



STATUS OF COMMUNITY SATELLITE PROCESSING PACKAGES

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4th Asia-Oceania Satellite Meteorological Users Conference
Melbourne, Australia
9 October, 2013

- ☐ 14 years of NASA Terra/Aqua Processing Package
- ☐ New Suomi NPP/JPSS VIIRS/CrIS/ATMS Processing Package
- ☐ Hosts Workshops around the world
- ☐ More than 1300 users in 33 countries & 7 continents
- ☐ Processing to include LEO and GEO satellites
- ☐ Funded by NASA H/Q & JPSS/NOAA



STATUS OF COMMUNITY SATELLITE PROCESSING PACKAGES



CSPP Team:

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Scott Mindock, Graeme Martin, Ray Garcia,
Geoff Cureton, Elisabeth Weisz, Nadia Smith,
Jim Davies, Bill Smith

IMAPP Team:

Allen Huang, Liam Gumley, Kathy Strabala,
Jim Davies, Elisabeth Weisz, Nadia Smith, Bill
Smith

CSPP Mission

<http://cimss.ssec.wisc.edu/cspp/>

- Support satellite (LEO & GEO) data and product users
- Provide official NOAA JPSS, NASA EOS algorithms as well as home grown and users contributed software
- Provide algorithms tailored or configurable to users with specific local unique environments and applications
- Offer dedicated training workshops & general remote sensing theory, algorithm, processing & applications lectures
- CSPP will expand to accommodate users' need
- Provide an End-to-End receiving, processing, and application system at low-cost (non-profit)

CSPP Release So Far

<http://cimss.ssec.wisc.edu/cspp/>

1. July 8, 2013 (CSPP CrIS, VIIRS and ATMS SDR Version 1.4)
2. July 8, 2013 (CSPP VIIRS EDR Version 1.1)
3. April 29, 2013 (CSPP CrIS, AIRS and IASI Dual Regression Retrieval Version 1.1)
4. February 22, 2013 (CSPP VIIRS SDR GeoTIFF and AWIPS Reprojection Ver. 1.0)
5. February 8, 2013 (CSPP VIIRS Cloud Mask and Active Fires EDR Version 1.0)
6. February 8, 2013 (CSPP CrIS, VIIRS and ATMS SDR Version 1.3)
7. November 26, 2012 (CrIS, AIRS and IASI Dual Regression Retrieval Ver 1.0)
8. October 4, 2012 (CrIS, VIIRS and ATMS SDR Version 1.2)
9. May 4, 2012 (CrIS UW Retrieval Version 1.0)
10. May 2, 2012 (CrIS, VIIRS and ATMS SDR Version 1.1)
11. March 14, 2012 (VIIRS and ATMS SDR Version 1.0)

CSPP Web Site



Community Satellite Processing Package

[Home](#)[Download](#)[Applications](#)[History](#)[Credits](#)[Forum](#)

The Community Satellite Processing Package (CSPP) supports the Direct Broadcast (DB) meteorological and environmental satellite community through the packaging and distribution of open source science software. CSPP supports DB users of both polar orbiting and geostationary satellite data processing and regional real-time applications through distribution of free open source software, and through training in local product applications. CSPP is funded through [NOAA JPSS](#).

Suomi National Polar-orbiting Partnership (NPP) Products

CSPP software to support Suomi NPP:

- [VIIRS](#), [ATMS](#) and now [CrIS](#) calibration and geolocation software (Raw Data Records (RDRs) to Science Data Records (SDRs));
[Learn more ...](#)
- [VIIRS](#) Environmental Data Records (EDRs);
[Learn more ...](#)
- [VIIRS](#) SDR reprojection software for the creation of GeoTIFFs and/or AWIPS NetCDF files;
[Learn more ...](#)
- [CrIS](#), [AIRS](#) and [IASI](#) University of Wisconsin dual regression single Field-of-View (FOV) Temperature, Moisture, Surface and Cloud Retrieval Environmental Data Record (EDR).
[Learn more ...](#)

Coming Soon:

- [VIIRS](#) Imagery and Land Properties Environmental Data Records (EDRs).
- [VIIRS](#), [MODIS](#) and [AVHRR](#) (POES and MetOP) Cloud and Land Surface Retrievals from [CLAVR-x](#).

For more information about Suomi NPP, please see:

- the [JPSS website](#);
- the [Suomi NPP website](#);
- the [Suomi NPP document library](#).

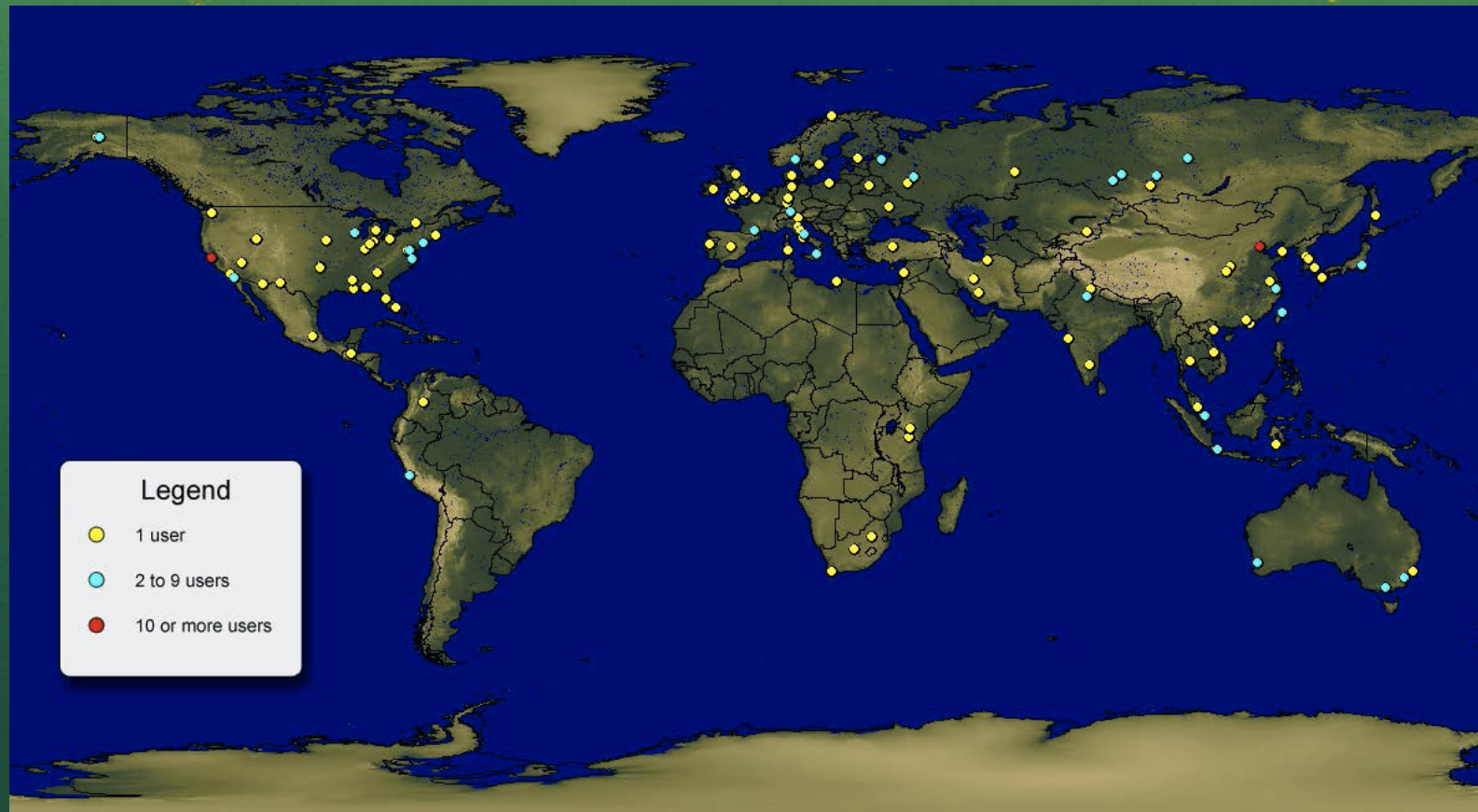
What's New

- [NPP SDR v1.4 Release](#)
- [VIIRS EDR v1.1 Release](#)
- [Hyperspectral Retrieval Software v1.1 Release](#)
- [VIIRS Reprojection Software v1.0 Release](#)

<http://cimss.ssec.wisc.edu/cspp/>

CSPP Users so far

<http://cimss.ssec.wisc.edu/cspp/>



More than **250 people** have downloaded some part of the CSPP suite of products representing **33 different countries** and **7 continents** so far.

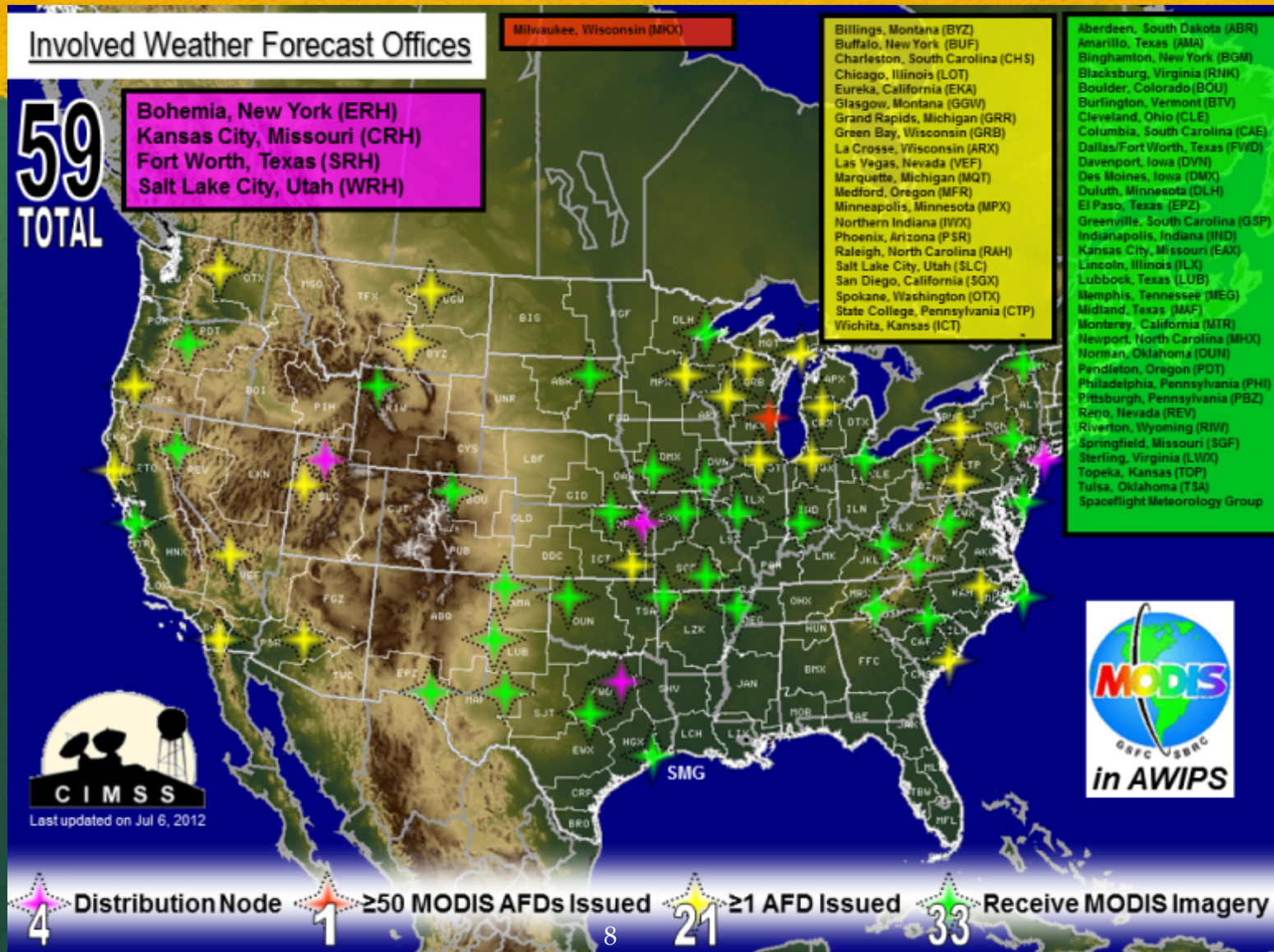
Who is Using CSPP?

