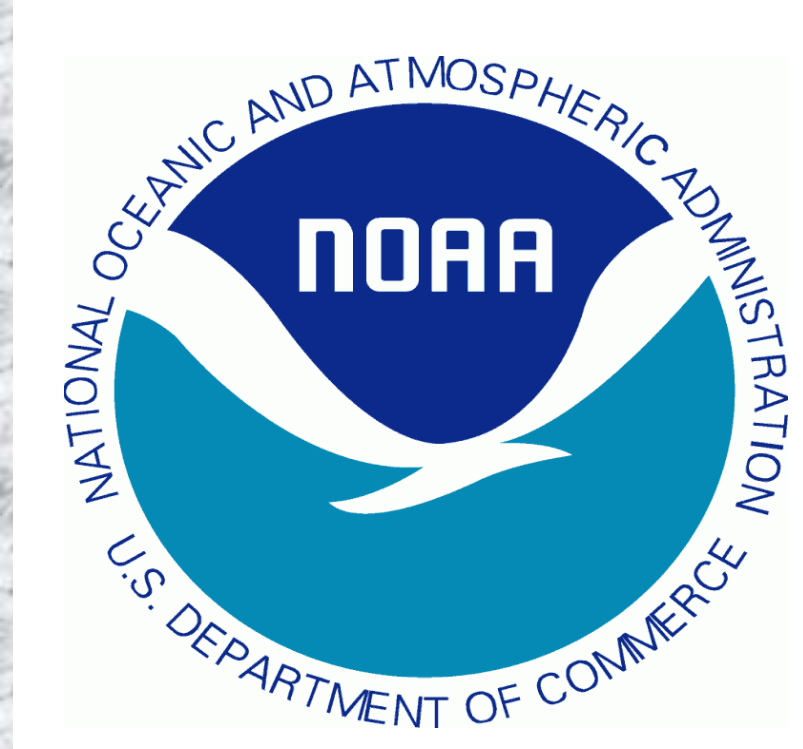


Exploitation of Hyperspectral Sounder and Microwaves sounder Data Products generated at NOAA/NESDIS

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NOAA/NESDIS Office of Satellite and Product Operations (OSPO)

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



The series of advanced operational sounders CrIS, in conjunction with ATMS, provides more accurate, detailed atmospheric temperature and moisture observations for weather and climate applications. Currently, the level 2 data products from S-NPP and IASI from Metop-A and Metop-B 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 routinely made available to the operational user community. 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. In an effort to ensure consistent levels of service for product monitoring and data quality assurance of the NOAA Unique Combined Atmospheric Processing System (NUCAPS) data products, the Office of Satellite and Product Operations (OSPO), has developed and implemented new innovative tools (including webpages for displaying analyses) in the ESPC operation that have made significant improvements in the diagnosis and resolution of problems when detected in the operational environment. The OSPO webpages have been extended to include the CrIS/ATMS SKEW-T (Logarithmic Pressure vs Temperature and Dew Point Temperature) sounding plots over the CONUS region. These pages are updated every hour to show the latest soundings from NUCAPS and IASI.

This presentation will showcase several of these tools that have been developed and deployed for the sounding products monitoring and data quality assurance maintenance and sustainment within the Environmental Satellites Processing Center (ESPC) operational environment. The presentation will also include a discussion on the ESPC system architecture involving sounding data processing and distribution for CrIS and IASI sounding products as well as the improvements made for data quality measurements, granule processing and distribution, and user timeliness requirements envisioned from the next generation of JPSS, Metop-C, and GOES-R satellites. There have been significant changes in the operational system due to system upgrades, algorithm updates, and value added data products and services.

NOAA Unique CrIS ATMS Processing System NUCAPS (SNPP and JPSS)

Infrared Atmospheric Sounding Interferometer (IASI) (Metop-A, and Metop-B)

NUCAPS - Temperature and humidity profiles at 15 US standard atmospheric levels with vertical accuracies of 1 degree Kelvin and 10 % per 1-km layer respectively, water vapor mixing ratio, Ozone mixing ratio, mixing ratio of CO, CO2, CH4, trace gases, and the cloud cleared radiances (CCR) on a global scale. These products are derived from the Cross-track Infrared Sounder (CrIS) and Advanced Technology Microwave Sounder (ATMS) currently onboard the Suomi National Polar-orbiting Partnership (SNPP) satellite and later will be available from the Joint Polar Satellite System (JPSS-1 and JPSS-2).

