High Spectral Resolution Infrared and Advanced Microwave Sounders (CrIS/ATMS) Data Products generated at NOAA/NESDIS

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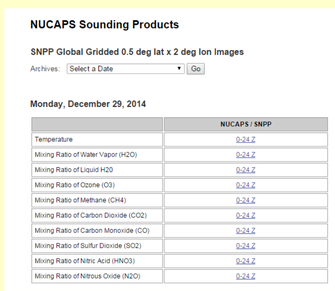
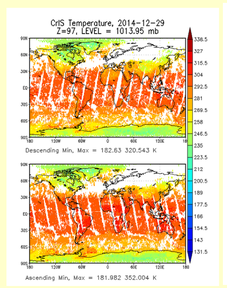
http://www.ospo.noaa.gov/Products/atmosphere/soundings/index.html

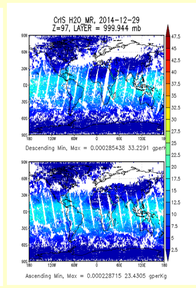
Recently, the National Oceanic and Atmospheric Administration (NOAA) National Environmental Satellite Data and Information Service (NESDIS) has made significant improvements for retrieving the atmospheric sounding using the high spectral resolution infrared and advanced microwave sounders data from the Cross-track Infrared Sounder (CrIS) and the Advanced Technology Microwave Sounder (ATMS) instruments on board the Suomi-National Polar-orbiting Partnership (S-NPP) and the Infrared Atmospheric Sounding Interferometer (IASI) which resides on the European Space Agency's (ESA) Metop series of polar-orbiting satellites.
In a series of advanced operational sounders CrIS, in conjunction with ATMS, provides more accurate, detailed atmospheric temperature and moisture observations for weather and climate applications. Higher (spatial, temporal and spectral) resolution and more accurate sounding data from CrIS and ATMS support continuing advances in data assimilation systems and NWP models to improve short- to medium-range weather forecasts. Currently the NOAA Unique Combined Atmospheric Processing System (NUCAPS) produces level 2 products from Metop-A/B and S-NPP satellites include temperature and humidity profiles; trace gases such as ozone, nitrous oxide, carbon dioxide, and methane; and the cloud cleared radiances (CCR) on a global scale and these products are available to the operational user community.
In an effort to ensure consistent levels of service and quality assurance for the NUCAPS data products the Office of Satellite and Product Operations (OSPO) of NOAA/NESDIS has implemented and executed new innovative tools to better monitor performance and data quality of the operational sounder and imager products that are being generated. The OSPO webpages and data quality monitoring tools have been extended to include the CrIS/ATMS SKEW-T (Logarithmic Pressure vs Temperature and Dew Point Temperature) sounding plots over the extended region of CONUS and these pages are updated every hour to show the latest soundings. At each grid points last ten soundings are retained to track the changes in the atmospheric conditions. The incorporation of these tools in the OSPO operation has facilitated the diagnosis and resolution of problems when detected in the operational environment.
This presentation will include several of these tools developed and deployed for the sounding products monitoring and data quality assurance which led to improving the maintenance and sustainment of the Environmental Satellites Processing Center (ESPC) processing systems. The presentation will include the discussion on the ESPC system architecture involving sounding data processing and distribution for CrIS and IASI sounding products. Discussion will also include the improvements made for data quality measurements, granule processing and distribution, and user timeliness requirements envisioned from the next generation of JPSS satellites. There have been significant changes in the operational system due to system upgrades, algorithm updates, and value added data products and services.

NUCAPS

http://www.ospo.noaa.gov/Products/atmosphere/soundings/nucaps/index.html







NUCAPS Sounding Products

The NOAA Unique CrIS/ATMS Processing System (NUCAPS) was developed to generate (1) spectrally and spatially thinned radiances, (2) retrieved products such as profiles of temperature, moisture, trace gases and cloud-cleared radiances, and (3) global validation products such as radiosonde matchups and gridded radiances and profiles. The thinned radiance products are produced in BUFR format using the NetCDF4 Reformatting Toolkit (N4RT) and are tailored to specifically Numerical Weather Prediction (NWP) centers. The NUCAPS Environmental Data Records (EDR) products are archived in Comprehensive Large Array-Data Stewardship System (CLASS) for non-real time users and can be acquired from www.nsof.class.noaa.gov.