Here is a sample

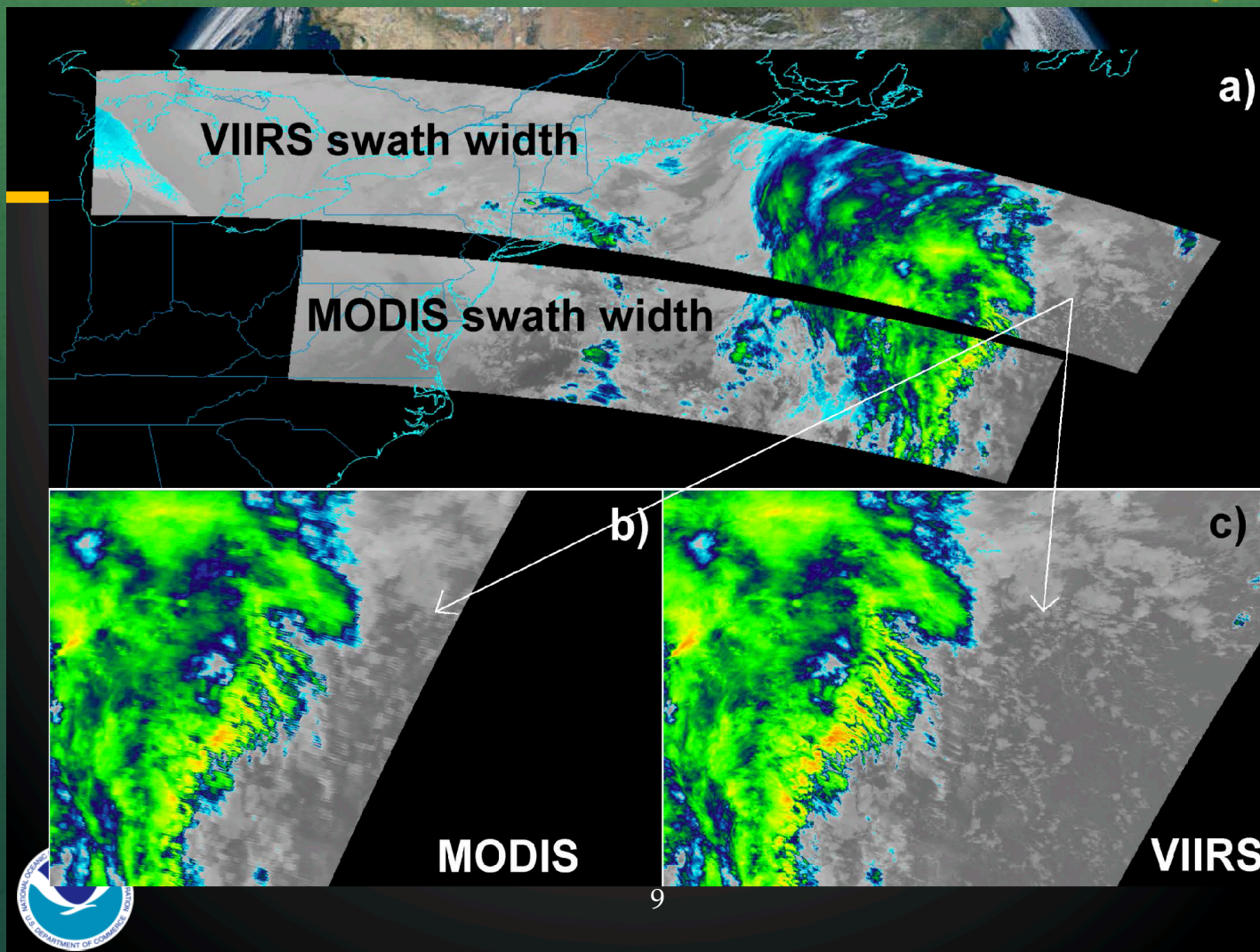
- EUMETSAT for EARS-NPP
EUMETCast distribution
- UK Met Office
- Météo-France
- CSIR South Africa
- Swedish Met Service
- DWD – German Met Service
- Australia Bureau of Meteorology
- Taiwan Central Weather Bureau
- Belarus National Academy of Science
- Indonesia Government Space Agency (LAPAN)
- German Aerospace Center
- CONABIO Mexico
- EURAC Remote Sensing Institute Italy
- China National Satellite Meteorological Center
- Brazil INPE
- Danish Meteorological Institute
- Japanese Meteorological Agency
- Norwegian Meteorological Institute
- Swedish Met Institute
- Kazakhstan Space Investigation Institute
- UK Plymouth Marine Lab
- Naval Research Lab
- Vendors SeaSpace, ScanEx, Spacetec and others.
- In addition, CSPP DB products are being used in the US NWS in HI, Alaska and CONUS

IMAPP MODIS products in AWIPS

VIIRS is in too



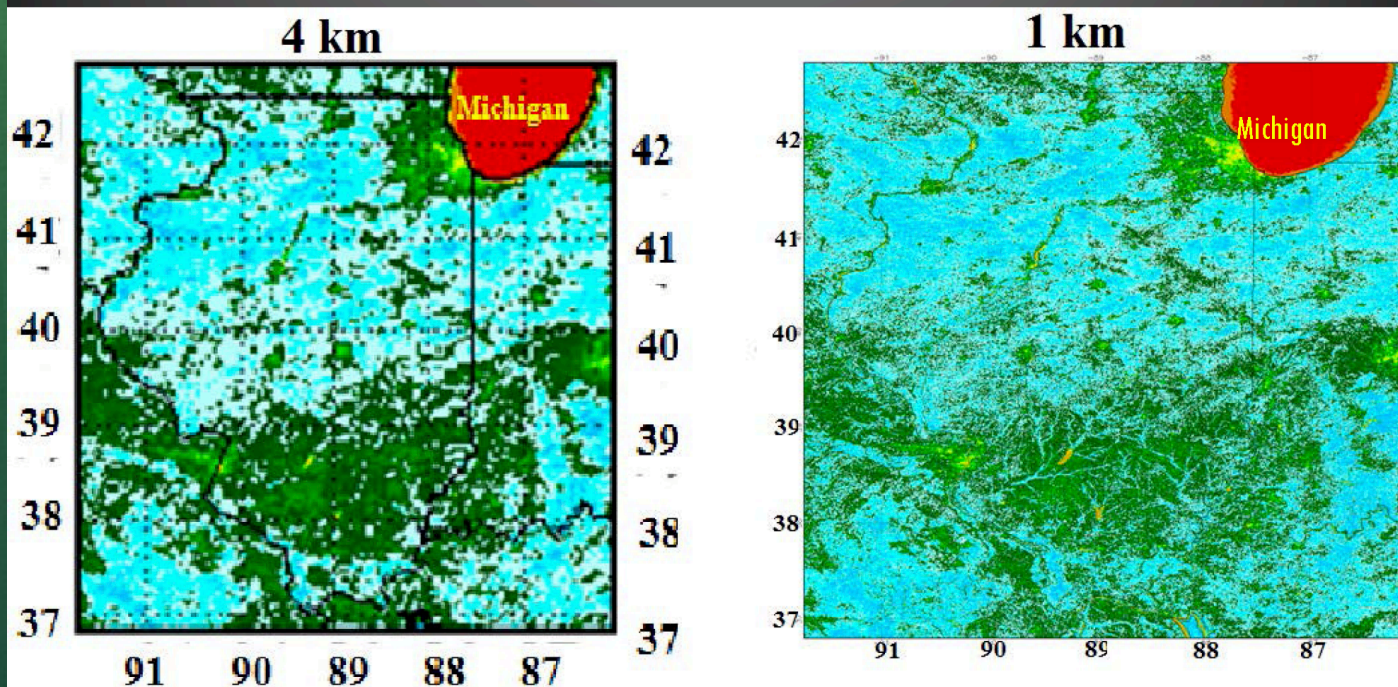
MODIS Vs. VIIRS



VIIRS NDVI

VIIRS NDVI, Jul 28, 2012

NDVI is used as a base for Vegetation fraction and Ecosystem classes used in NWS modeling

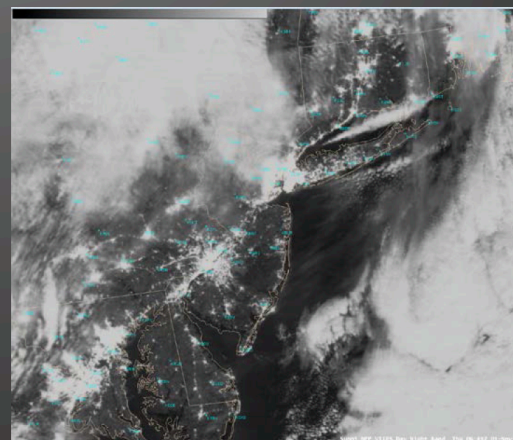
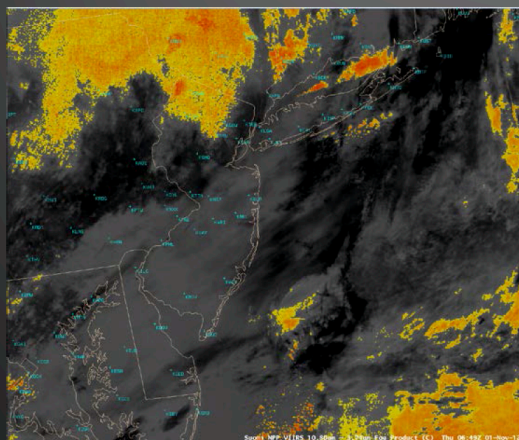


1 km resolution NDVI shows many features which is hard to see with 4 km data:

small lakes & reservoirs
river valleys;
forest

VIIRS Fog Detection by DNB imagery

Improved Fog Products – using DNB



Cloud mask: Images show an example how DNB can improve cloud detection. Left image shows difference M12 (3.75um) – M15 (11um) brightness temperature, one cloud test in the current cloud mask. Water clouds appear yellow and red. Right image shows VIIRS DNB, where water clouds are very bright. It can be seen that DNB will detect low-level clouds those are missed in IR.





