°, 38.16°


Data Product:
Sea_Surface_Anomalies
Start Date: 1/1/2015
End Date: 12/31/2015
Operation: Time Series
Update Chart
Sea_Surface_Anomalies
Haiyang-2A AltiKa Cryosat-2 Jason-2
1000
500
0
-500
-1000
centimeters
Jan 2015
Apr 2015
Jul 2015
Mean
Range
Std Dev
Equation: y = 11.38x + 31.61
Highcharts.com
Line Type: Basic Line
Trendline Type: Linear
Close
9/24/15
1000 km
Position: -49.84°, 37.6°

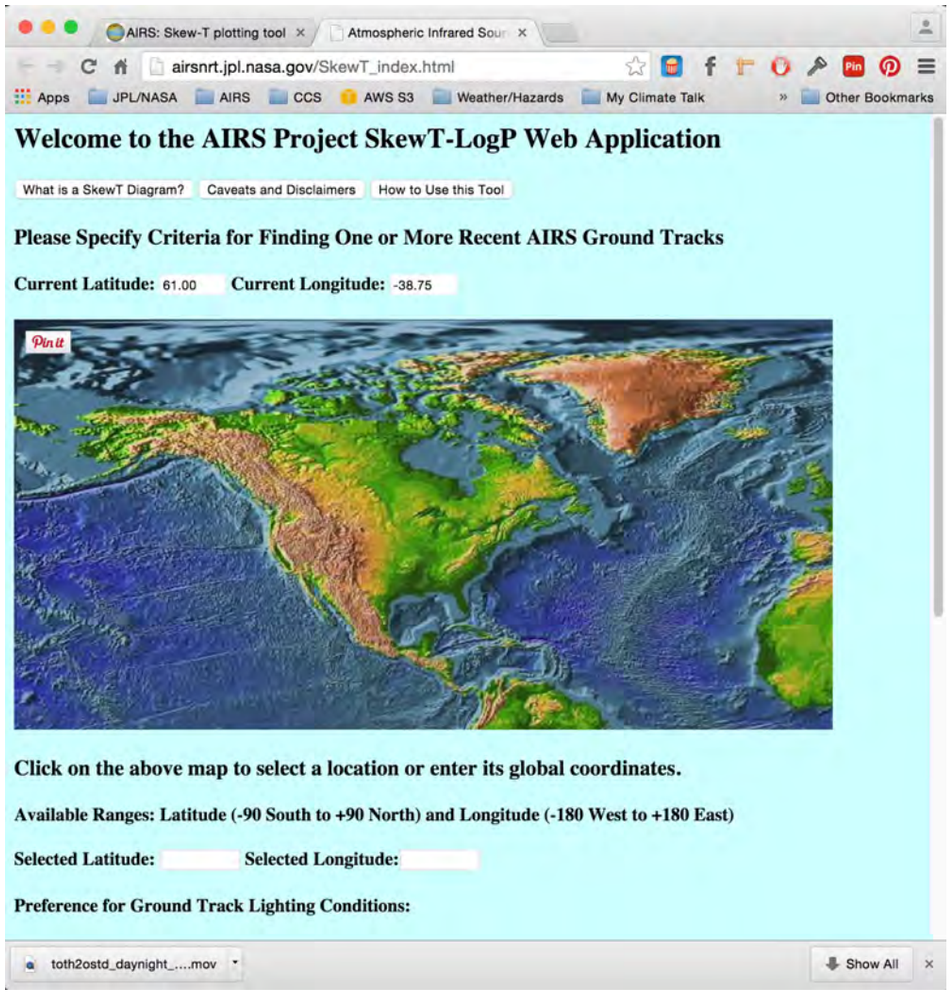

Data Product:
Sea_Surface_Anomalies
Start Date: 1/1/2015
End Date: 12/31/2015
Operation: Time Series
Update Chart
Sea_Surface_Anomalies
Haiyang-2A AltiKa Cryosat-2 Jason-2
centimeters
150
125
100
75
50
25
Jan 2015
Apr 2015
Jul 2015
Mean
Range
Std Dev
Equation: y = 11.38x + 31.61
Highcharts.com
Line Type: Basic Line
Trendline Type: Linear
Close
9/24/15
1000 km
Position: -49.84°, 37.6°

