

Hazard Mitigation Products Produced by the Satellite Analysis Branch for the Benefit of Severe Weather Forecasting

**UNCA Severe Weather Workshop Asheville, North Carolina
April 17, 2010**







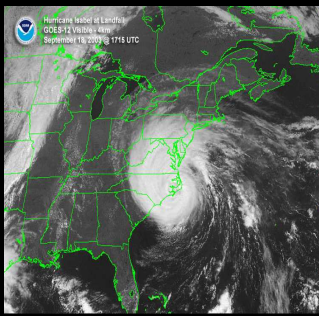
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Outline of the Presentation

- **The Tropical Program**
- **The Precipitation Program**
- **The Smoke, Fire and Air Quality Program**
- **Conclusion and Final Thoughts**

UNCA Severe Weather Workshop

Part
1

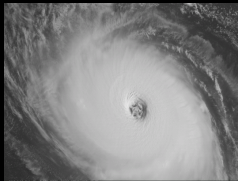
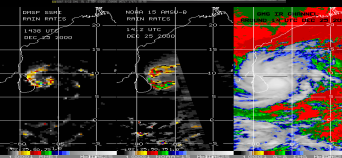


Tropical Program

Tropical Program

Tropical Storms: Global Geostationary and Polar Orbiting microwave satellite data are monitored for the formation, movement, and intensity of tropical storms, hurricanes, and typhoons.

Routine analyses of these storms are relayed to the National Weather Service and many other international agencies such as the Regional Specialized Meteorological Centres (RSMC) forecast Tropical Cyclones.

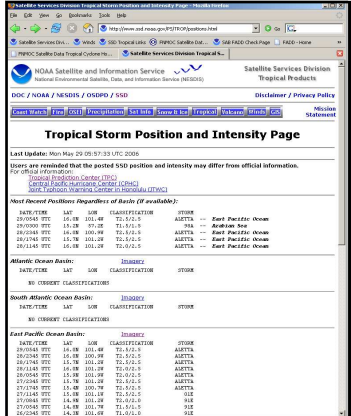
UNCA Severe Weather Workshop Satellite Analysis Branch Tropical Program History

- The Tropical program at the Satellite Analysis Branch (SAB) began monitoring tropical systems in early 1970s using a technique called the Dvorak technique created by Vern Dvorak of NESDIS.
- The Dvorak technique is a method using enhanced Infrared and/or visible satellite imagery to quantitatively estimate the intensity of a tropical system. Indications of continued development and/or weakening can be found in the cloud features. Using these features, the pattern formed by the clouds of a tropical cyclone, expected systematic development, and a series of rules, an intensity analysis and forecast can be made. This information is then standardized into an intensity code.

<http://www.ssd.noaa.gov/PS/TROP/dvorak.html>

CI	MWS	MWS	MSLP	MSLP	Saffir-Simpson
Number	(Knots)	(MPH)	(Atlantic)	(NW Pacific)	Category
1	25 KTS	29 MPH			
1.5	31 KTS	36 MPH			
2	30 KTS	35 MPH	1009 mb	1000 mb	
2.5	35 KTS	40 MPH	1005 mb	997 mb	
3	40 KTS	46 MPH	1000 mb	991 mb	
3.5	45 KTS	52 MPH			
4	45 KTS	52 MPH	994 mb	984 mb	
4	65 KTS	75 MPH	987 mb	978 mb	1 (64-83 KTS)
4.5	77 KTS	89 MPH	979 mb	966 mb	1 (64-83 KTS); 2 (84-95 KTS)
5	90 KTS	104 MPH	970 mb	954 mb	2 (84-95 KTS); 3 (97-113 KTS)
5.5	102 KTS	117 MPH	960 mb	941 mb	3 (97-113 KTS)
6	115 KTS	132 MPH	948 mb	927 mb	4 (114-135 KTS)
6.5	127 KTS	146 MPH	935 mb	914 mb	4 (114-135 KTS)
7	140 KTS	161 MPH	921 mb	898 mb	5 (136+ KTS)
7.5	155 KTS	178 MPH	906 mb	879 mb	5 (136+ KTS)
8	170 KTS	196 MPH	890 mb	858 mb	5 (136+ KTS)

Tropical Cyclone Center Location and Intensity Estimation



Dvorak Infrared and Visible Satellite Technique

Users

North Atlantic Ocean
Eastern North Pacific Ocean
Central Pacific Ocean
URL: For Tropical Positions

www.ssd.noaa.gov/PS/TROP/positions.html

US Military - JTWC
WMO Regional Specialized Meteorological Centers (RSMC)
in Tokyo, New Delhi, Wellington, Brisbane, Perth, Darwin, Fiji and Wellington