IASI - Temperature and humidity profiles with vertical accuracies of 1 degree Kelvin and 10 % per 1-km layer respectively, water vapor mixing ratio, Ozone mixing ratio, mixing ratio of CO, CO2, CH4, trace gases, and the cloud cleared radiances (CCR) on a global scale. These products are derived from the Infrared Atmospheric Sounding Interferometer and Advanced Technology Microwave Sounder (ATMS) currently onboard the Metop-A and Metop-B satellites and later will be available from the Metop-C

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

NUCAPS

NUCAPS Sounding Products	
SNPP Global Gridded 0.5 deg lat x 2 deg lon Images	
Active: [Select Date] [Go]	
Tuesday, April 14, 2015	
Parameter	NUCAPS1 SNPP
Temperature	0.2/2
Mixing Ratio of Water Vapor (H2O)	0.2/2
Mixing Ratio of Carbon Dioxide (CO2)	0.2/2
Mixing Ratio of Methane (CH4)	0.2/2
Mixing Ratio of Carbon Monoxide (CO)	0.2/2
Mixing Ratio of Nitric Oxide (NO2)	0.2/2
Mixing Ratio of Sulfur Dioxide (SO2)	0.2/2
Mixing Ratio of Nitrous Oxide (N2O)	0.2/2

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 radiance matchups and gridded radiances and profiles. The thinned radiances products are produced in BUFR format using the NetCDF4 Reformatting Toolkit (NART) 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.nsf.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, 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, 359 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.

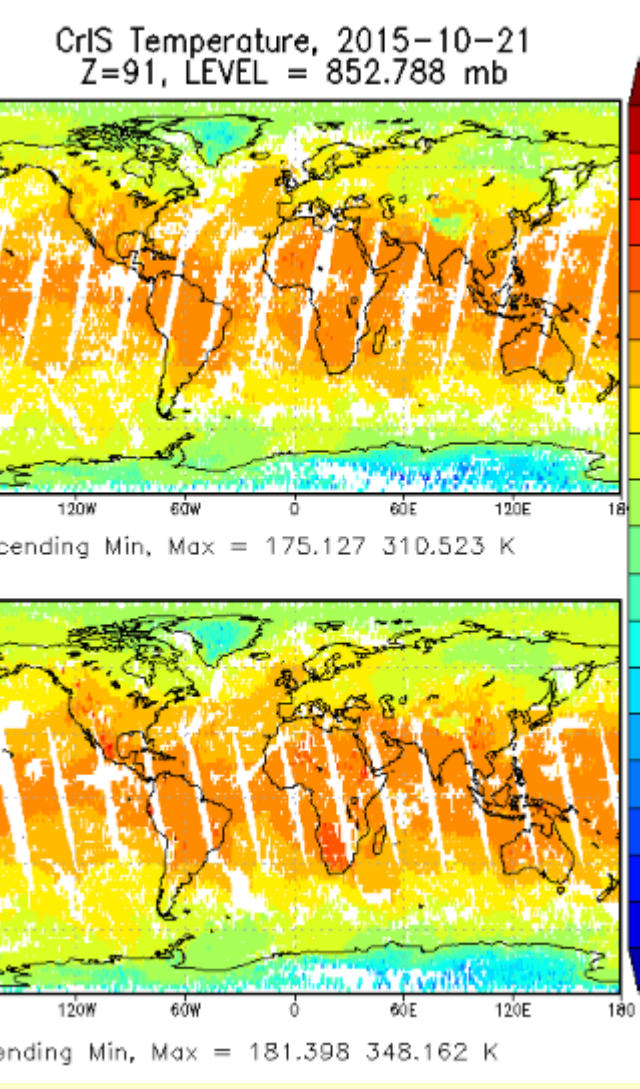
NUCAPS/SNPP Global Gridded Products

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). 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, 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, 359 mb, 254 mb, 196 mb, 147 mb, 99.5 mb, 68.8 mb, 49.3 mb, 27.6 mb, 8.82 mb, 838 mb).