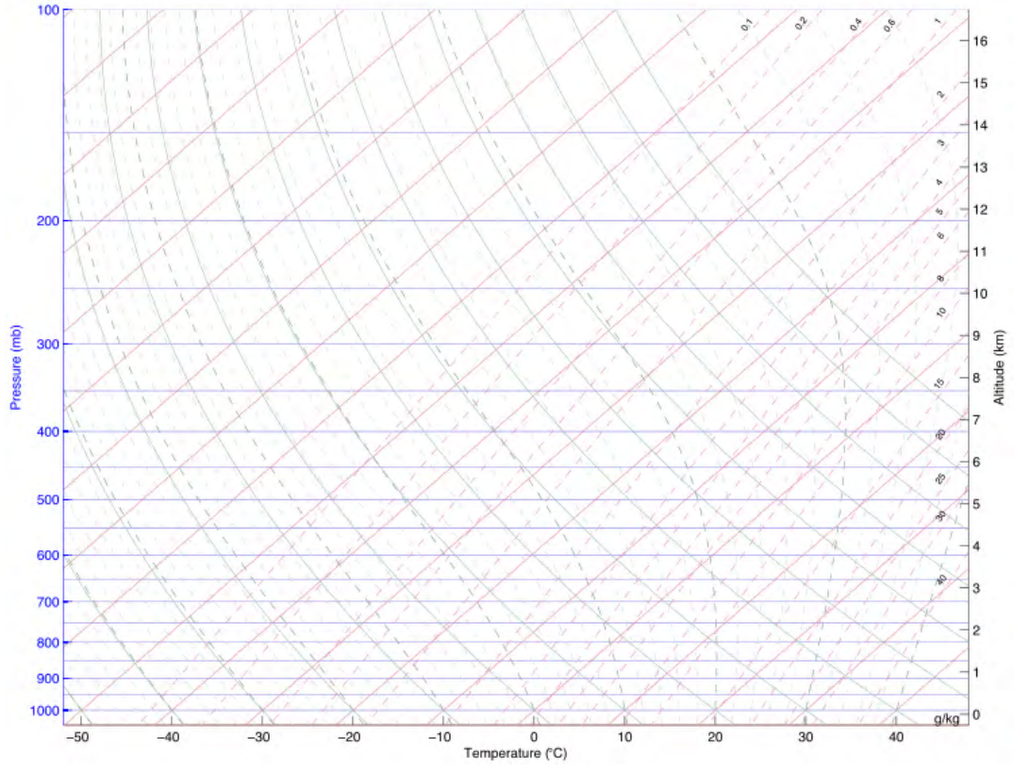

Data Product:
Sea_Surface_Anomalies
Start Date: 1/1/2015
End Date: 12/31/2015
Operation: Longitude/Time Hofmoeller
Update Chart
Sea_Surface_Anomalies
Haiyang-2A AltiKa Cryosat-2 Jason-2
-40°
-60°
-80°
Latitude
1/2015
1/2015
1/2015
1/2015
1/2015
1/2015
1/2015
1/2015
0
100
200
Highcharts.com
Value: Mean
Colors: Default
Close
9/24/15
1000 km
Position: -49.84°, 37.6°


Data Product:
Sea_Surface_Anomalies
Start Date: 1/1/2015
End Date: 12/31/2015
Operation: Latitude/Longitude Time-Average
Update Chart
Sea_Surface_Anomalies
Haiyang-2A AltiKa Cryosat-2 Jason-2
Latitude
50°
40°
30°
20°
-81 -78 -75 -72 -69 -66 -63 -60 -57 -54 -51 -48 -45 -42 -39 -36 -33 -30 -27
100 200 300
Highcharts.com
Value: Standard Deviation
Colors: Default
Close
9/24/15
1000 km
Position: -49.84°, 37.6°

4 – AIRS Skew-T Tool update

- Already installed on AIRS web site
- Improve the user interface
- Add ability for users to input their own NST
- Get the word out
- Installed Google analytics





New Maps

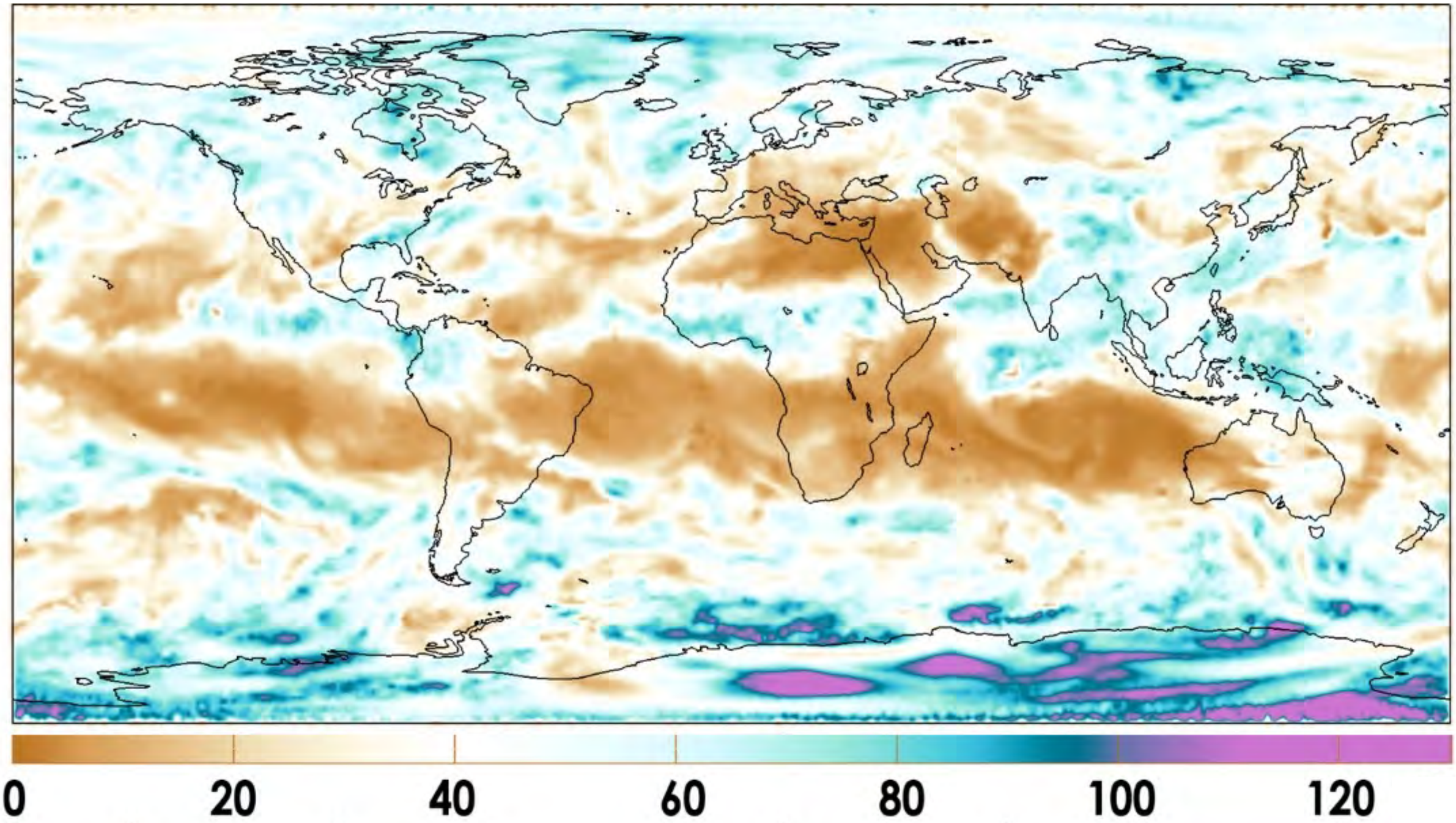
what do we want the map to communicate?