NUCAPS/SNPP Global Granules Composite Images

The NUCAPS global granules composite images are produced for the last seven days at the 15 fixed air pressure levels or layers. They are produced by using the NUCAPS retrievals which are derived based on a fixed air pressure variable grid: temperature is derived at the fixed pressure levels (1014 mb, 853 mb, 707 mb, 497 mb, 407 mb, 300 mb, 260 mb, 201 mb, 151 mb, 103 mb, 71.5 mb, 51.1 mb, 29.1 mb, 9.5 mb, 1.0 mb), and mixing ratio variables are derived at the layer pressure using the effective air pressure variable (1000 mb, 840 mb, 695 mb, 487 mb, 399 mb, 293 mb, 254 mb, 196 mb, 147 mb, 99.5 mb, 68.8 mb, 49.3 mb, 27.6 mb, 8.82 mb, .838 mb). Each product is computed separately for each granule, and then the global image is generated by combining the data from individual granules based on the granule geographical location. For each image the granules from the preceding 12 hours of observation are used; each image combines the granules of data measured at both ascending and descending nodes.

NUCAPS/SNPP Global Gridded Products

SNPP Global Gridded 0.5 deg lat x 2 deg lon Images

NUCAPS EDR Global Gridded products include the Temperature (deg K), Water Vapor Mixing Ratio (g/Kg), Liquid Water Mixing Ratio (g/Kg), Ozone Mixing Ratio (ppb), Methane Mixing Ratio (ppb), Carbon Dioxide dry mixing ratio (ppm), Carbon Monoxide Mixing Ratio (ppb), Sulfur Dioxide mixing ratio (ppb), Nitric Acid Mixing Ratio (ppb), and Nitrous Oxide Mixing Ratio (ppb).Â The retrievals are derived based on a fixed air pressure variable grid: temperature is derived at the fixed pressure level (1014 mb, 853 mb, 707 mb, 497 mb, 407 mb, 300 mb, 260 mb, 201 mb, 151 mb, 103 mb, 71.5 mb, 51.1 mb, 29.1 mb, 9.5 mb, 1.0 mb) and mixing ratio variables are derived at the layer pressure using the effective air pressure variable (1000 mb, 840 mb, 695 mb, 487 mb, 399 mb, 293 mb, 254 mb, 196 mb, 147 mb, 99.5 mb, 68.8 mb, 49.3 mb, 27.6 mb, 8.82 mb, .838 mb).

NUCAPS/SNPP Retrieval Statistics

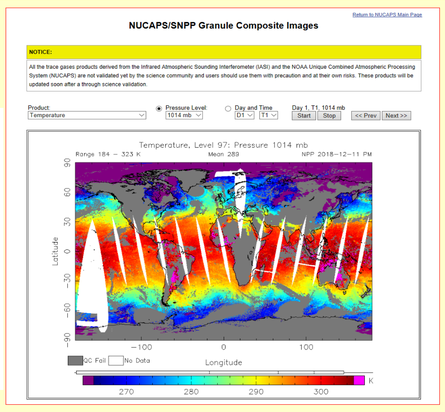
The NUCAPS retrieval statistics are generated for Temperature (Tp) over two layers: average over mid-troposphere (520-790 mb) and average over full troposphere (200-1100 mb); and Water Vapor Mixing Ratio (WVMR) statistics are generated over full troposphere. The NUCAPS retrieval estimates are compared with GFS estimates to compute bias and rms error over these layers and are plotted for each granule on the 24-hour scale for the day.