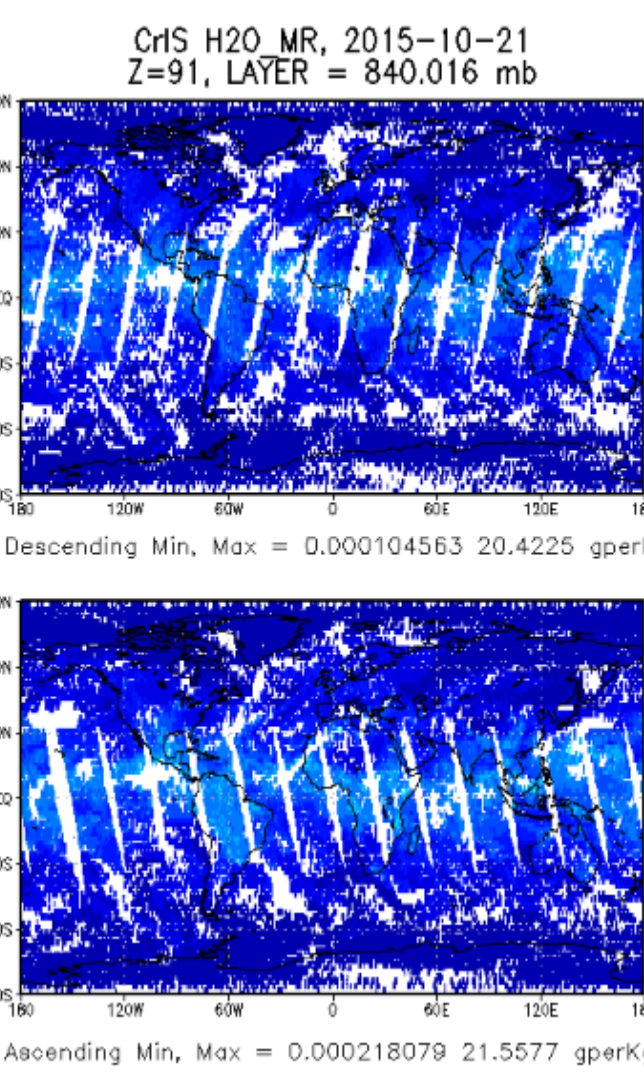
NUCAPS/SNPP Retrieval Statistics

The NUCAPS retrieval statistics are generated for Temperature (T_p) 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 (sum(Nacc(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(gmean(k)*bias(k)) / sum(gmean(k)), where sum is for k = 1, K
rms = sqrt (sum (gmean(k)*rms(k)^2) / sum(gmean(k))), where sum is for k = 1, K