color table: global, and must hold across seasons

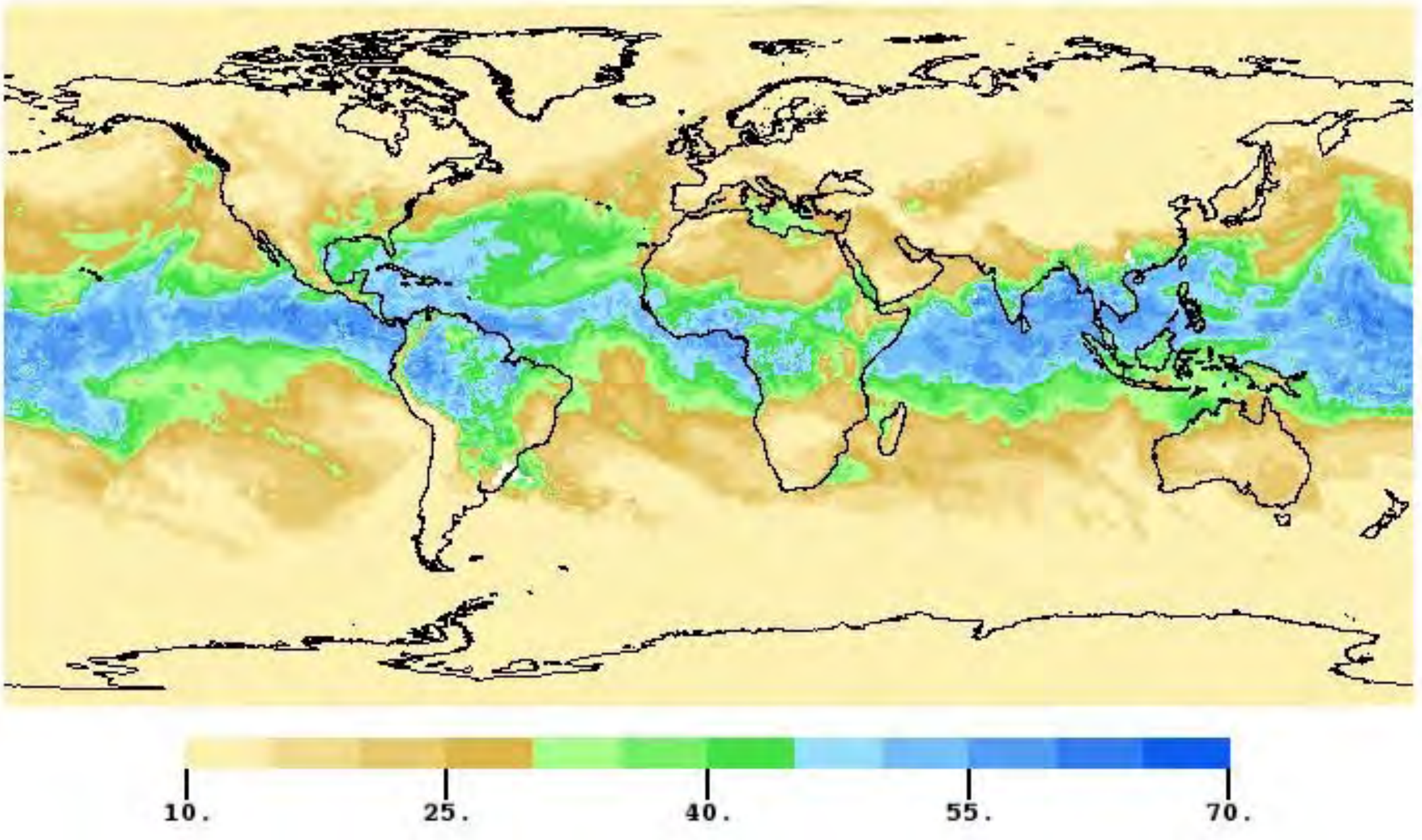
color “feels like” the product

AIRS Relative Humidity 500hPa

7.15-17.2007 desc

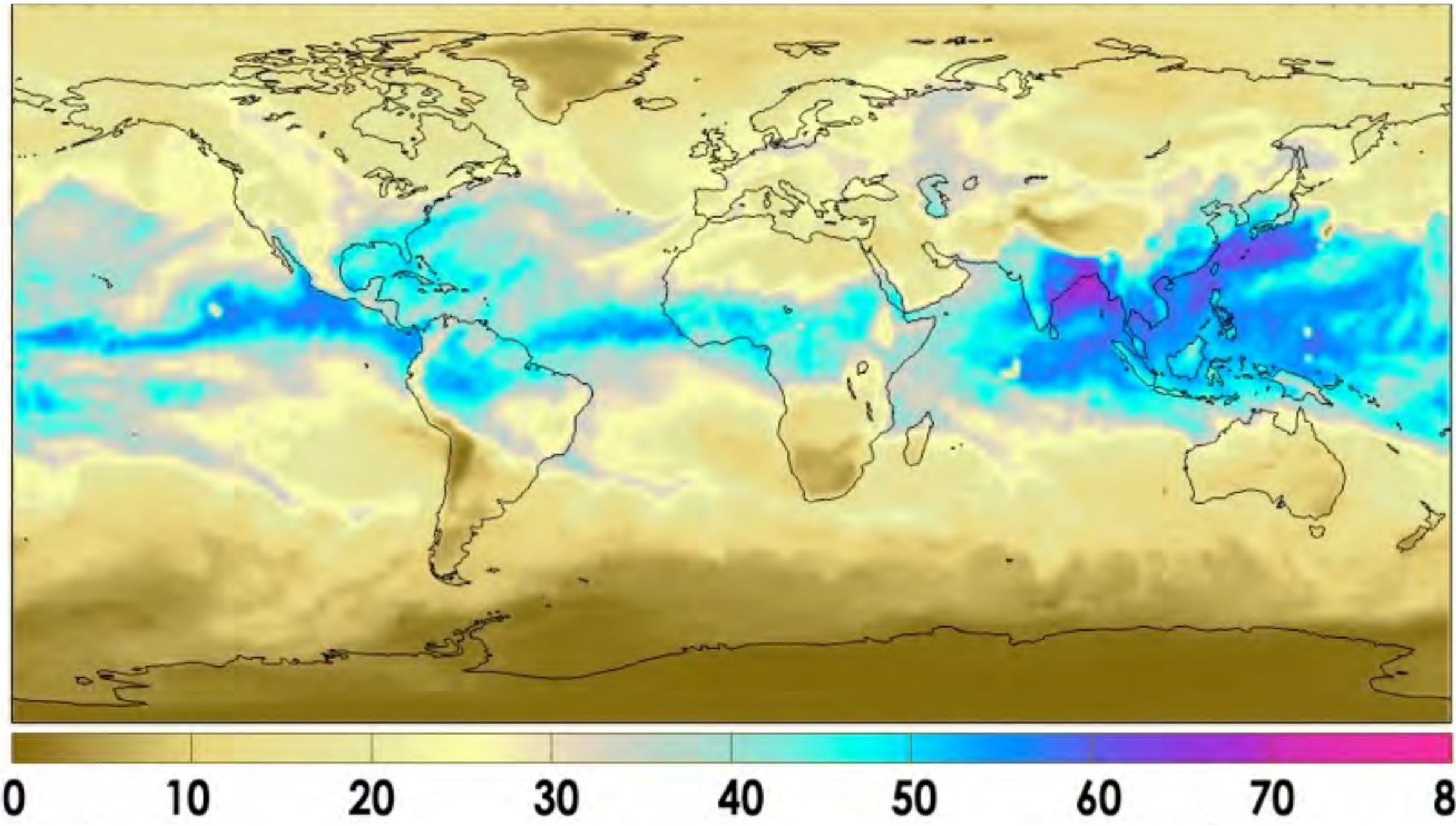


AIRS TOTAL PRECIPITABLE WATER VAPOR (mm) 20151008-20151010



AIRS Water Vapor total column