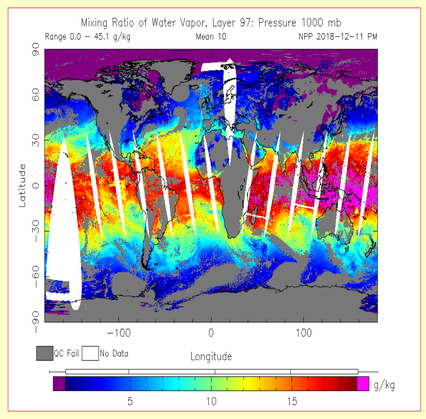
To generate the temperature bias and rms error over a large ensemble of K granules one needs to take the bias for a single granule, bias(k), weighted by the number of accepted cases, Nacc(k) such as:

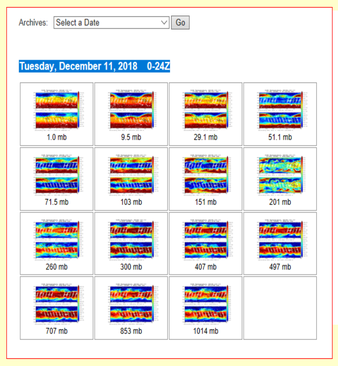
bias = sum {Nacc(k)*bias(k)} / sum{Nacc(k)}, where sum is for k = 1, K
rms = sqrt [{(sumNacc(k)*rms(k)^2) } / sum {Nacc(k)}], where sum is for k = 1, K

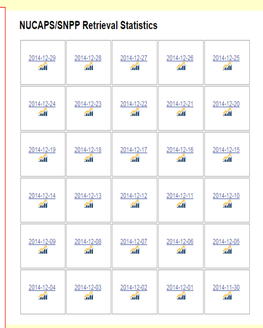
To generate the WVMR bias and rms error over a large ensemble of K granules the following formulas are used:

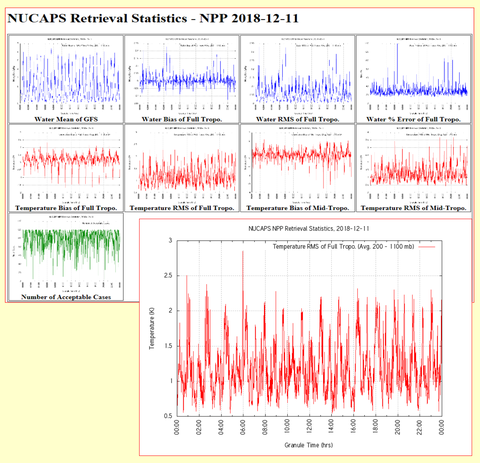
bias = sum{qmean(k)*bias(k)} / sum{qmean(k)}, where sum is for k=1, K
rms = sqrt [{sum (qmean(k)*rms(k)^2)} / sum{qmean(k)}], where sum is for k = 1, K











NUCAPS P-skew-T Website with Global Coverage

BACKGROUND:
Vertical profiles of the Temperature and Dew Point temperature are derived from the CrIS/ATMS instruments onboard the NOAA SNPP satellite, as well as the IASI instruments aboard the Metop-A and Metop-B satellites. They are dynamically displayed using the Javascript D3 library with a Skew-T Log-P diagram format. Skew-T Coverage exists for the entire globe. Previously, this coverage was restricted to only the U.S. continental region (CONUS). Using this map, one can view a NUCAPS sounding plots, as well as the corresponding aerologic and profile data tables, all as part of a 10-day animation (separate page).

PURPOSE:
This website shows Skew-T plots and the relevant profile and aerologic data tables based on data output from the nucaps algorithm.

USAGE:
There are a couple ways to show NUCAPS Skew-T data tables and soundings plots. First, the user must click the button on the upper-left side of the map with the black rectangle ("Draw a rectangle"). By clicking this button, the user can click and drag to draw a rectangular domain of interest on the interactive and zoomable map. After drawing the rectangle, colored dots will appear on the map in the domain of interest. These colored dots represent the age of the latest sounding at that particular location.

By checking the "Hover Thumbnail Viewer" checkbox above the map, the user can hover over each square (dot) on the map to view a thumbnail (for the most recent day) sounding plot. By actually clicking a square (dot) on the map, the user will navigate to a 10-day sounding animation page for that particular sounding location. For each step in this animation page, sounding profiles are plotted, along with the relevant profile and aerologic data tables for that particular sounding for that particular day.