URL: For Tropical Bulletins
<http://www.ssd.noaa.gov/PS/TROP/bulletins.html>

NOAA Satellite Imagery on the Web

- Tropical Cyclone Sectors

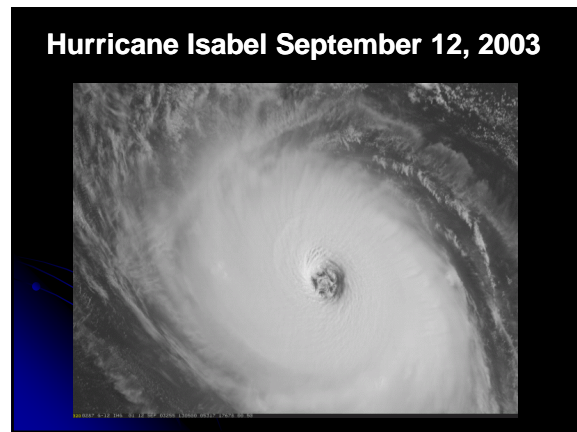
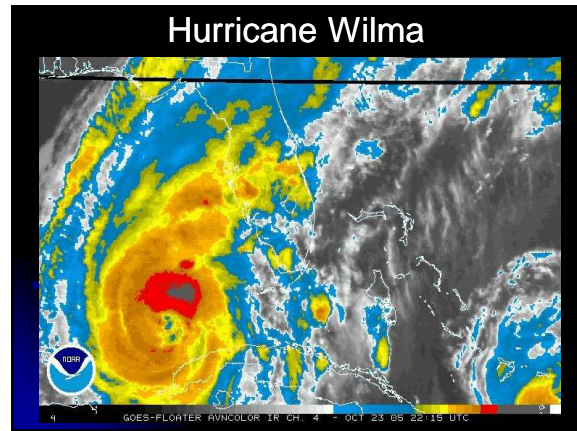
North Atlantic
www.ssd.noaa.gov/PS/TROP/trop-atl.html

North Pacific
www.ssd.noaa.gov/PS/TROP/trop-epac.html

- Operational Significant Event Imagery (OSEI)

Tropical Cyclone Events
www.osci.noaa.gov/Events/Tropical/

Significant Hurricane Pages
[www.ssd.noaa.gov/GOES/YYYY\(Name\)](http://www.ssd.noaa.gov/GOES/YYYY(Name))



UNCA Severe Weather Workshop

Part 2

Precipitation Program

NOAA's Satellite Analysis Branch Precipitation Program

24/7/365 monitoring of precipitation with emphasis on satellite analysis, short term trends and rainfall estimates

Supporting NWS WFO/RFCs

Priorities

- heavy rainfall / flash flooding
- moderate to heavy winter precipitation
 - West Coast winter storms
 - Great Lake snows

Precipitation Product available on AWIPS - SPENES is the AWIPS ID and the WMO header for the message is TXUS20 KNES

<http://www.ssd.noaa.gov/PS/PCPN/>

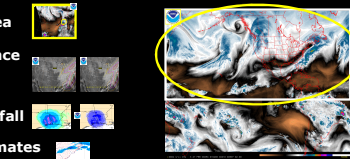
NOAA's Satellite Services Division Precipitation Program

24/7/365 monitoring of precipitation with emphasis on satellite analysis, short term trends and rainfall estimates

Supporting NWS NCEP HPC

Priorities

- excessive rainfall area
- 0-6 hr rainfall guidance
- precipitation trends
- satellite tropical rainfall
- satellite rainfall estimates



<http://www.ssd.noaa.gov/PS/PCPN/>

Satellite Precipitation (SPENES) Message

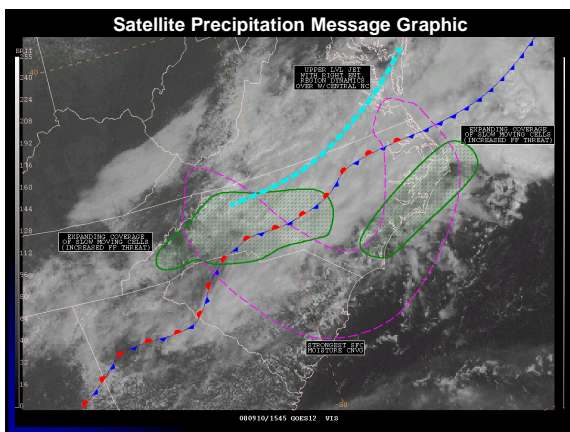
SATELLITE PRECIPITATION ESTIMATES... DATE/TIME 09/10/08 1600Z
 SATELLITE ANALYSIS BRANCH/MESSAGE--NRPJ--...
 LATEST DATA USED: GOES-12-1545Z DS
 LOCATION... NORTH CAROLINA... SOUTH CAROLINA...
 ATTN WFOS..._AKO..._MRX..._RAH..._LM..._CAE..._GSP...
 ATTN RFCS..._SERFC...
 EVENT... CONTINUING HWY RAINFALL ALONG STNRY FRNT