NPP VIIRS used by Operational Forecasters

3 Nov 2012 11:20 UTC



Forecasters in Hawaii issued this discussion

HAWAIIAN ISLANDS SATELLITE INTERPRETATION MESSAGE

NWS CENTRAL PACIFIC HURRICANE CENTER HONOLULU HI

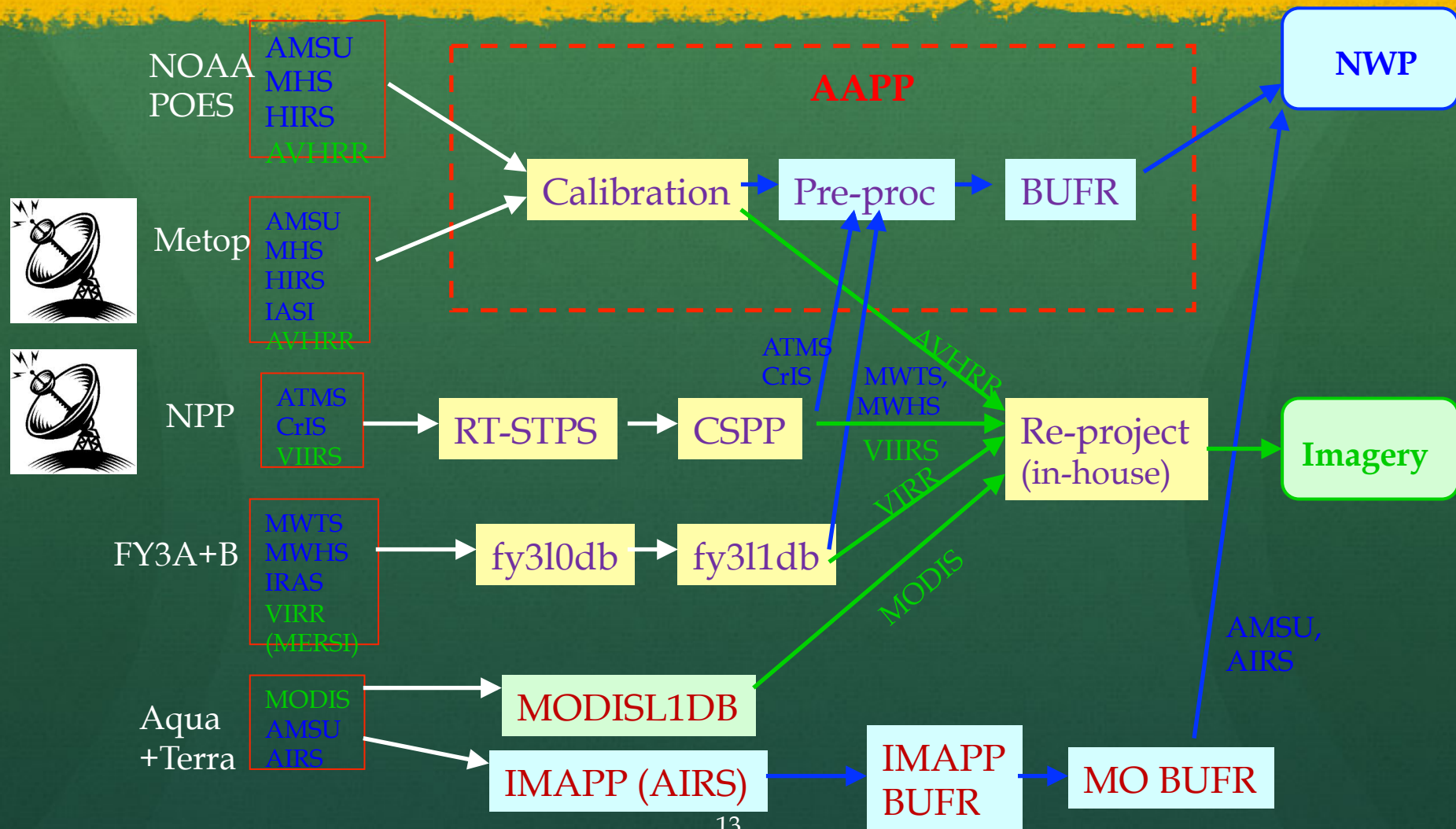
1230 UTC SAT NOV 03 2012

BASED ON DATA THROUGH 1200 UTC NOVEMBER 03 2012

.....

NIGHTTIME SATELLITE IMAGERY FROM THE VIIRS DAY-NIGHT BAND SHOWS MOSTLY CLOUDY SKIES OVER THE WINDWARD BIG ISLAND WITH RADAR CONFIRMING SOME LIGHT SHOWERS IN THE AREA. THE WINDWARD HANA COAST AND LOWER SLOPES ARE COVERED WITH LOW CLOUDS WHILE THE REST OF MAUI COUNTY IS CLEAR. ON OAHU...PARTLY CLOUDY SKIES PREVAIL. ON KAUAI...THE EARLIER CLOUDY SKIES HAVE CLEARED IN THE EARLY MORNING

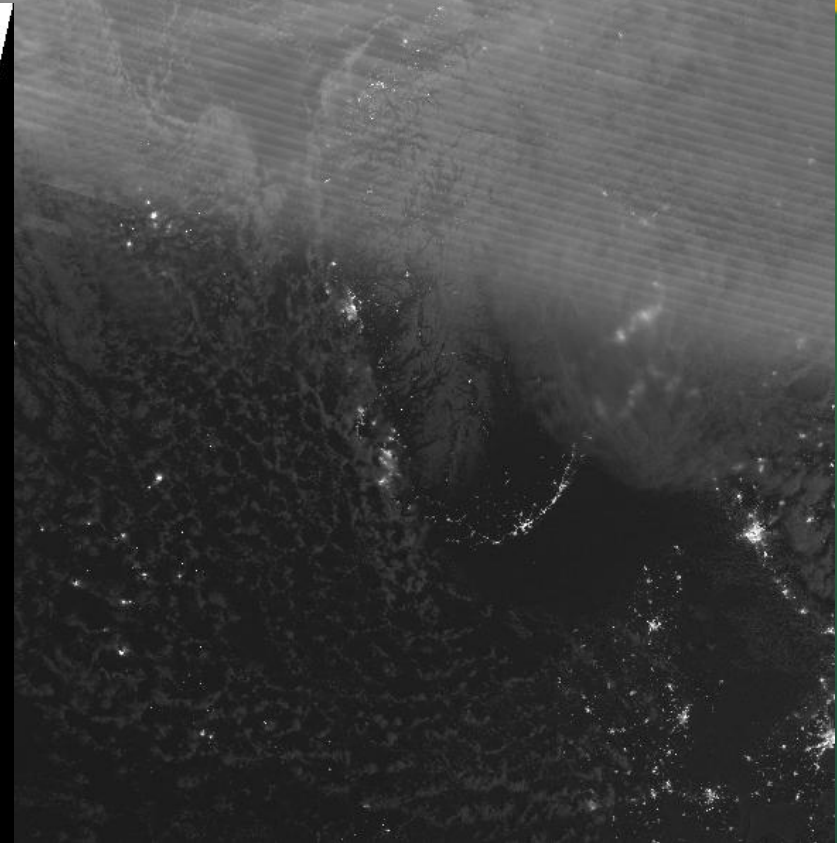
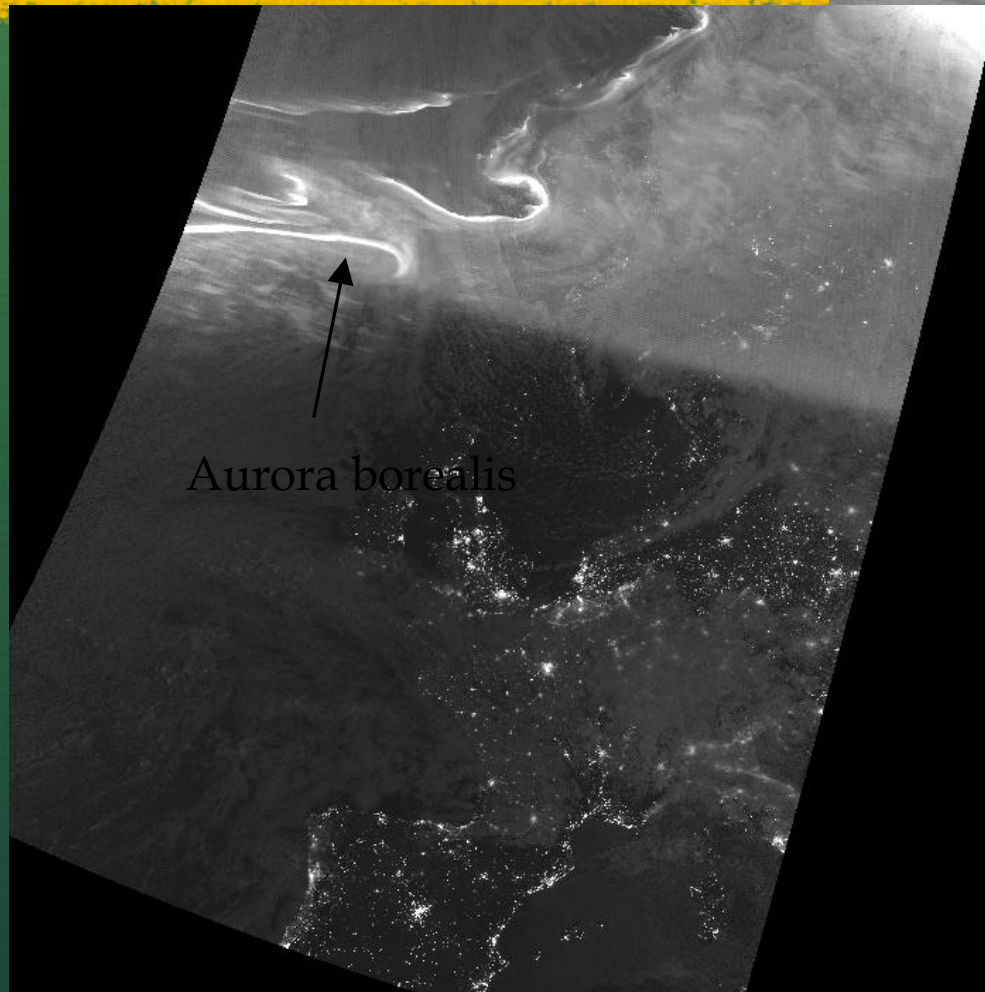
DB processing chain at the Met Office - UK