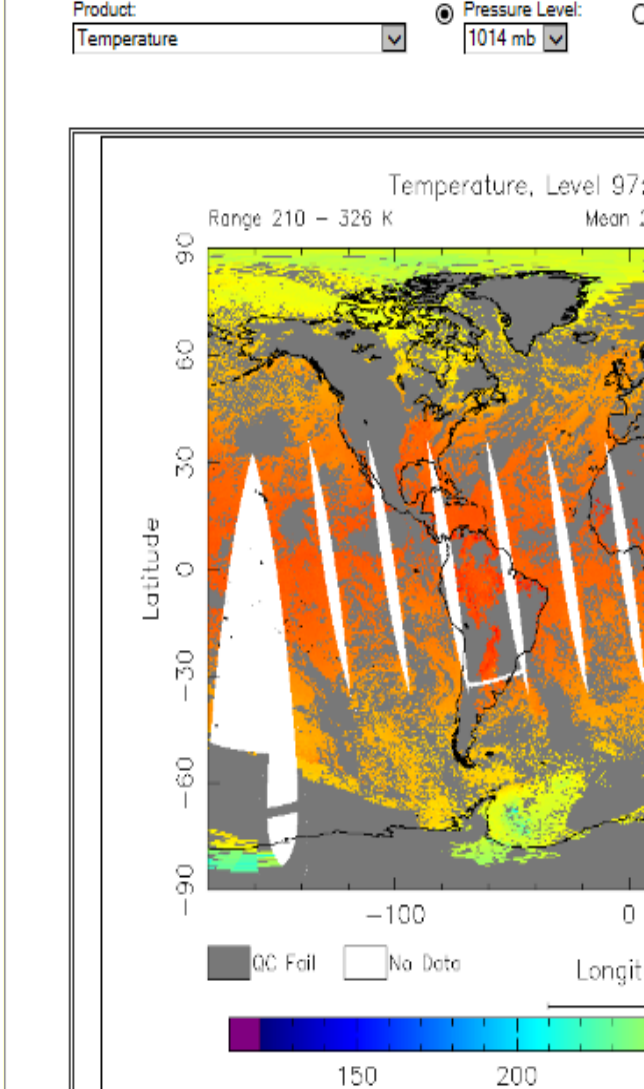
CrIS Temperature, 2015-10-21



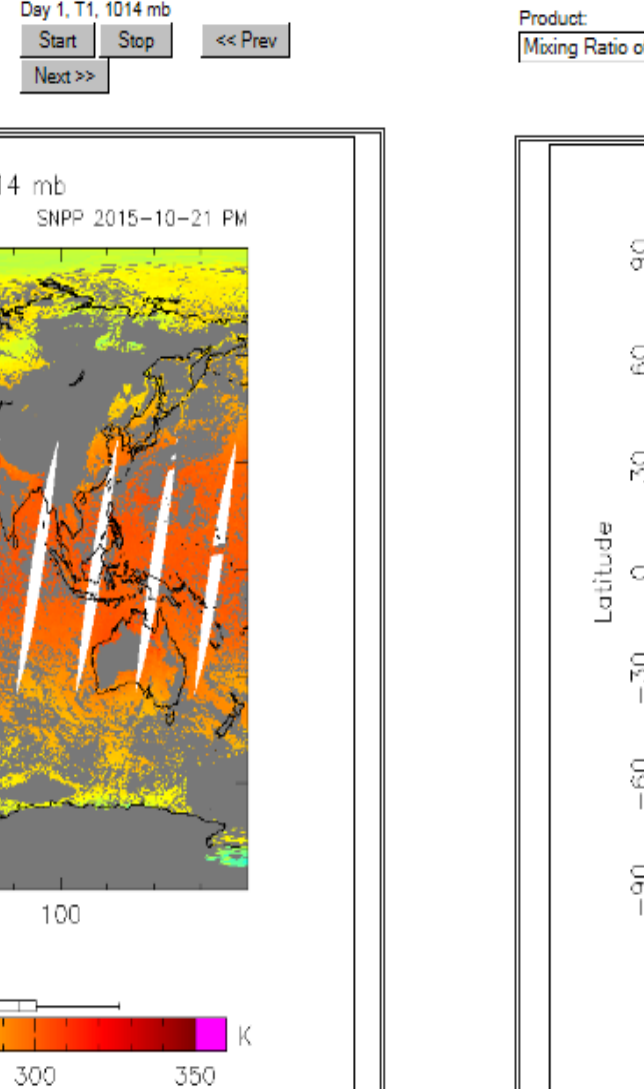
CrIS H2O MR, 2015-10-21



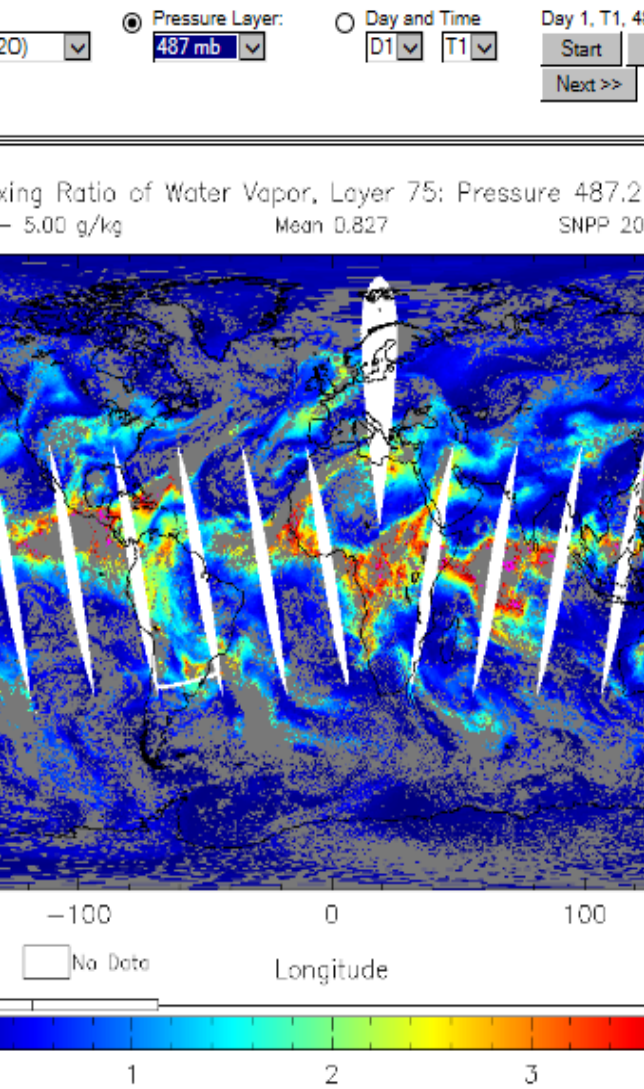
NUCAPS/SNPP Granule Composite Images



NUCAPS/SNPP Granule Composite Images



NUCAPS/SNPP Retrieval Statistics Graphics: 2017-11-15



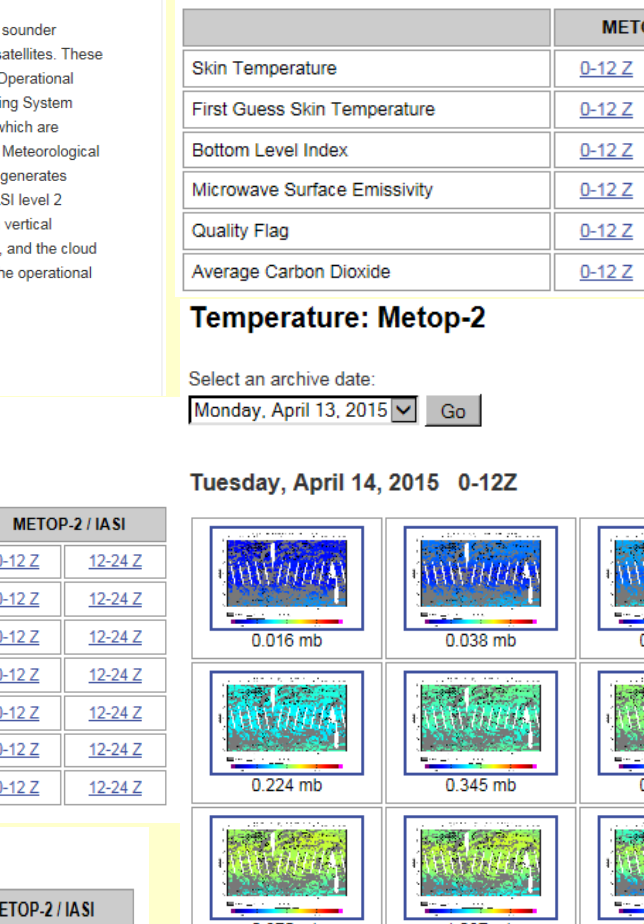
IASI Sounding Products

Cloud Top Properties
Cloud Top Fraction - 2 Images displayed over two levels
Water Vapor Profiles - 2 Images displayed over two levels
STABILITY Parameters
Stability Parameters - 10 Stability Parameters
Infrared Surface Emissivity - 50 Infrared Parameters
Microwave Emissivity - 7 Microwave Parameters
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.