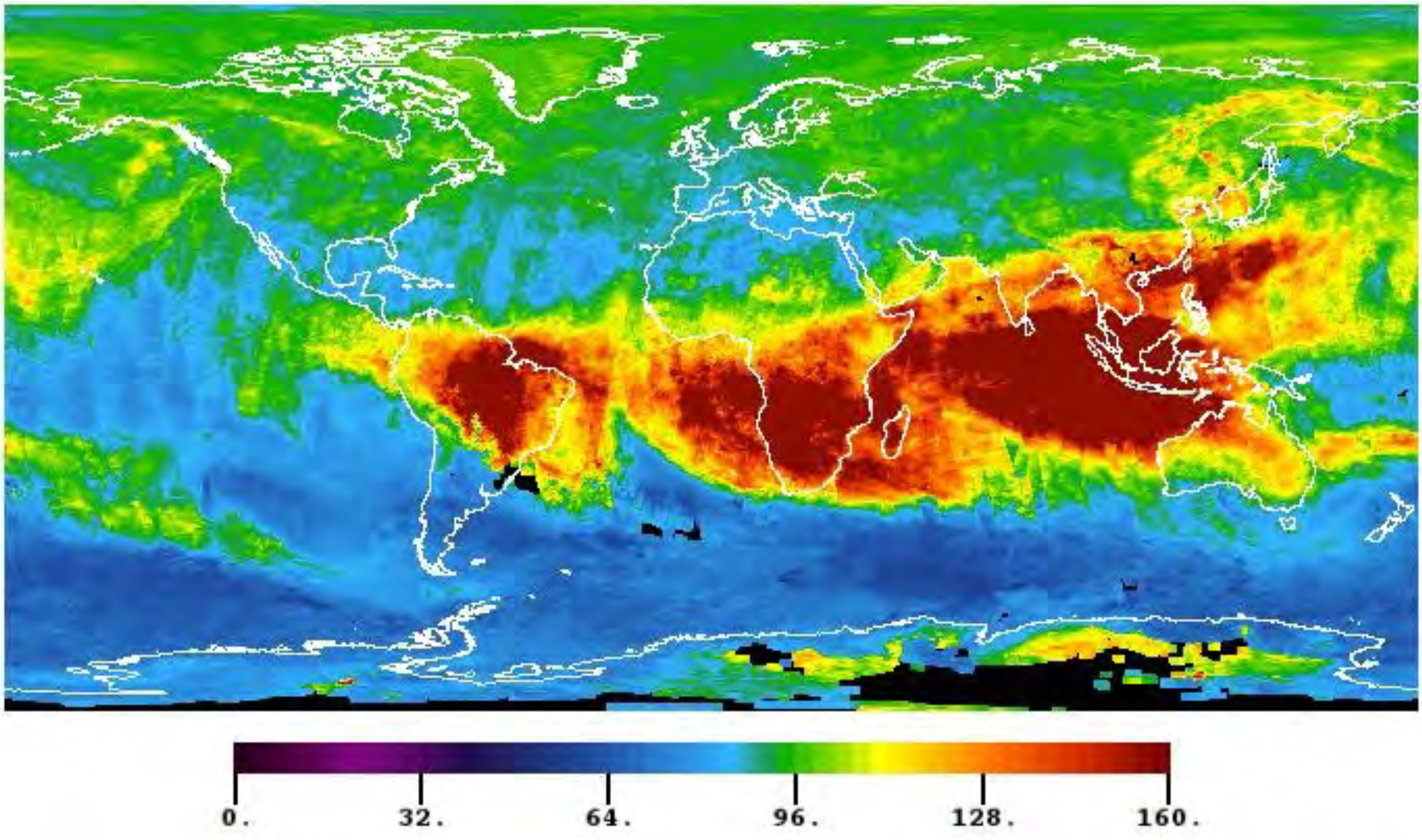
7.15-17.2007 desc



0 10 20 30 40 50 60 70 80

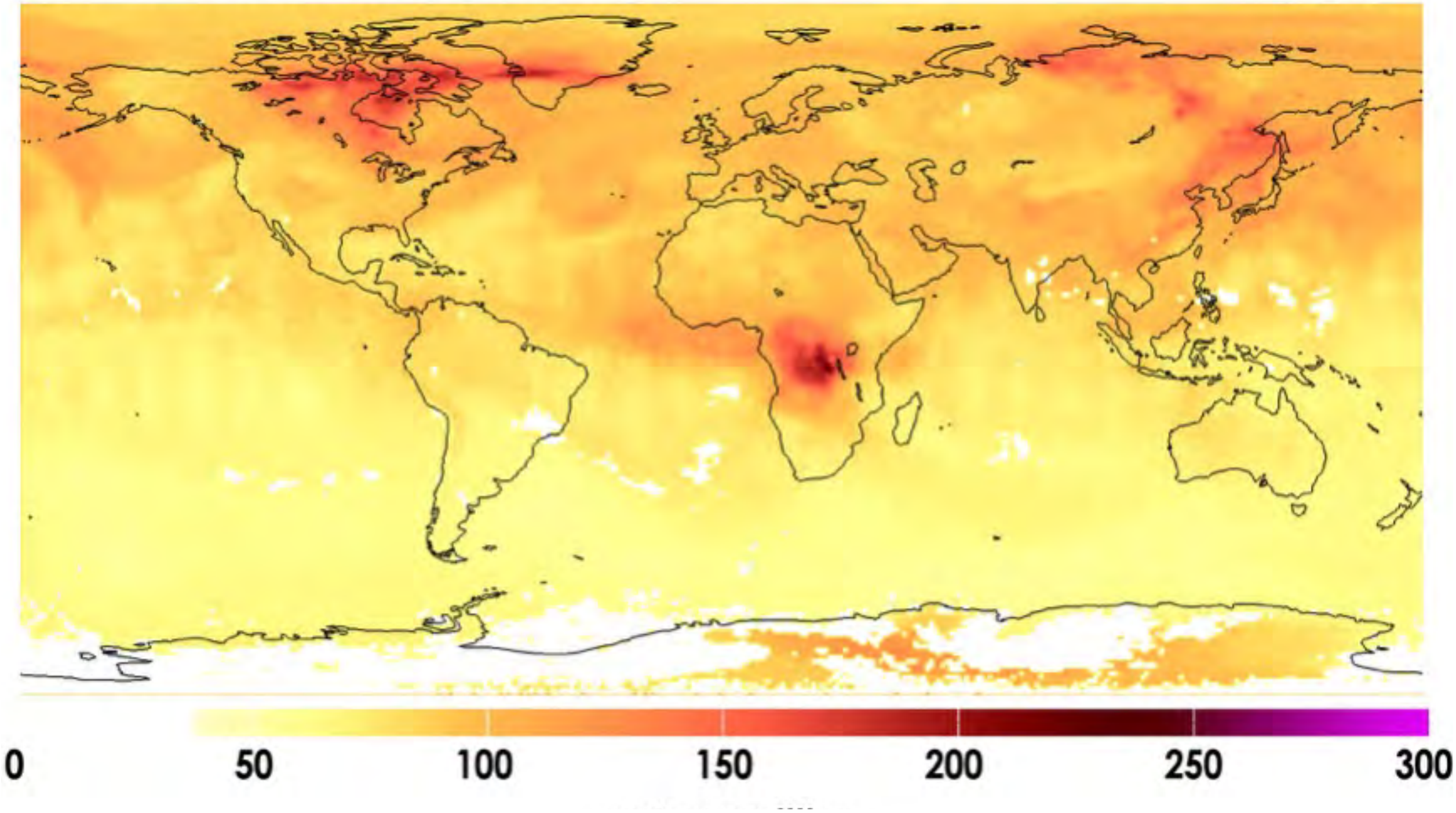
millimeters

AIRS CO AT 500mb (ppbv) 20151008-20151010

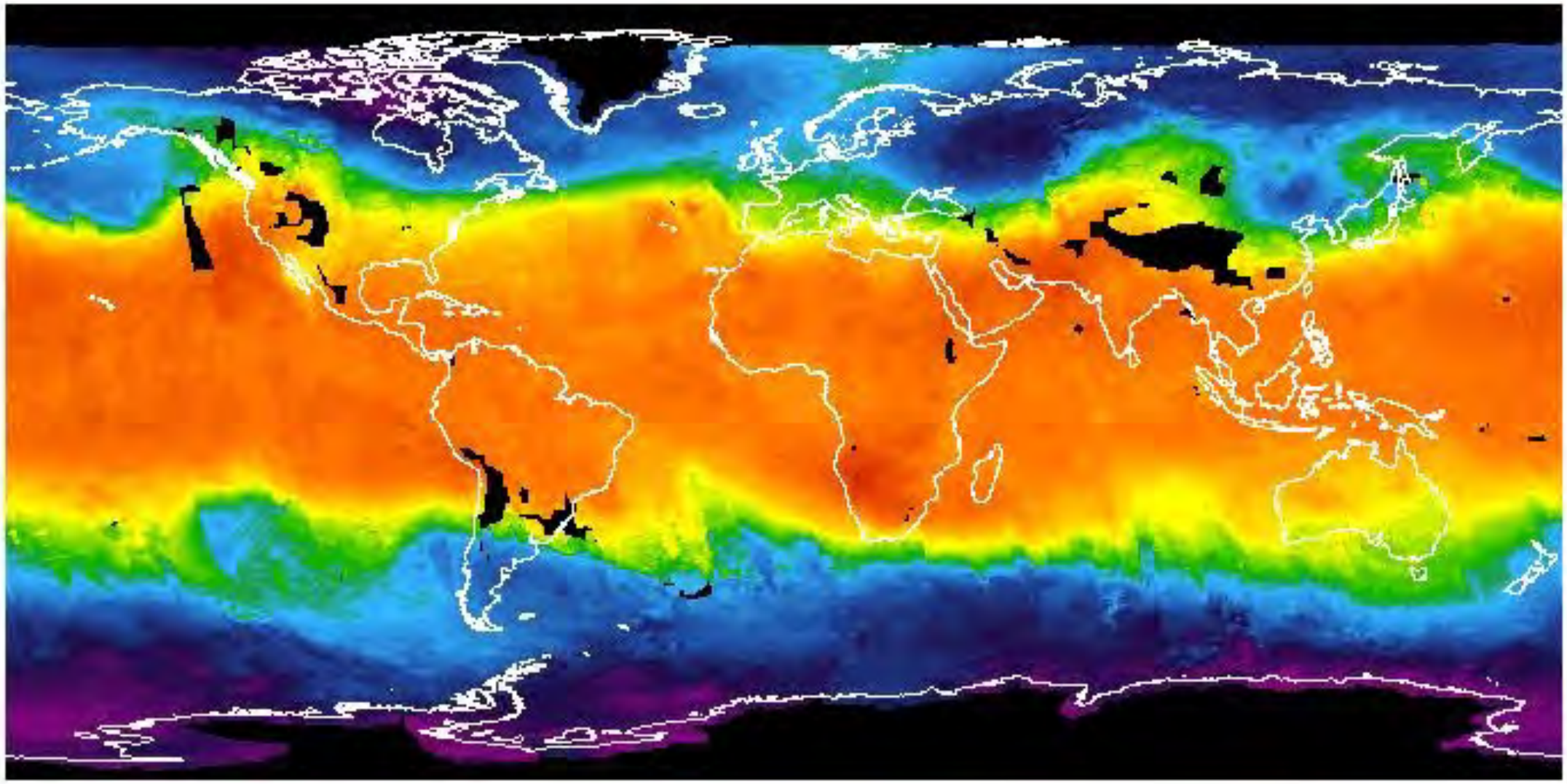


AIRS Carbon Monoxide 500hPa

7.26-28.2014 desc