DNB stray light problem

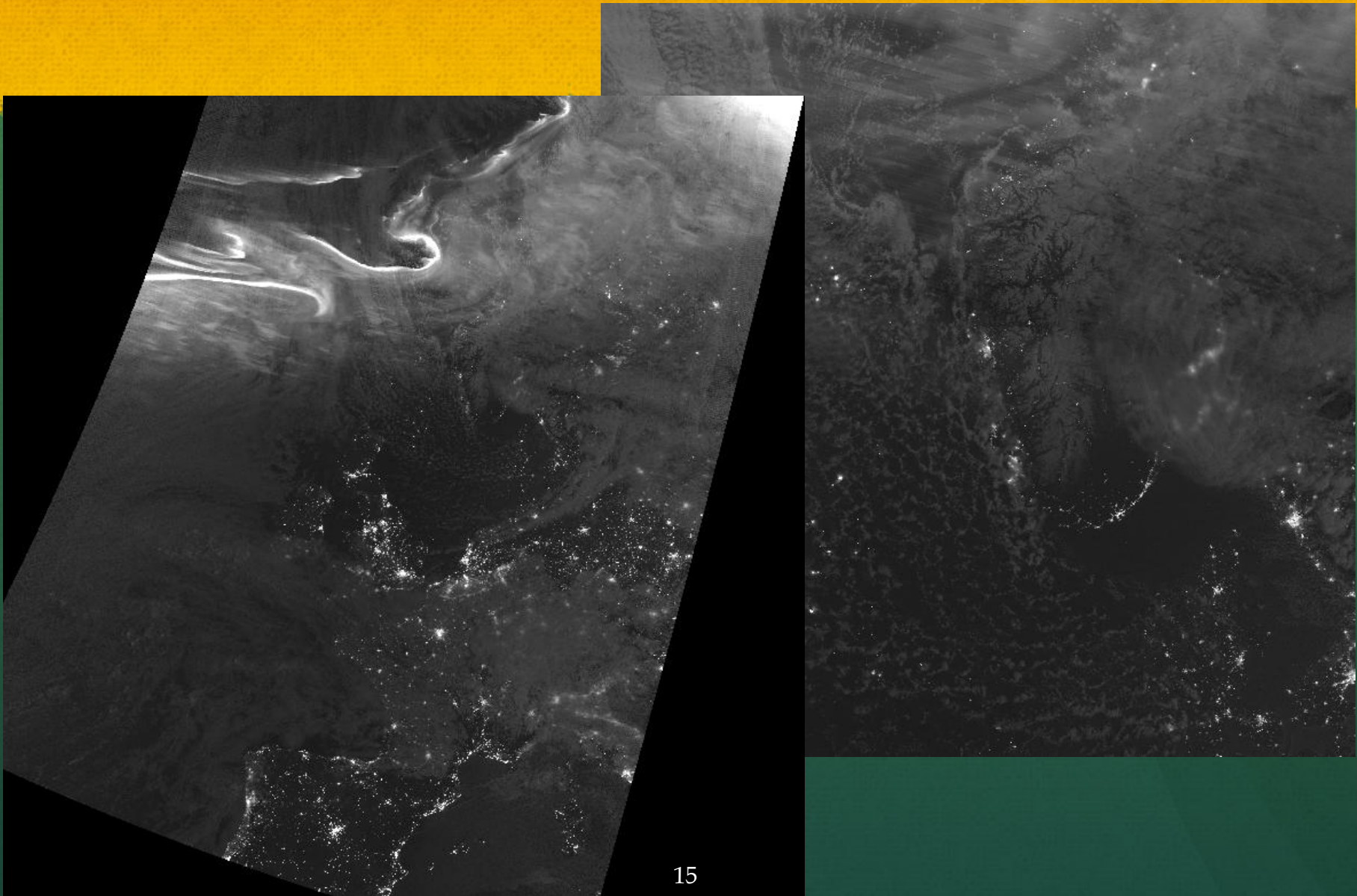
Night time scene, but satellite sunlit

Note prominent scan cycle (16 lines)



9th Oct 2012

Corrected DNB imagery



DNB stray light problem Correction Solution Developed by Met Office - UK



Our solution

1. Estimate a radiance correction for each of the 16 detectors in a scan (use a reference dark scene)
2. Use SCSolarZenithAngle to roughly locate the day/night transition (look at 70° - 82°)
3. For each line in the test scene, compute the 25th percentile of the radiance
4. For each scan (16 lines), compute the product of the radiance, r , and the reference correction, R

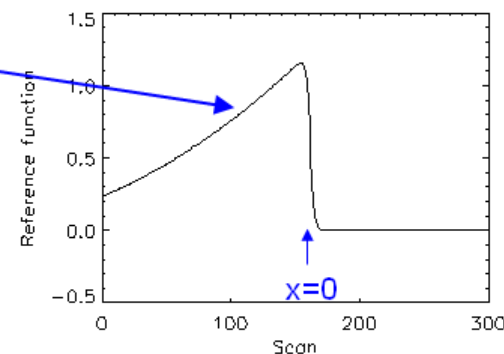
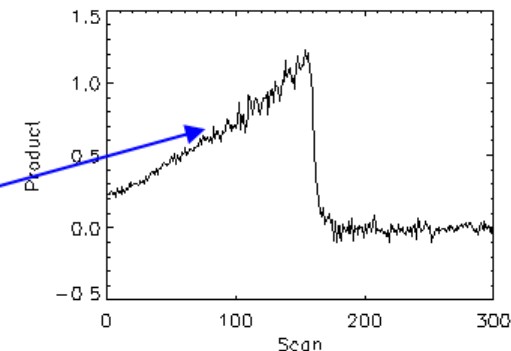
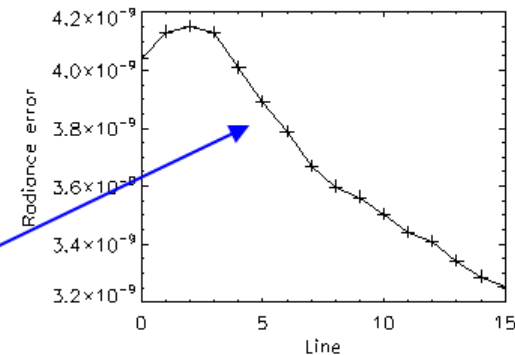
$$\frac{\sum (r - \bar{r})(R - \bar{R})}{(\sum (R - \bar{R}))^2}$$

5. Take a fixed reference function and shift it until the best match is obtained

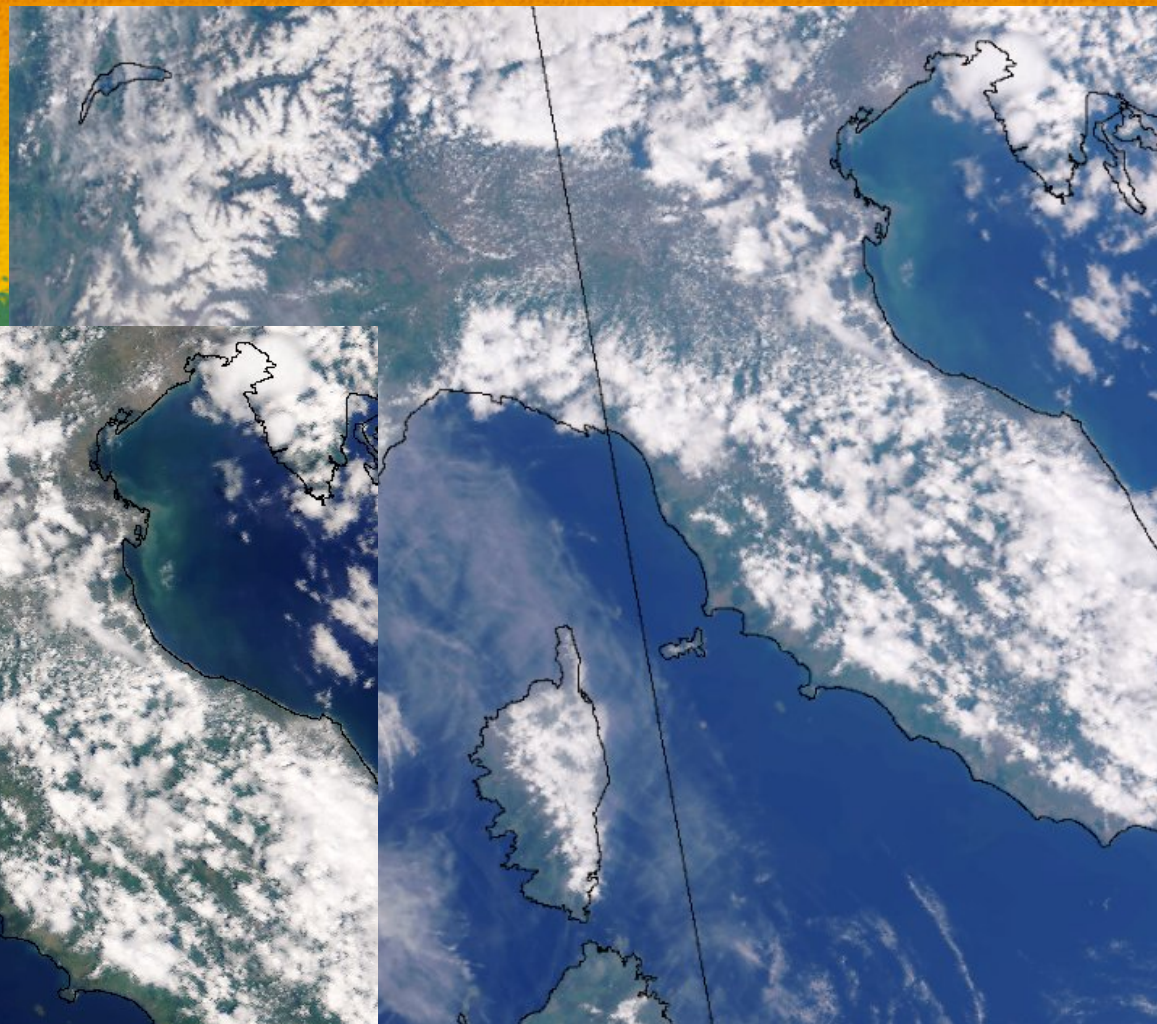
$$y = A + Bx + Cx^2 + 0.5(1 - \tanh(x/w))$$

A, B, C, w are constants; vary the x origin

5. Fit the amplitude
6. For each scan, multiply the radiance correction (step 1) by the optimised reference function (step 5), hence correct each line