MAP LEGEND & MEANINGS
The color of each dot (square) on the map represents the age of the profile ranging from 0 to 24 hours, with an increment of 1.7 hours.

This most recent profile generated is less than 1.7 hours as shown by a blue color and the oldest profile older than 24 hours is shown by a black square color. The XML data powering the data behind the map is refreshed every 20 minutes, however and the whole globe is divided into a 0.5 X 0.5 degree grid. Each grid may contain more than one CrIS FOV but the closest FOV to the center of the grid was selected for the purposes of displaying a sounding plot and profile
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DOWNLOADING NUCAPS SKEW-T XML DATA
To download XML Skew-T for some user-defined rectangular domain, the user may click the button "Download XML Data for Area of Interest" above the map. To this end, some domain should have been drawn on the map. Clicking this button will open a new, blank page in which, after some time, a window will appear in which the user can download "out.xml" , which contains all of the relevant NUCAPS
Skew-T data for the rectangular region, for all 10-days of the animation (10 day range). This includes all of the temperatures, pressures, as well as aerologic table data. Note that the domain size is limited to a rectangular domain no larger than 50 deg. N-S by 100 deg. E-W.

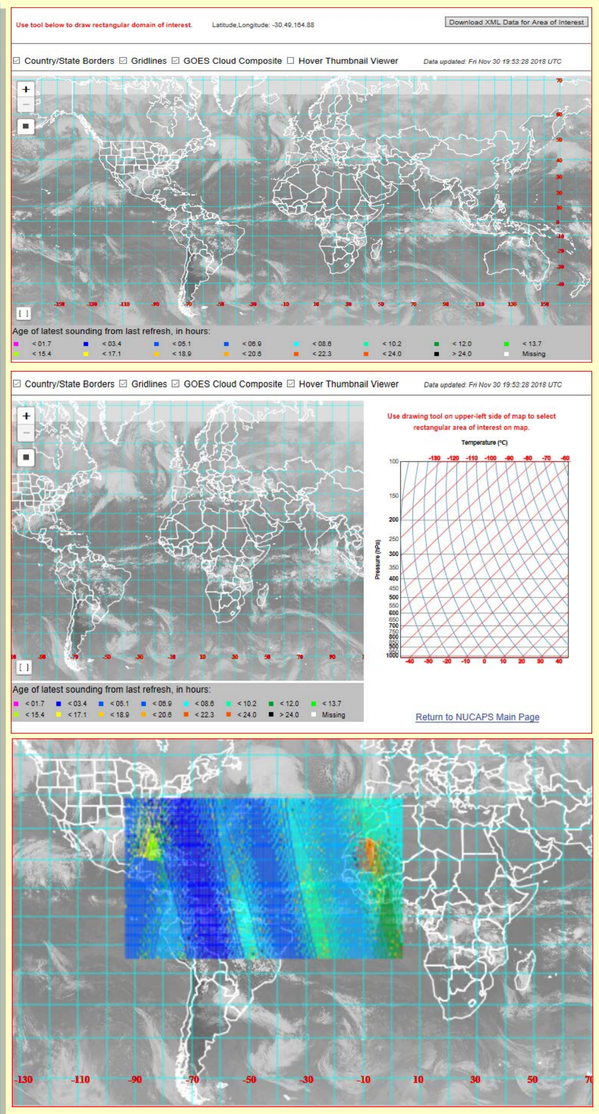
GENERAL MAP UTILITIES & FEATURES
The user can use the checkboxes above the map to show or hide the following map layers on the map:

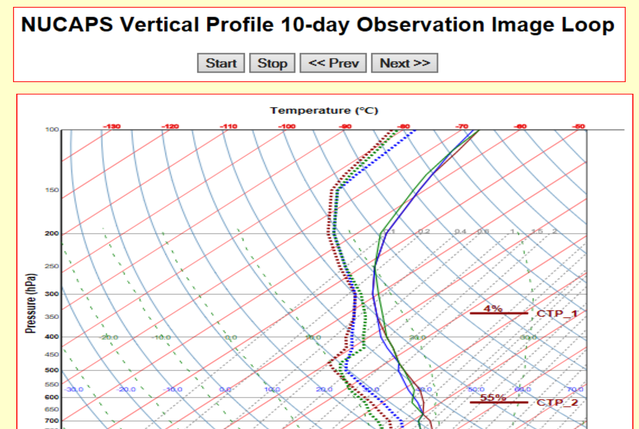
(1) Country and U.S. state political boundaries