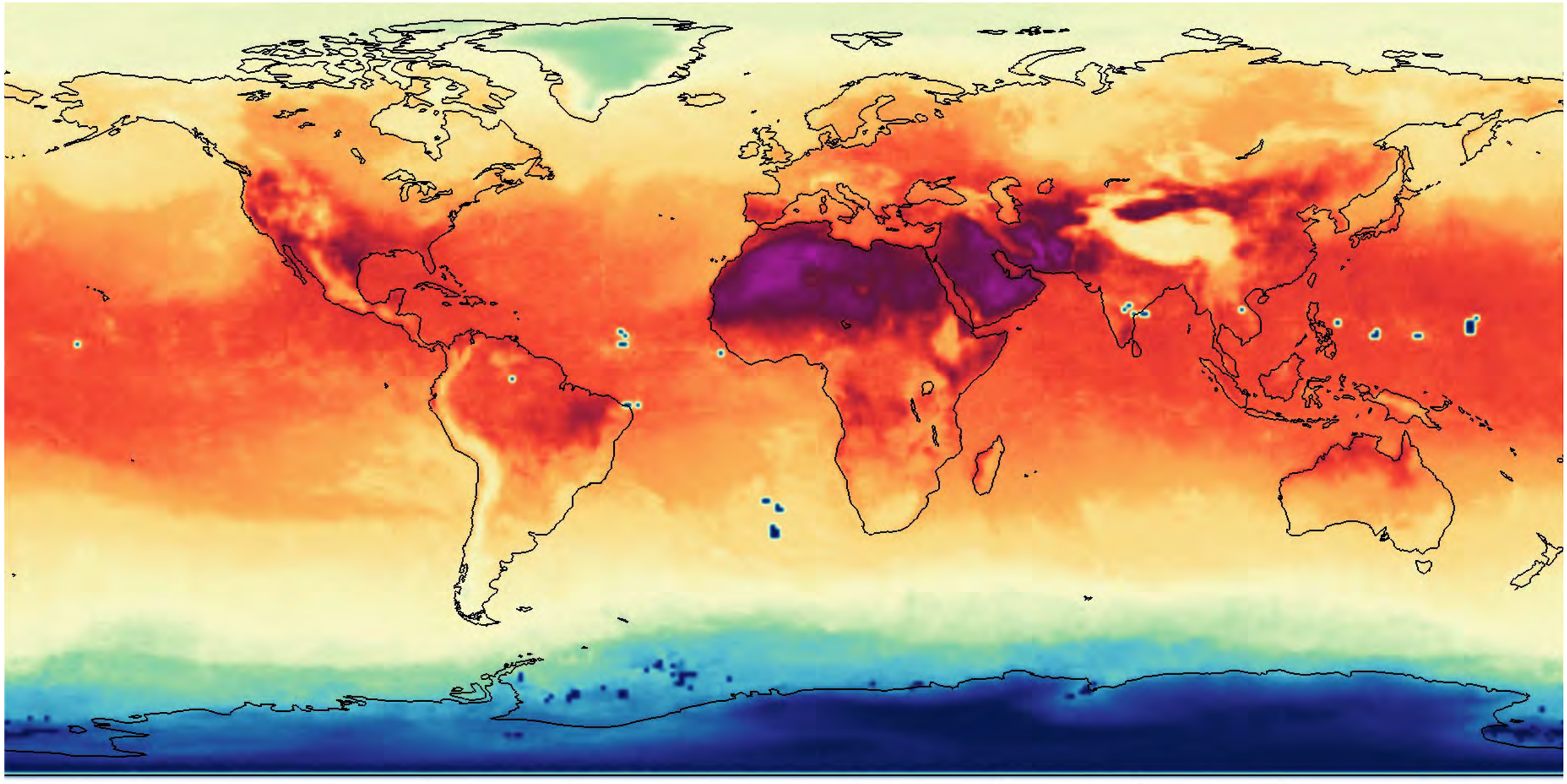


AIRS DAILY AIR TEMPERATURE (F) AT 700mb 20151008-20151010



AIRS Surface Air Temperature

7.27-29.2014 desc

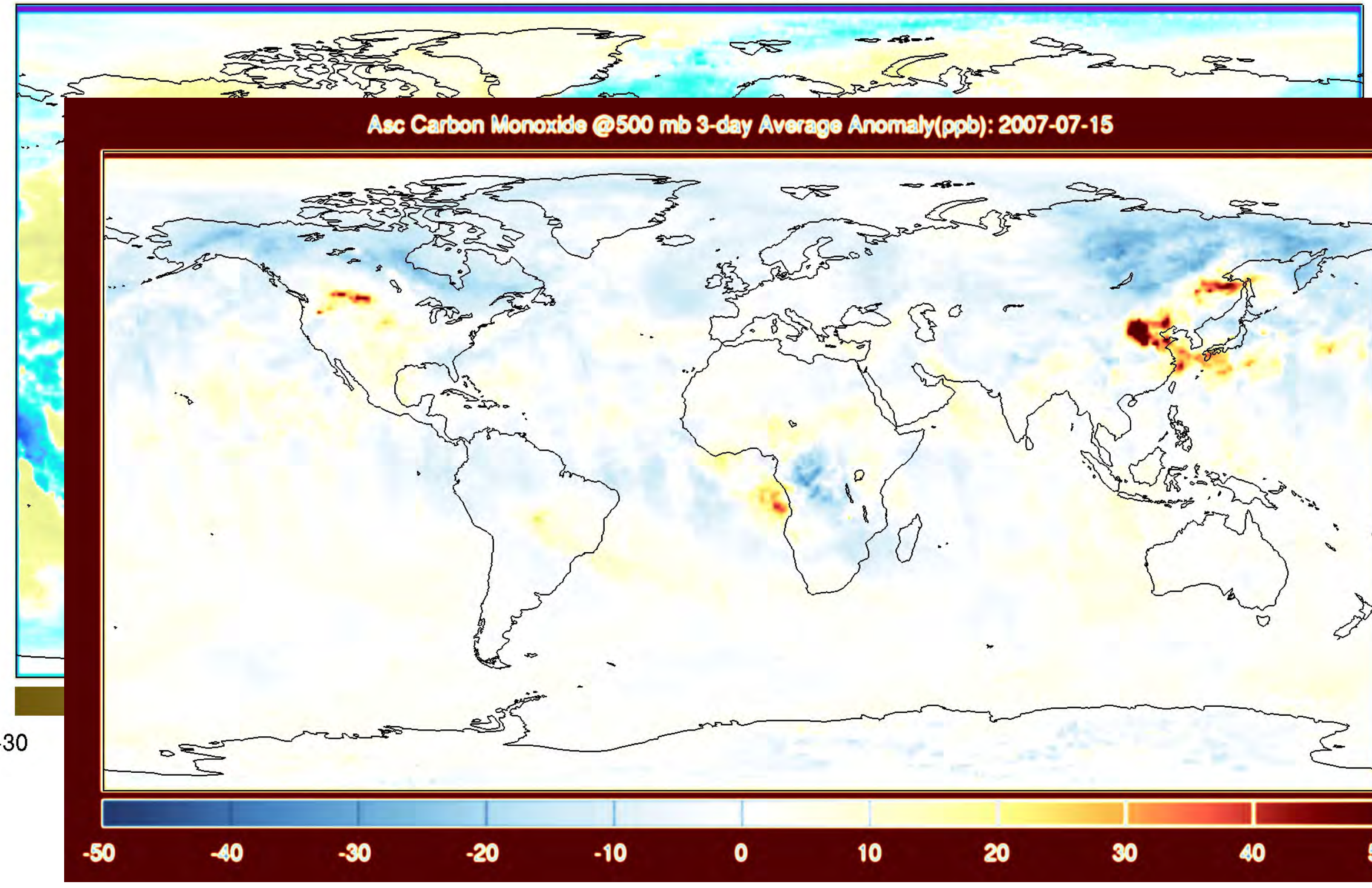


-82	-64	-46	-28	-10	8	26	44	62	80	98	116
210	220	230	240	250	260	270	280	290	300	310	320
-63	-53	-43	-33	-23	-13	3	7	17	80	27	47

degrees Fahrenheit/Kelvin/Celsius

Anomaly maps

Asc Total Integrated Water Vapor 3-day Anomaly: 2015-02-04



FY16 Goals

Maps
AIRS anomaly maps, L4 (interim) maps, new maps to GIBS via LANCE/DAAC

L4 products
Drought, Dengue, Volcanic Dust/Ask/SO2: code support for drought, dengue

Graphics
Flyers for each new map, explains how to read map, access data, print or web page

Tools
robust AIRS browse tool, working AIRS analysis tool, working Skew-T tool

GIS
AIRS+GIS combos, reach out to GIS community

SERVIR
Can we provide science/maps to SERVIR researchers?

Brochure
New brochure standard products/ applications, for web site or print

NASA Applied Sciences DEVELOP interns

Conferences
AIRS Science Team Meetings, AGU, AMS, ESRI (GIS)

Reaching Out & Metrics
let communities know about our maps and measure usage

Applications Workshop

at AIRS Spring science team meeting?

AIRS Water Vapor total Column