VIIRS true colour



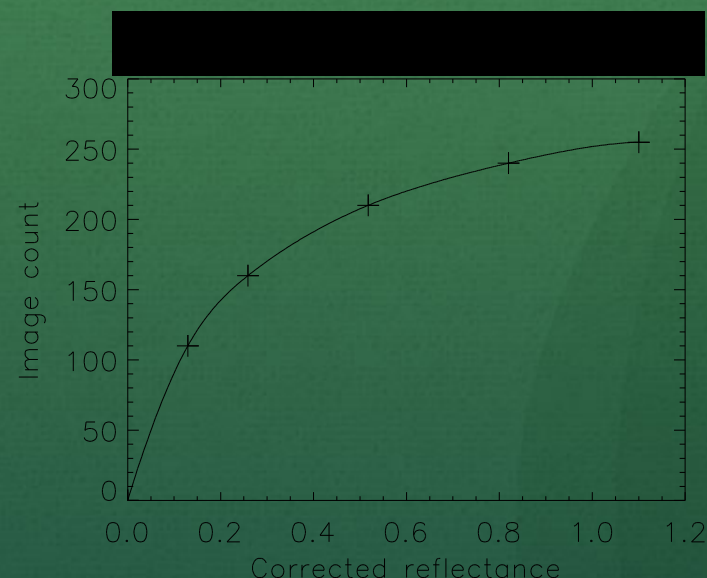
Uncorrected



Corrected

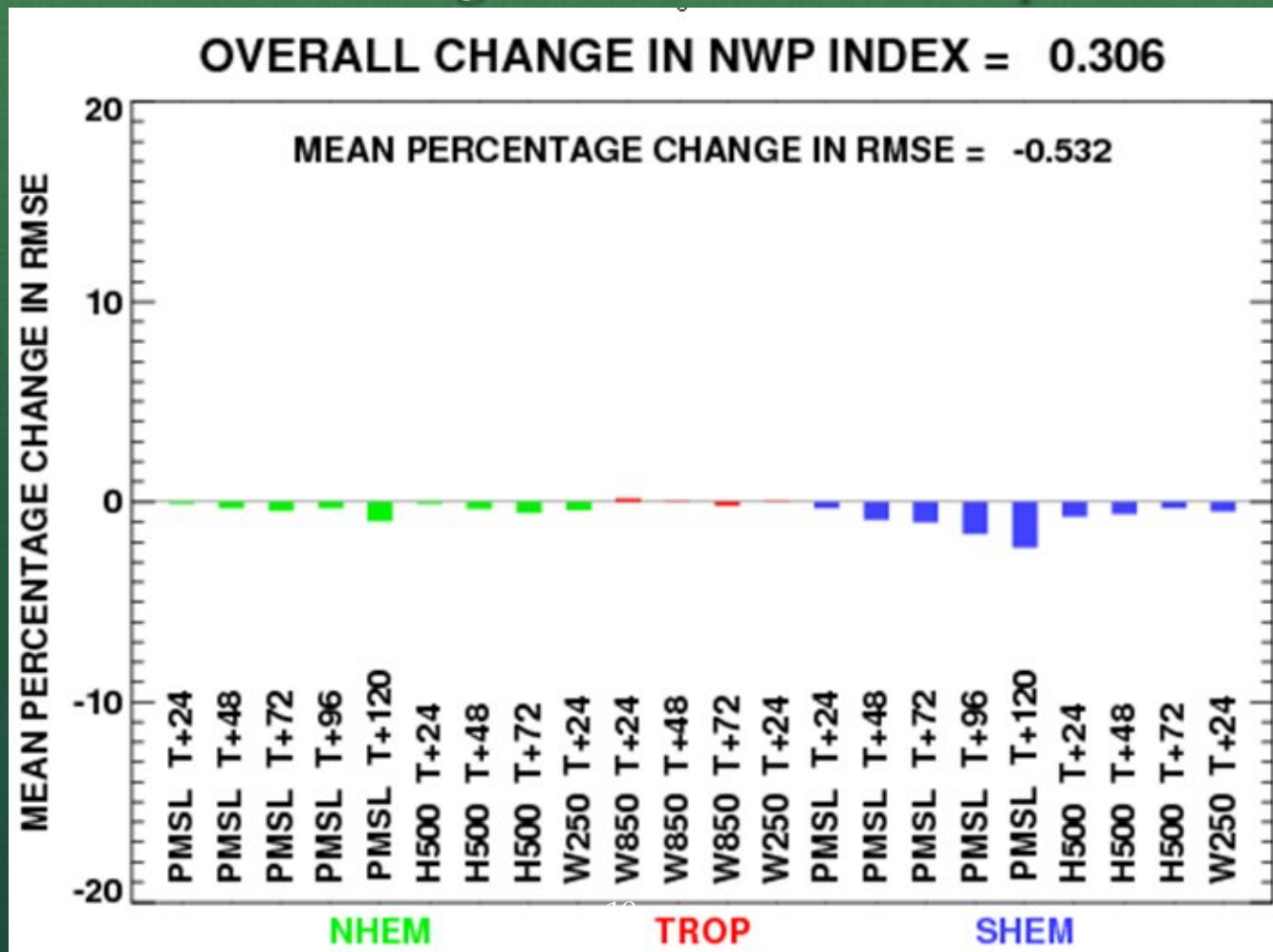
VIIRS true colour

- Using the new version of UW's "crefl" software (version 1.7.1)
 - supports MODIS and VIIRS
- Channels M2, M4, M5 or I1
- Same radiance to grey-scale mapping as MODIS (see *Creating Reprojected True Color MODIS Images: A Tutorial* by Gumley et al.)



Use of NPP data in NWP

- ATMS and CrIS data assimilated operationally in Met Office global model from April 2013



From
package
trials

Lower
errors



SMHI - NWC SAF



DR processing at SMHI with VIIRS

- X/L-band station installed Nov 2011
- Running RT-STPS-CSPP-PPS-Pytroll pre-operationally since Spring 2012
- In operation since Dec 18, 2012