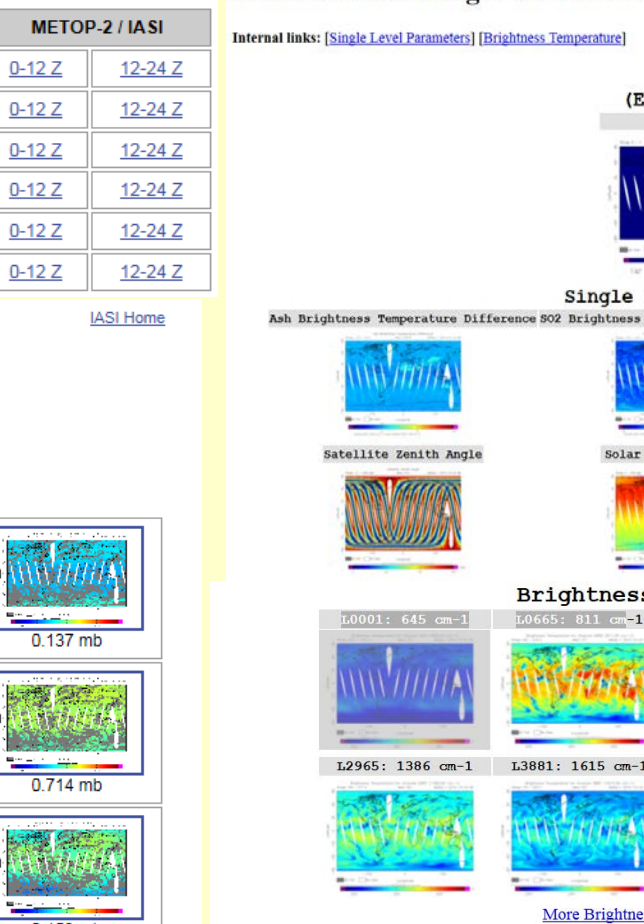
Surface Properties, Satellite Info, and Retrieval Flags

Parameter	Metop-A IASI	Metop-B IASI
Sea Temperature	0.2/2	0.2/2
Top Ocean Skin Temperature	0.2/2	0.2/2
Bottom Layer Index	0.2/2	0.2/2
Microwave Surface Emissivity	0.2/2	0.2/2
Quality Flag	0.2/2	0.2/2
Average Carbon Dioxide	0.2/2	0.2/2
Temperature: Metop-2	0.2/2	0.2/2

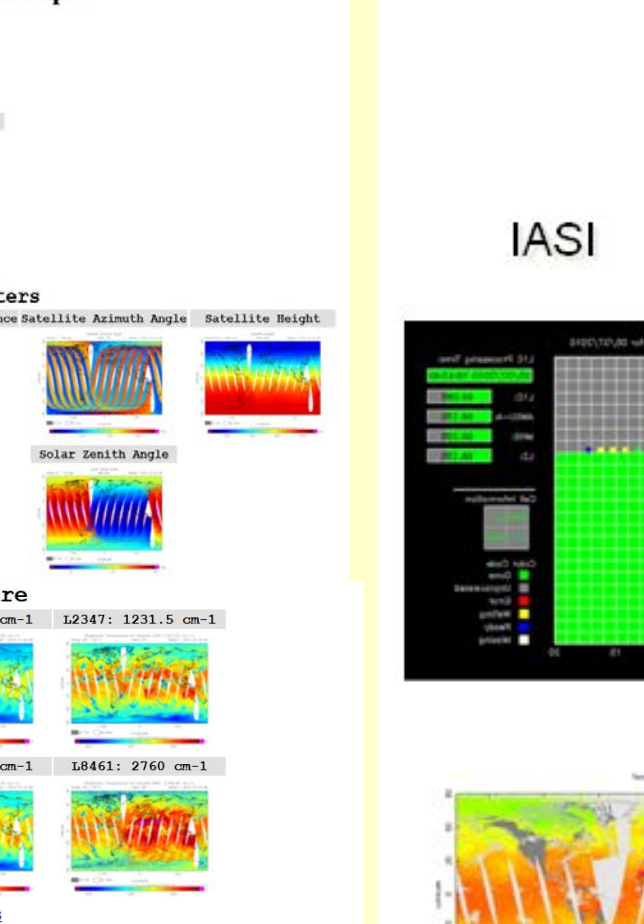
IASI Level 1C Images for 2015-10-21 AM - Metop-1



