

Implementing Polar Projections with OGC Services for the Enhancement of AIRS NRT Visualization in LANCE

Peisheng Zhao^{1,2}, Feng Ding^{1,3}, Michael Theobald^{1,3}, Dana Ostrenga^{1,3}, Jennifer Wei¹, Wenli Yang^{1,2}, David Meyer¹ ¹NASA Goddard Earth Sciences Data & Information Services Center (GES DISC); ²Center for Spatial Information Science and Systems, George Mason University, ³ADNET System Inc.,

The Atmospheric Infrared Sounder (AIRS) Near-Real Time (NRT) data from the Land Atmosphere Near real-time Capability for EOS (LANCE) element at the Goddard Earth Sciences Data and Information Services Center (GES DISC) provides information on the global and regional atmospheric state, with very low temporal latency, to support climate research and improve weather forecasting. Open Geospatial Consortium (OGC) services are being utilized to facilitate access to, and integration of, LANCE AIRS NRT data and images. The map is refreshed every 45 minutes, and about 2 hours behind real-time.

Ongoing AIRS NRT imagery enhancement work includes adding a new set of the images in polar projections. Polar projections are commonly used for mapping the Antarctic and Arctic regions. We have implemented a more precise south polar (EPSG:3031) projection and north polar (EPSG:3413) projection making our OGC service instances more useful and interoperable. Thus, AIRS NRT data can be easily accessed and integrated with other applications, greatly increasing the impact of our data on researches and applications in polar regions.



An open and interoperable way for access and integration of AIRS NRT data

AIRS NRT Data

AIRS NRT variables

Variable Name	Data Source
Surface Air Temperature	Level 2 AIRS2RET_NRT
Surface Skin Temperature	Level 2 AIRS2RET_NRT
Air Temperature at 850hPa	Level 2 AIRS2RET_NRT
Air Temperature at 700hPa	Level 2 AIRS2RET_NRT
Air Temperature at 500hPa	Level 2 AIRS2RET_NRT
Surface Relative Humidity	Level 2 AIRS2RET_NRT
Relative Humidity at 850hPa	Level 2 AIRS2RET_NRT
Relative Humidity at 700hPa	Level 2 AIRS2RET_NRT
Relative Humidity at 500hPa	Level 2 AIRS2RET_NRT
Carbon Monoxide Mole Fraction in Air at 500hPa	Level 2 AIRS2RET_NRT
Methane Mole Fraction in Air at a00hPa	Level 2 AIRS2RET_NRT
Total Cloud Fraction	Level 2 AIRS2RET_NRT
Cloud Top Height	Level 2 AIRS2RET_NRT
Sulfur Dioxide Brightness Temperature Difference	Level 2 AIRS2SUP_NRT
Dust Score	Level 2 AIRS2SUP_NRT

Polar Projections

The polar projection is an azimuthal projection based on a plane perpendicular to the Earth axis in contact with the North or South Pole. It shows that all points on the map are at the correct azimuth and at proportionally correct distances from the center point. In polar projections, parallels of latitude are mapped to concentric circles, and all lines of longitude are mapped to radiating straight lines.



< 200.0 K

EPSG: 3413 – WGS84/NSIDC Sea Ice Polar Stereographic North

https://disc1.gesdisc.eosdis.nasa.gov/test/daac-bin/wms_airsnrt?version=1.1.1 &service=WMS&request=GetMap&SRS=EPSG:3413&WIDTH=1024&HEIGHT=1024 &TRANSPARENT=TRUE&FORMAT=image/png&bbox=-6100000,-6100000,6100000,6100000&styles=gibs&LAYERS=AIRS_TSurfAir_A_NRT,coast_lin e,grid20,US_states&time=2019-11-30

EPSG: 3031 – WGS84/Antarctic Polar Stereographic South https://disc1.gesdisc.eosdis.nasa.gov/test/daac-bin/wms_airsnrt?version=1.1.1 &service=WMS&request=GetMap&SRS=EPSG:3031&WIDTH=1024&HEIGHT=1024 &TRANSPARENT=TRUE&FORMAT=image/png&bbox=-6100000,-6100000,6100000,6100000&styles=gibs&LAYERS=AIRS_TSurfAir_A_NRT,coast_lin e,grid20,US_states&time=2019-11-30

LOCATION	IMGDATE
/AIRVBRAD/AIRS.VisGlobalBrowsc.2019.11.20.hdfg5.tif	2019-11-20
/AIRVBRAD/AIRS.VisGlobalBrowse.2019.11.20.hdfg6.tif	2019-11-20
/AIRVBRAD/AIRS.VisGlobalBrowsc.2019.11.20.hdfg7.tif	2019-11-20
/AIRVBRAD/AIRS.VisGlobalBrowsc.2019.11.20.hdfg8.tif	2019-11-20
/AIRVBRAD/AIRS.VisGlobalBrowsc.2019.11.20.hdfg9.tif	2019-11-20
/AIRVBRAD/AIRS.VisGlobalBrowse.2019.11.21.hdfg1.tif	2019-11-21
/AIRVBRAD/AIRS.VisGlobalBrowse.2019.11.21.hdfg2.tif	2019-11-21
/AIRVBRAD/AIRS.VisGlobalBrowse.2019.11.21.hdfg3.tif	2019-11-21

Build a shapefile as a spatial-temporal index

OGC WCS provides common interfaces to access customized multi-dimensional and multi-

OGC WMS provides geospatial data as a "map", which is generally rendered dynamically from real geographical data in a spatially referenced pictorial image format, such as PNG, GIF, or



EPSG:4326

The 'gdalwarp' with specific warp options is used to implement this reprojection:

SOURCE_EXTRA: number of extra pixels added around the source window **SAMPLE_GRID**: force the sampling to include internal points as well as edge points

SAMPLE_STEPS: modifies the density of the sampling grid.

gdalwarp -of GTiff -wo SOURCE_EXTRA=20 -wo SAMPLE_GRID=YES -wo SAMPLE_STEPS=12 -s_srs epsg:4326 -t_srs EPSG:3413 -ts 1024 1024 -te -6100000 -6100000 6100000 6100000 input_4326.tif output_3413.tif



≥ 340.0 K

Time Averaged Map of Air Temperature at Surface (Nightime/Descending, AIRS-only) daily 1 deg. [AIRS AIRS3STD v006] K





https://ntrs.nasa.gov/search.jsp?R=20190034163 2020-03-11T15:24:37+00:0

Data Reprojection



Use MapServer on-the-fly reprojection



"Arctic Blast" in Polar Projection

The first Arctic frigid air "blast" of the 2019 season headed over North America more than a month before official astronomical winter began, and caused air temperatures to drop sharply over most of the United States.

The figures show the surface air temperate from AIRS descending/nighttime mode on November 7, 2019, in both north polar projection and equilateral projection. The map in polar projection clearly gives a better view of such a synoptic weather event originating from the northern polar region.