Nov 8 08:56



Nov 8 10:27



Nov 8 13:53



Nov 15 13:05

Nov 16 16:20

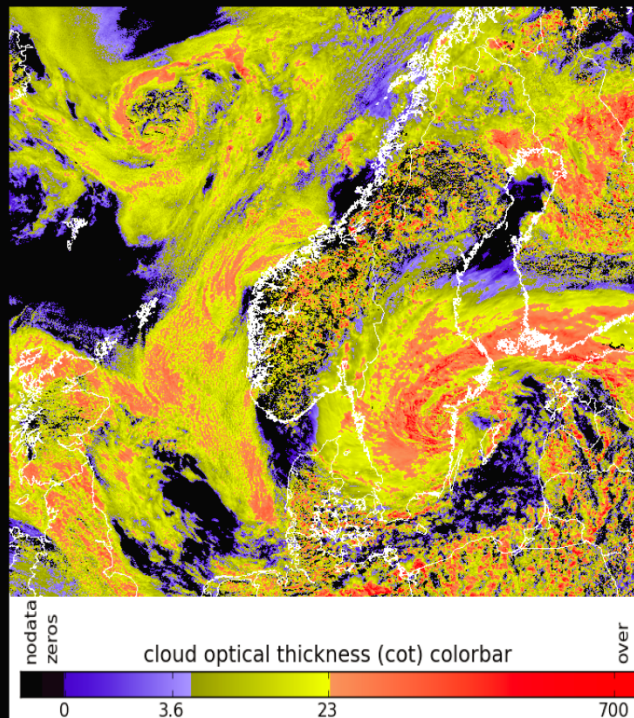


SMHI - NWC SAF

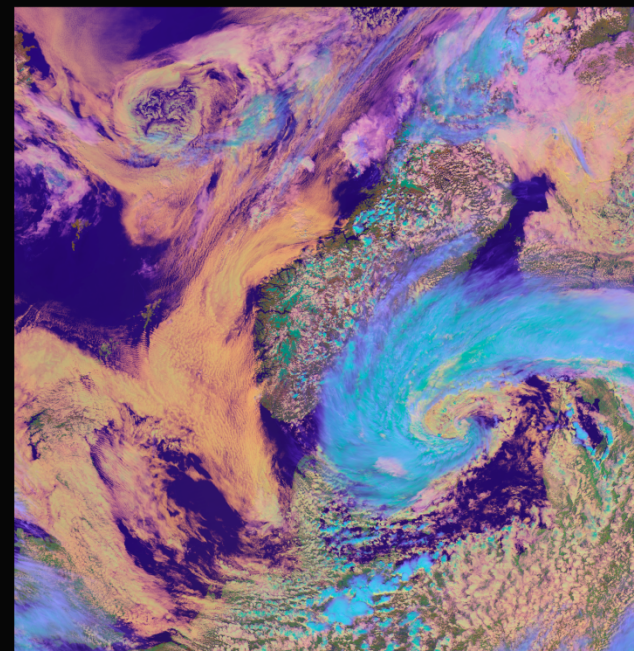


VIIRS products

Cloud Optical Thickness



VIIRS: June 25 11:49 UTC, 2012



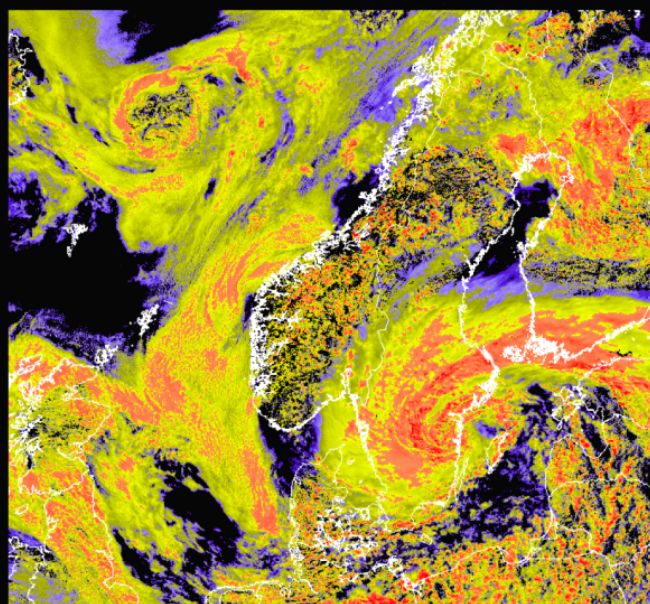
SMHI - NWC SAF



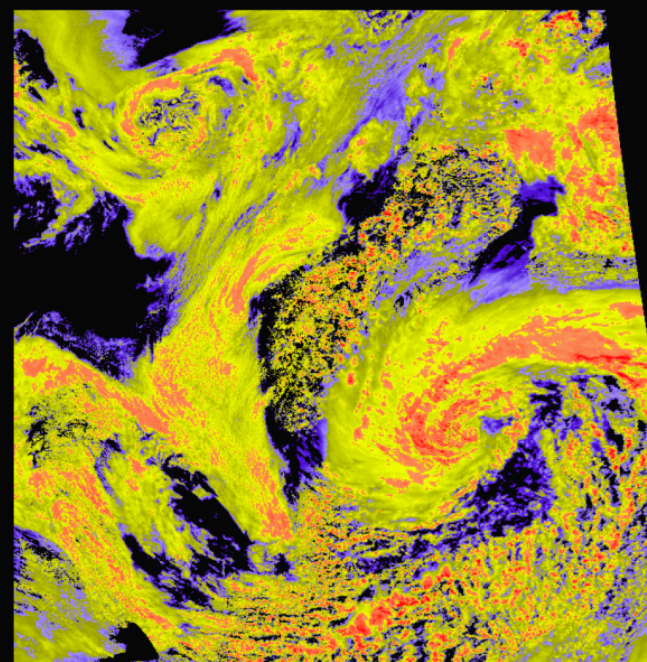
VIIRS versus AVHRR products

Cloud Optical Thickness

VIIRS: June 25 11:49 UTC, 2012

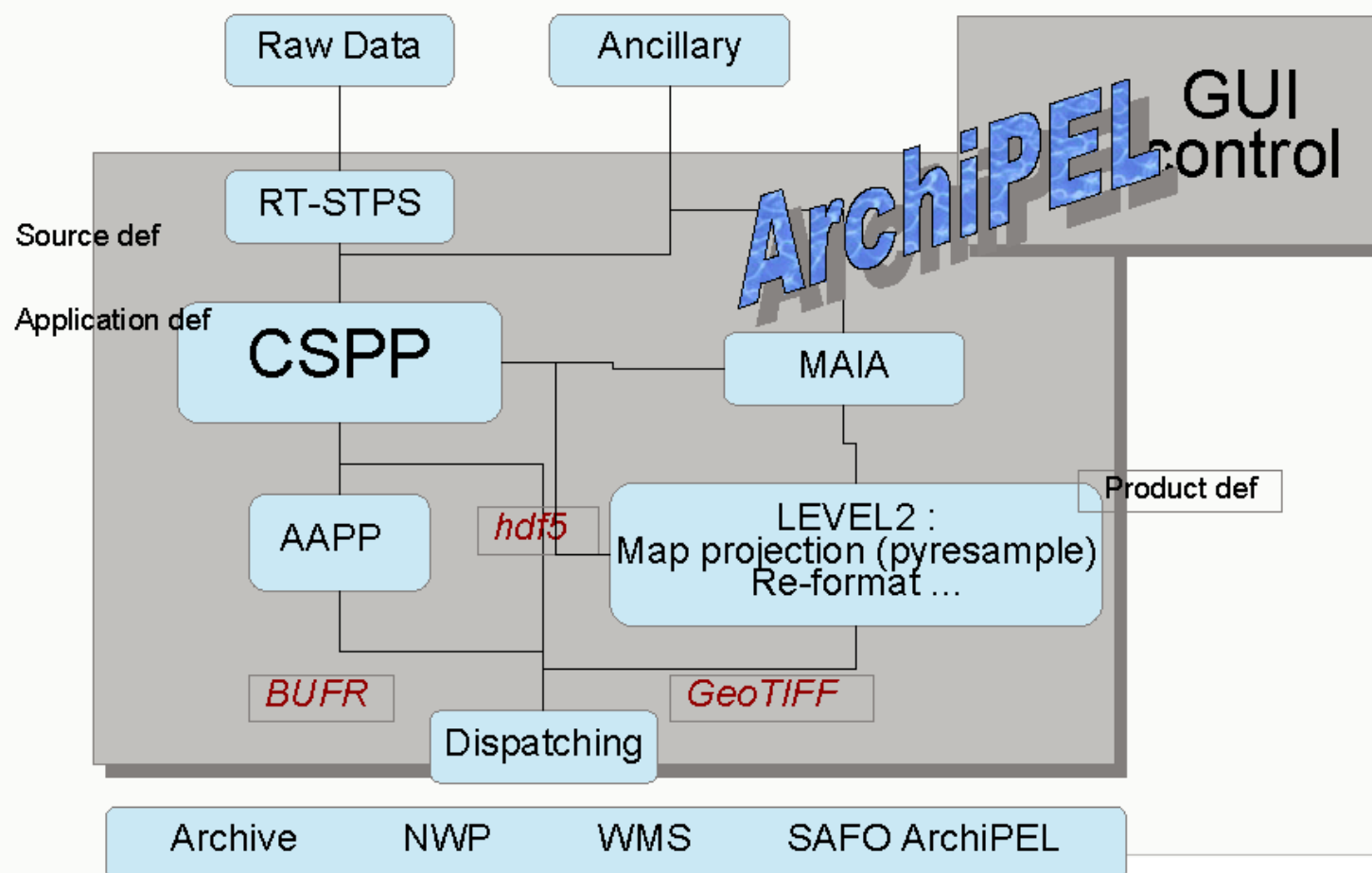


AVHRR: June 25 12:22 UTC, 2012



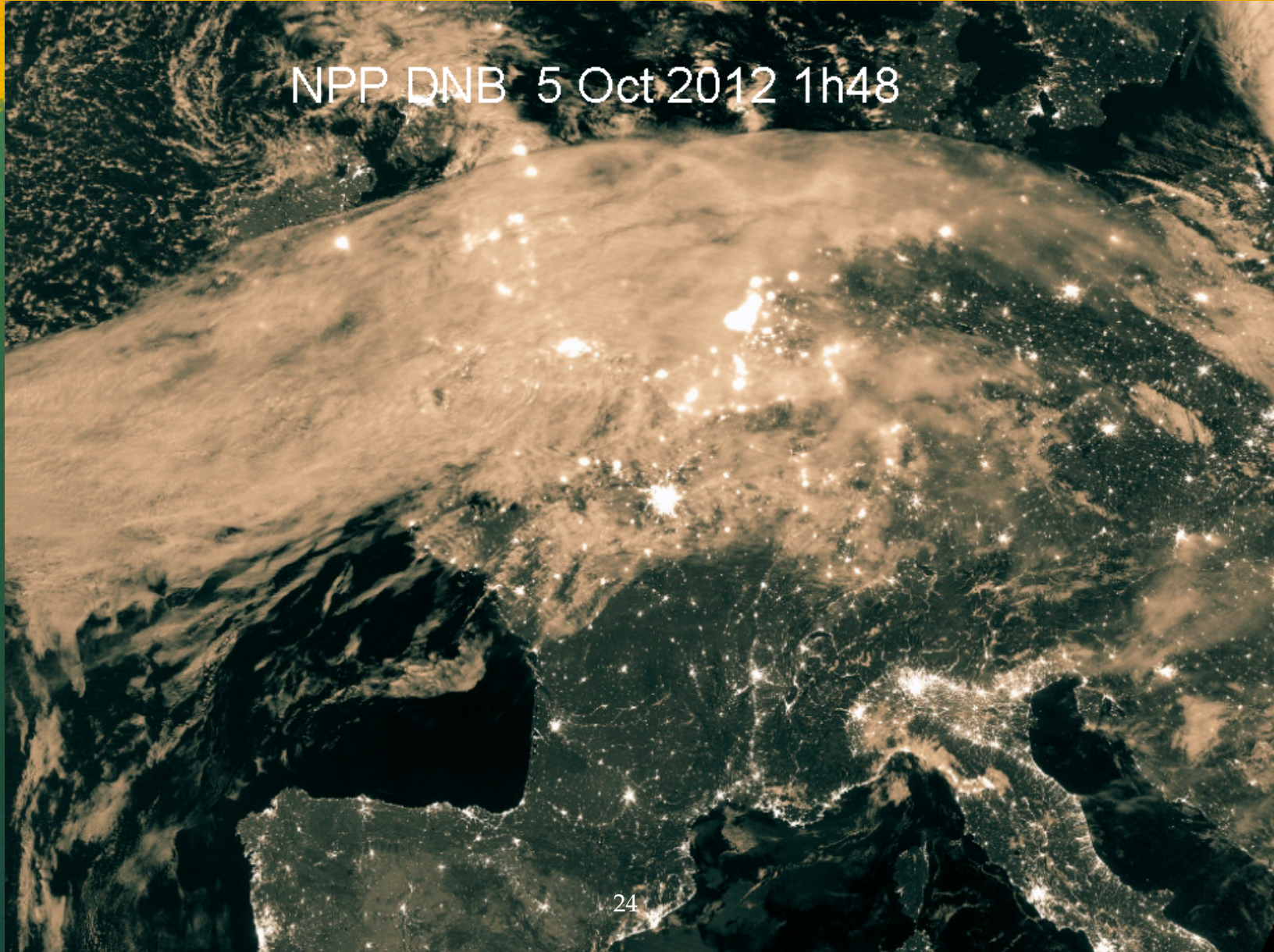
Meteo France CMS

ArchiPEL and CSPP

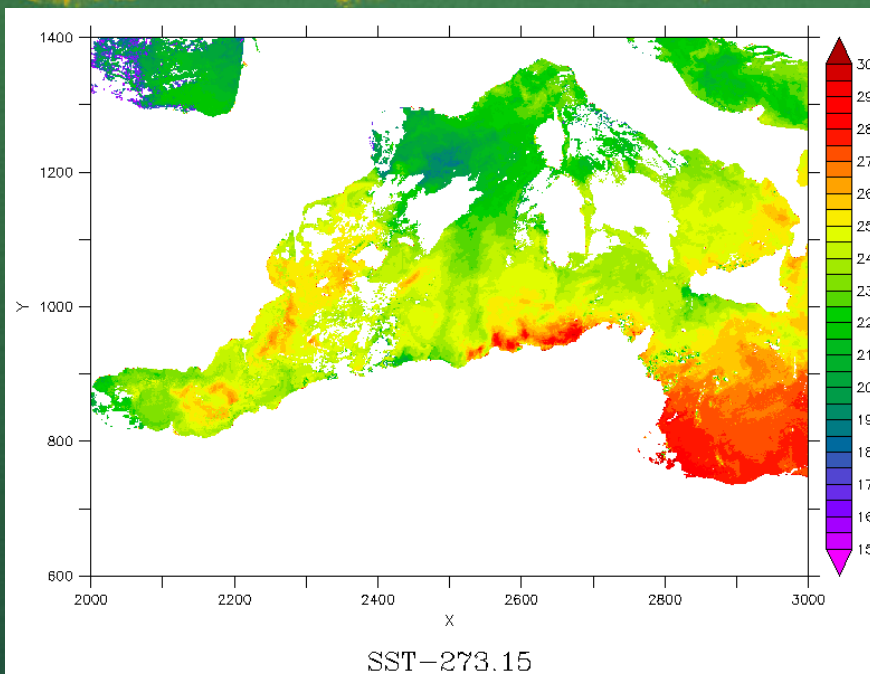


Meteo France CMS

NPP DNB 5 Oct 2012 1h48



Meteo France CMS



SST Overall Validation results

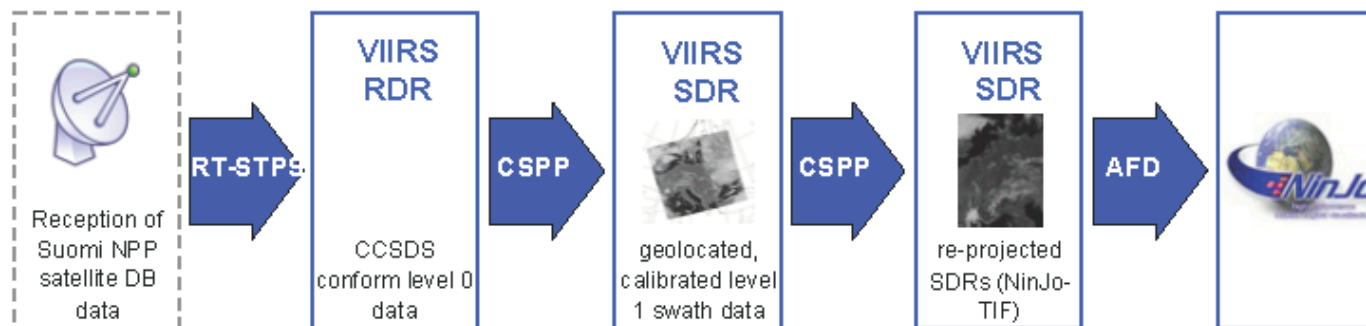
NAR area; 15 October 2012 till 15th March 2013

Quality levels 3-5

	Daytime		Nigh time	
Quality	3-5	5	3-5	5
Number of cases	3088	990	3648	1678
bias	-0.13	-0.10	-0.05	0.03
std-dev	0.46	0.34	0.37	0.29

Deutscher Wetterdienst (DWD), Germany

VIIRS Processing Chain at DWD



Step 1: Develop a module to create NinJo-compatible images ✓

Step 2: Testmode using a Developer NinJo server-client pair. ✓

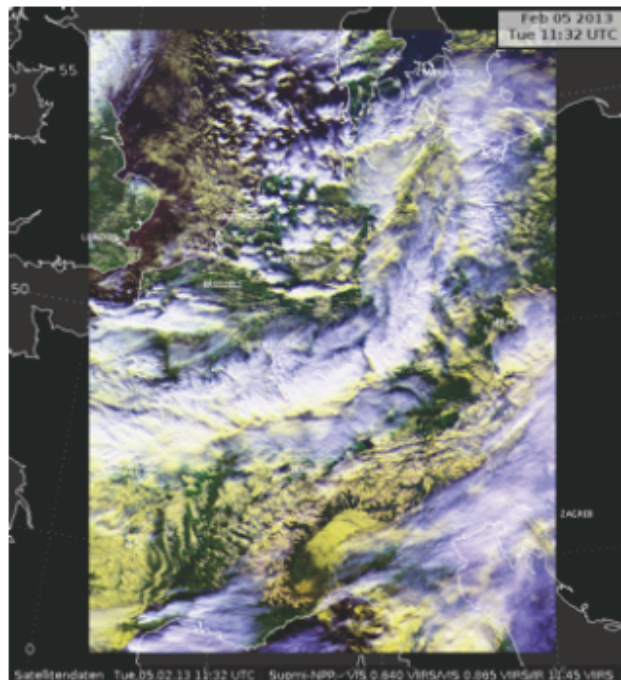
Step 3: Incorporation into the official NinJo release ✓ > **NinJo 1.7.1**

Current status: We are ready for S-NPP VIIRS - thanks to the excellent work of the CSPP team !!