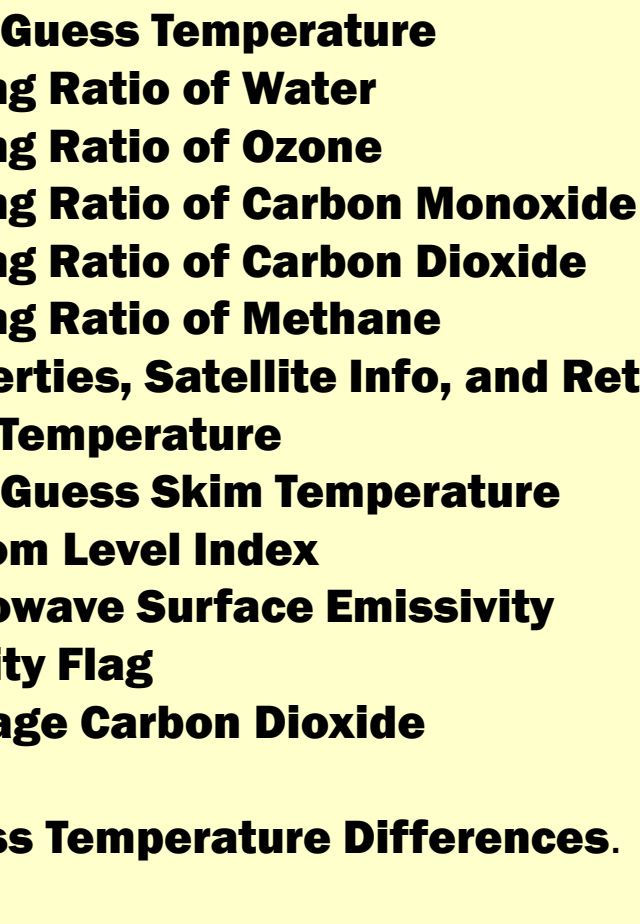
Products Quality Monitoring Cont.....