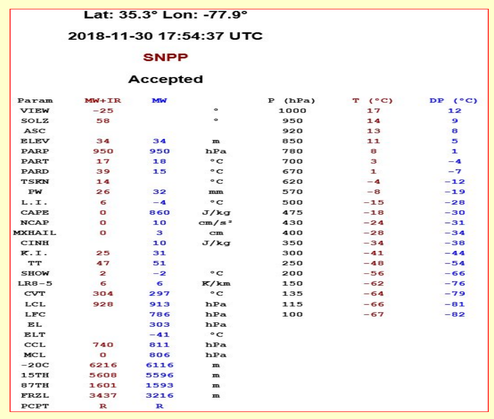
(2) Gridlines for longitudes and latitudes (every 10 degrees)

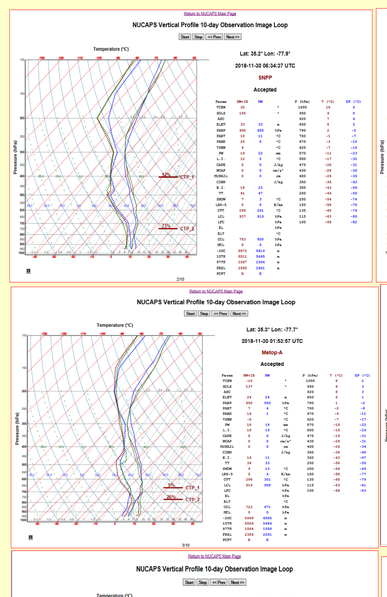
(3) GOES Cloud Composite image for global coverage

(4) The sounding preview panel with profile plots for NUCAPS soundings (Log-P diagram).

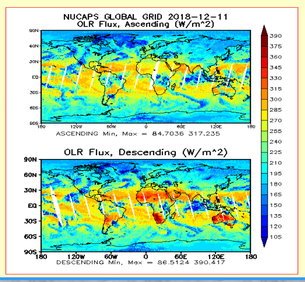


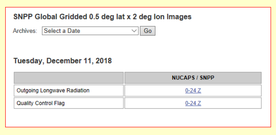






NUCAPS Outgoing Longwave Radiation Products





IASI

http://www.ospo.noaa.gov/Products/atmosphere/soundings/iasi/index.html

Temperature profiles
Water vapor profiles
Radiances (thinned, cloud cleared, reconstructed)
Principal components
Stability parameters (CAPE, Lifted Index, Convective Inhibition, Pressure of Equilibrium Level, Temperature Level of Free Convection, etc.)
Cloud products (Cloud Top Pressure, Cloud Top Fraction)
Trace gases
Emissivity

- 100 levels
- **retrieved temperatures**
- **First Guess Temperature**
- **Mixing Ratio of Water**
- **Mixing Ratio of Ozone**
- **Mixing Ratio of Carbon Monoxide**
- **Mixing Ratio of Carbon Dioxide**
- **Mixing Ratio of Methane**

Surface Properties, Satellite Info, and Retrieval Flags
- **Skin Temperature**
- **First Guess Skin Temperature**
- **Bottom Level Index**
- **Microwave Surface Emissivity**
- **Quality Flag**
- **Average Carbon Dioxide**

SO2 Anomaly
Ash Brightness Temperature Differences.

Cloud Top Properties
Cloud top Fraction - 2 Images displayed over two levels
Cloud Top Pressure - 2 Images displayed over two levels
STABILITY Parameters
Stability Parameters - 10 Stability Parameters
Infrared Surface Emissivity - 50 Infrared Parameters
Microwave Emissivity - 7 Microwave Parameters