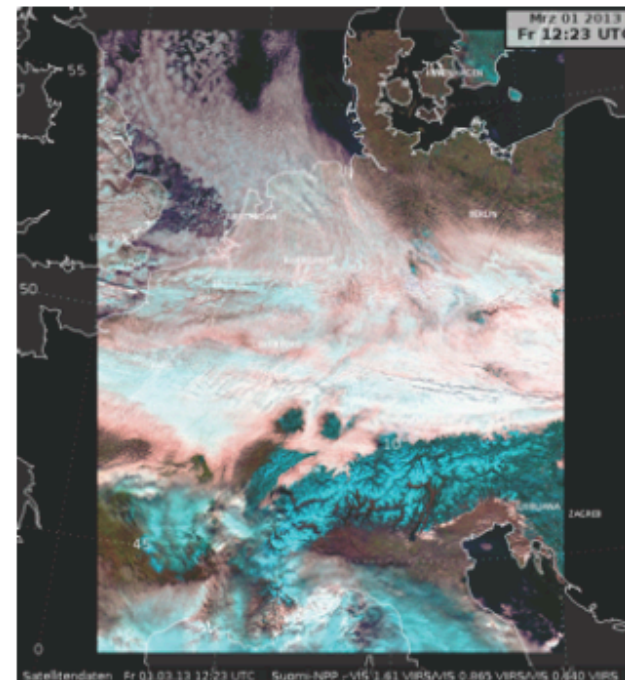
Deutscher Wetterdienst (DWD), Germany



S-NPP VIIRS examples in NinJo



→ Strong cold-front across Germany. Inside the strong convection zone the first thunderstorms of the year occurred.



→ Norwegian foehn brings sunshine to Schleswig-Holstein and Mecklenburg-West Pomerania.



National Commission for Knowledge and Use of Biodiversity CONABIO - Mexico

Current operational processes (VIIRS)

Raw data acquisition and processing

L0 (Terascan – RT-STPS [patched])

RNSCA-RVIRS

Level1 Products (CSPP 3.1. SDR_1_3 EDR_1_0)

GDNBO's

Day Night Band

SVI's

SVM's

AVAFO

IICMO

Higher level products

Npp.points
(homemade)

Hotspot
characterization

GEOTIFs

End-user products

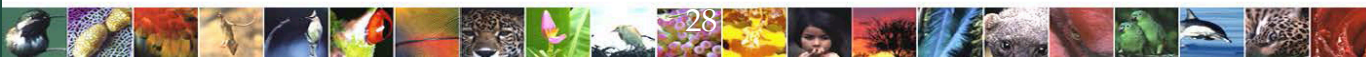
Shapefiles and
KML

Web page
publication

Email alert

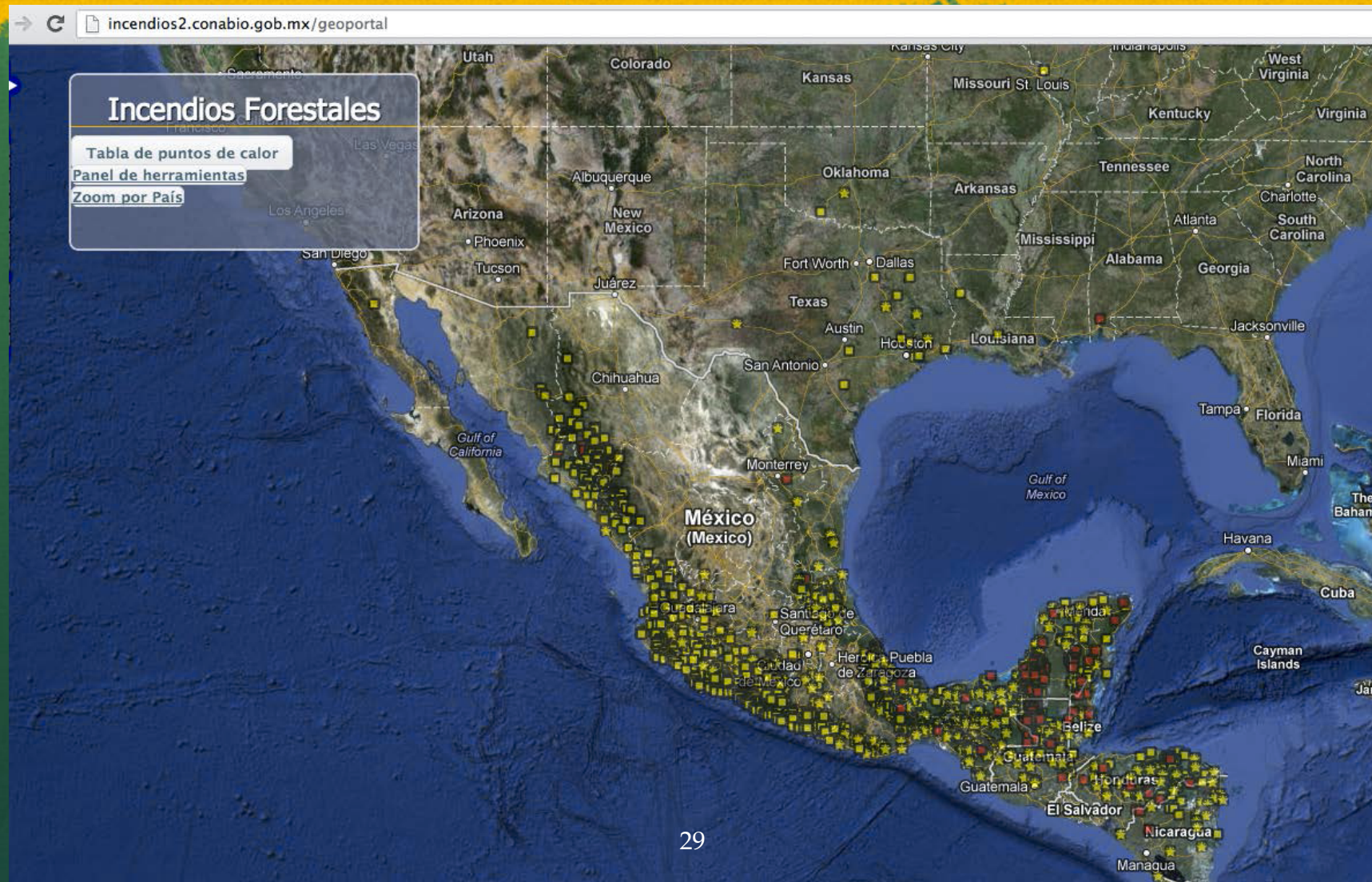
W*S Services

Burned area
afection *



CONABIO - Mexico

Viirs and Modis Active Fires





Suomi NPP Regional Services Current Status

- Svalbard, Lannion, Athens and Maspalomas completed and routinely receiving Suomi NPP
- Kangerlussuaq installation postponed to summer 2013 due to flooding of access bridge
- EARS-ATMS and EARS-CrIS services in trial since November 2012 and operational from 15 May 2013
- EARS-VIIRS to start Summer 2013 with pass-based processing, End 2013 with segment based processing



- Next: More X-band stations in the network: Madison?

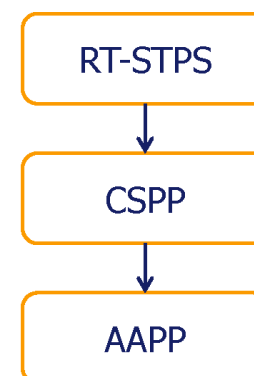


New EUMETSAT Provided Global and Regional NPP Services Product Processing

By NOAA at
IDPS/NDE

Global	Regional
ATMS	ATMS
CrIS	CrIS
	VIIRS

By EUMETSAT



CSPP Home Grown Algorithm Example

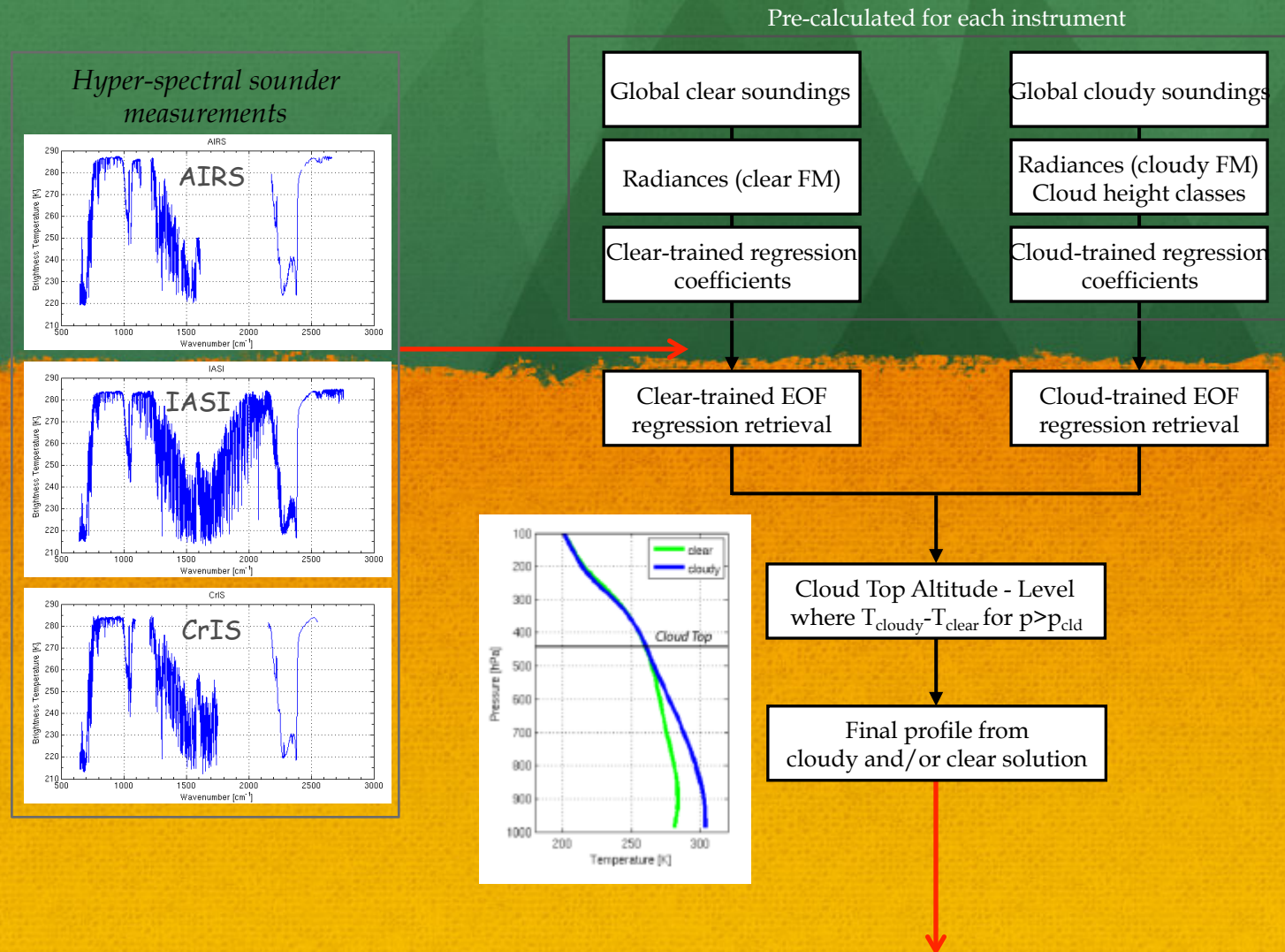
CrIS L2 Software and Products Home Grown Algorithm