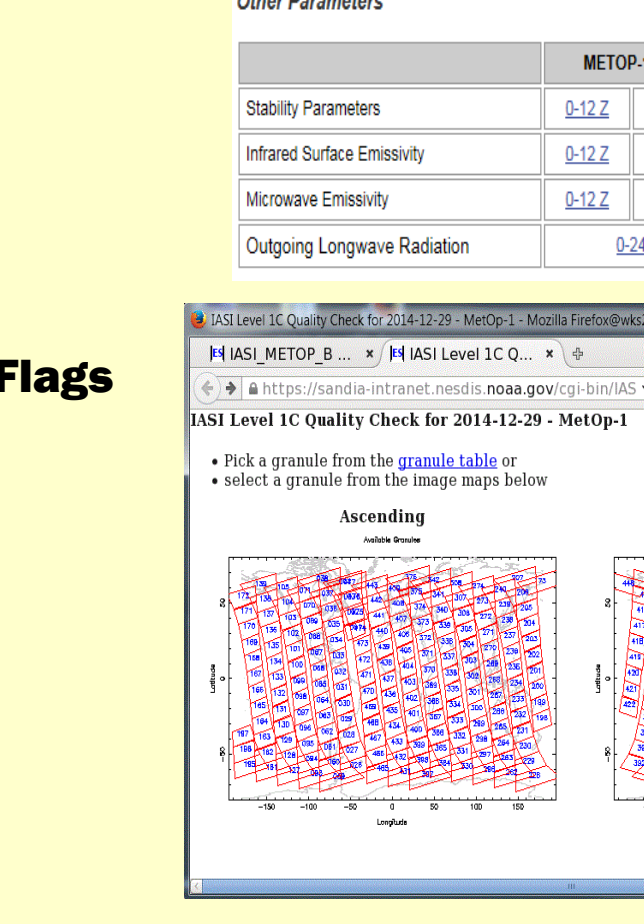
Mixing Ratio of Methane: Metop-2



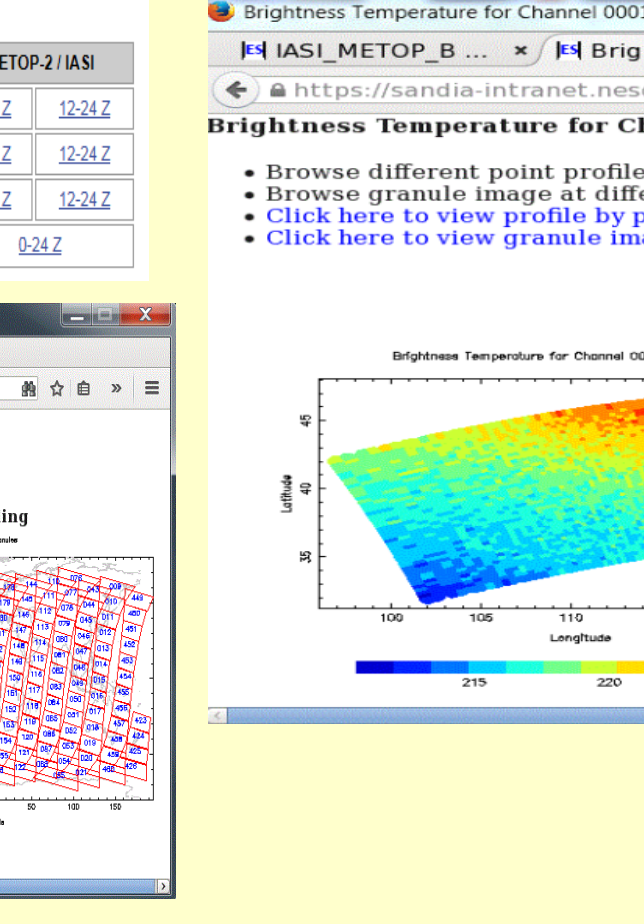
NUCAPS Vertical Profile



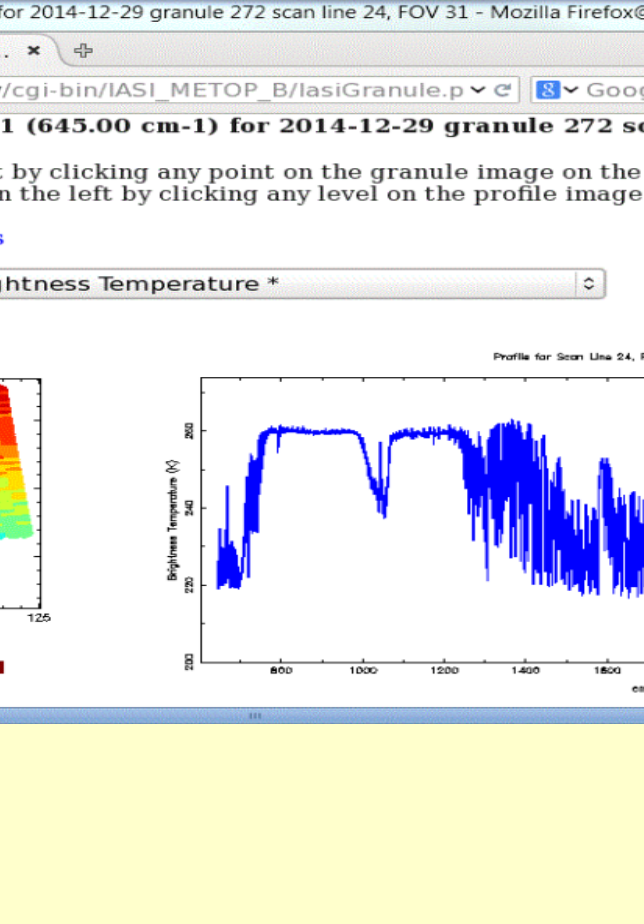
General Information: OCS Atmospheric Sounding Display



NUCAPS/SNPP Global Statistics



NUCAPS/SNPP Granule Processing Status



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

NUCAPS

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