CSPP UW Hyper-Spectral Retrieval Package V1.0
Developed at CIMSS for AIRS, IASI and CrIS L1 to L2 processing

*Elisabeth Weisz, Nadia Smith, Bill L. Smith Sr.
and the CSPP team*

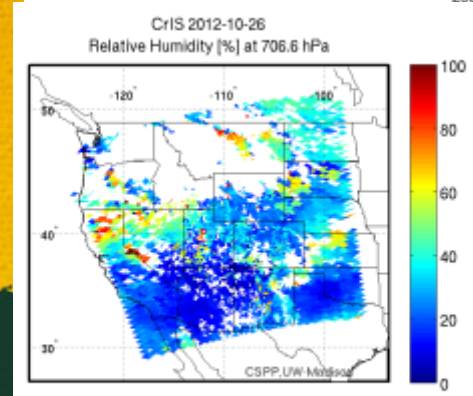
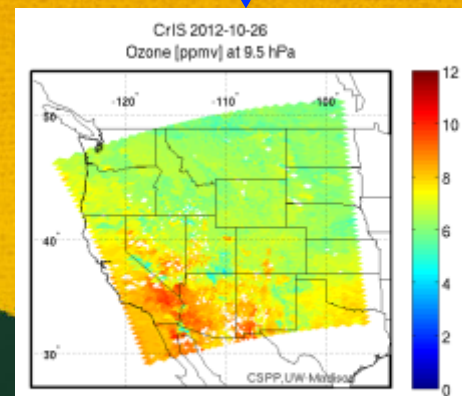
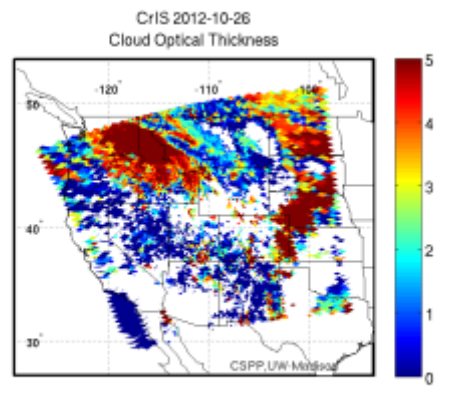
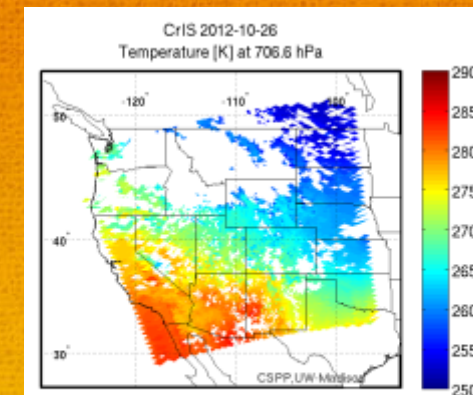
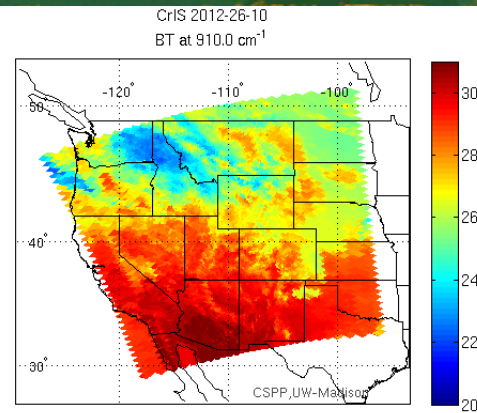
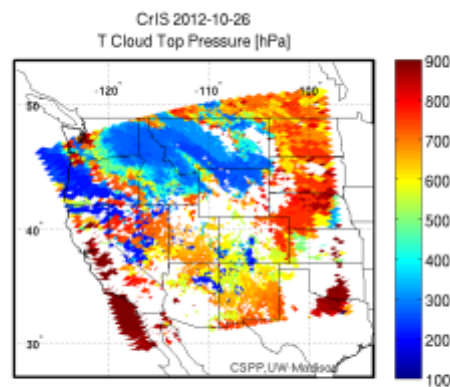
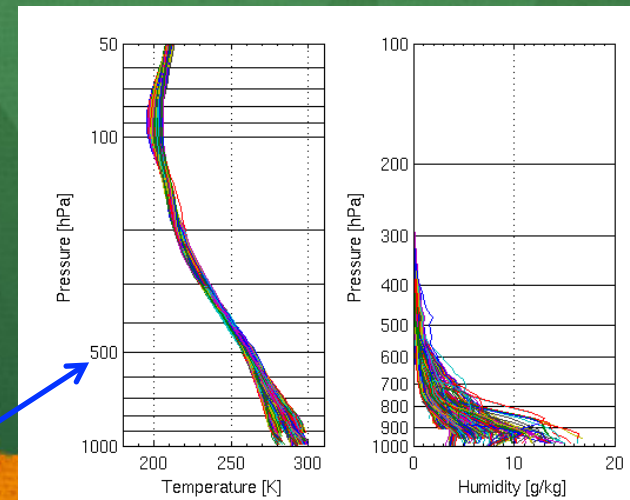
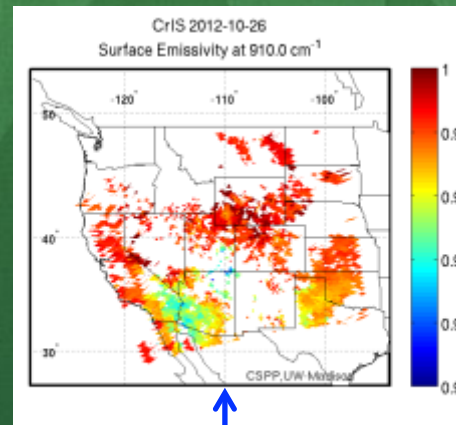
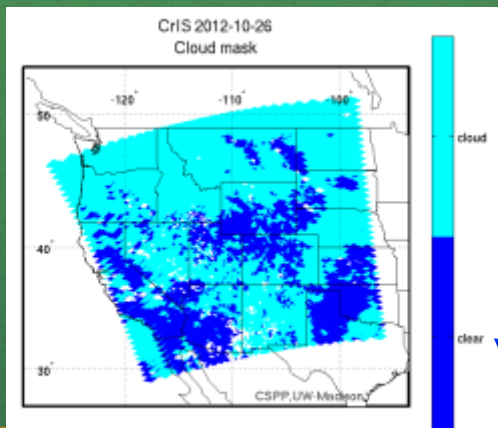
26 Nov 2012

Dual-Regression Algorithm Overview



Temperature, Humidity and Ozone profiles, Surface and Cloud parameter at single FOV resolution

Retrieval Product Examples (10 DB CrIS granules, 10-26-2012)



Dual-Regression Retrieval Products

- atmospheric temperature [K] at 101 pressure levels
- atmospheric humidity [g/kg] at 101 pressure levels
- atmospheric ozone [ppmv] at 101 pressure levels
- atmospheric relative humidity [%] at 101 pressure levels
- atmospheric dew point temperature [K] at 101 pressure levels
- surface skin temperature [K]
- surface emissivity at instrument spectral resolution [cm⁻¹]
- total precipitable water (vertically integrated from 100 hPa to surface) [cm]
- precipitable water 1, 2, 3 (vertically integrated from 900 hPa to surface, 700 to 900, 300 to 700 hPa) [cm]
- total ozone amount (vertically integrated) [dobson units]
- lifted index [deg celsius]
- convective available potential energy [J/kg]
- CO2 concentration [ppmv]
- cloud top pressure [hPa]
- cloud top temperature [K]
- cloud optical thickness
- effective cloud emissivity
- cloud mask (values: 0 clear, 1 cloud)

We also output:

- latitude [degrees] , longitude [degrees]
- pressure levels [hPa]
- surface emissivity wavenumbers [cm⁻¹]
- channel index (indices of good channels used in retrieval)
- quality flag (1 x 3)
- GDAS surface pressure, temperature and relative humidity (gdas values interpolated to sounder grid)

Output Format: hdf5

CSPP to include GEO Products

- Propose to use GEOCAT, the GOES-R AWG testbed developed at CIMSS/SSEC, as the initial release package to support GEO in CSPP.
- GEOCAT supports GOES 12-15, MTSAT, MSG.
- GEOCAT also supports GOES-R ABI GRB format.
- GEOCAT is self-contained FORTRAN-90 and C code, well tested and documented.

CSPP GEO Products - GEOCAT Products for GOES-E/W

Level 1B

- o0.65 um reflectance
- o3.9 um reflectance
- o3.9 um brightness temperature
- o6.7 um brightness temperature
- o11 um brightness temperature
- o13.3 um brightness temperature

Level 2 Cloud Products

- oCloud mask
- oCloud phase/type
- oCloud top height
- oCloud top temperature
- oCloud top pressure

- oCloud 11 um emissivity
- oCloud visible optical depth
- oCloud effective radius
- oCloud liquid water path
- oCloud ice water path

Level 2 Fog/ Low-Cloud Products

- oProbability of Marginal Visual Flight Rules (MVFR)
- oProbability of Instrument Flight Rules (IFR)
- oProbability of Low Instrument Flight Rules (LIFR)
- oLow cloud geometric thickness

CSPP GEO S/W Detail

- Package would include GEOCAT executable code and scripts for 64-bit Intel Linux systems.
- SSEC/CIMSS would provide GVAR to AREA converter (AREA is input format for GEOCAT).
- Output format is HDF4.
- Ancillary data would be identified and downloaded automatically at runtime.
- Source code can also be made available.

CSPP GEO Work Plan (Sep/13)

- V1.0 (2013)
L1 and L2 Cloud products for current GOES.
- V1.1 (2014)
Add support for Meteosat and MTSAT.
- V1.2 (2014)
Add other AWG L2 products (land, ocean).
- V1.3 (2015)
Add support for Himawari ABI.
- V2.0 (2016)
Add support for GOES-R ABI.

Supporting software tools (e.g., GEO2GRID) could provide support for AWIPS and GeoTIFF compatible output formats.

1st CSPP/IMAPP Users Group Meeting



CSPP / IMAPP Users' Group Meeting

|| 21-23 May 2013 | Pyle Center
University of Wisconsin-Madison



CSPP/IMAPP USERS GROUP MEETING AGENDA 2013/05/16 LG (FINAL)

May 21-23, 2013

Pyle Center, 702 Langdon Street, Madison, WI 53706, USA

Participants from:

1. SSEC/UW-Madison; 2. NOAA; 3. NASA; 4. EUMETSAT;
5. Met Office UK; 6. MeteoFrance; 7. Landgate, Australia;
8. SMHI; 7. CONABIO, Mexico; 8. DWD, Germany;
9. EURAC, Italy; 10. GINA, Alaska;
11. SeaSpace; & 12. ECNU, China

CSPP Summary

CSPP users represent 33 countries on 7 continents

The purpose of CSPP software is to support different research, teaching and weather/environmental monitoring applications

CSPP facilitates the sharing of expertise in advancing optimal use of international weather & environmental satellite assets

CSPP team is eager to collaborate with scientists like you & welcomes your inputs/contributions

<http://cimss.ssec.wisc.edu/cspp/>