consultation phone number
 weather offices and RFC in concern area
 analysis discussion

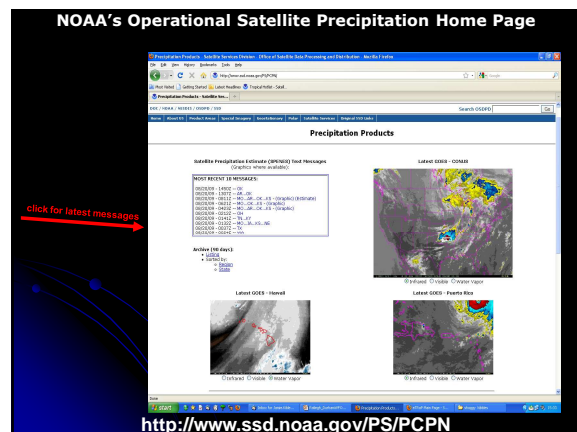
SATELLITE ANALYSIS AND TRENDS... STNRY FRNT DRAPED OVER THE SERVLUS HAS LITTLE SEEN APPROACHING IN WV IMAGERY THAT WILL HELP TO KICK IT OUT OF NC/SON GA DURING AT LEAST THE NEXT 24 HRS... ONLY FEATURE SEEN IS A SMALL SWV IMPULSE NR THE INTERSECTION OF THE MISS/VA STATE LINES WHICH SHOULD ENHANCE ON IN THE AFTERNOON INTO EVENING AS IT CROSSES GA AND ENTERS NW SC/WRN NC... GOES STLT WINDS SHOW AN UPPER LVL JET STRETCHING FROM THE MID-ATLANTIC REGION NEW TO OFF THE NEW ENGLAND COAST... WITH RIGHT ENTRANCE REGION DYNAMICS POSITIONED OVER CENTRAL WIND AND N SC FOR INCREASED DVG ALGHT... OBJECTIVE ANALYSIS ALSO INDICATES INCREASING SFC MOISTURE CNVG FROM CENTRAL SC TO SW VA WHERE NEW CELL ACTIVITY HAS BEGUN TO INITIATE... 12Z PW ANALYSIS INDICATED A THIN REGION ON 2 PWVS RAINING FROM MWK TO FFC TO BRK WITH JUST UNDER 2" VALUES AT GSO... FAIRLY WEAK UNORGANIZED LOW LVL FLOW PER WVPVS HAS ALLOWED FOR SLOW MOVEMENT OF CELLS WITH SOME EVEN BEING STNRY LIKE THE ONES STILL AFFECTING ANSON/RICHMOND COUNTIES... SC ONSHORE FLOW SHOULD ALLOW FOR STORMS TO FORM OVER N-CENTRAL SC WITH COVERAGE INCREASING OVER SE NC AS WELL... BUILDING INTO THE PART OF THE FRNT NOW OFF THE NC COAST... THIS WILL ALLOW FOR HWY RAINS ROUGHLY FROM KNC2A TO KXSE IN SE NC... OTHER AREA OF CONCERN REMAINS THE CENTRAL... AND NOW THE WEN PARTS OF NC... PER GSO/MHX 12Z SOUNDINGS... CLOUD TOPS HAVE REMAINED ANYWHERE FROM 8-10C BELOW THE ELS AND SHOULD EXHIBIT SIGNS OF COOLING/STRENGTHENING DURING THE NEXT FEW HRS... PARTICULARLY OVER W/NS NC WHERE DAYTIME HEATING HAS CREATED A MORE UNSTABLE ENVIRONMENT... 6HR AUTOMATED SFT ESTIMATES SHOW UP TO 2.2" OVER S-CENTRAL NC ENDING 1500Z BUT THE MAX IS SHIFED TO THE ENE DUE TO PARALLAX AND CIRRS BLOW OFF TO THE ENE... ACTUAL MAX IS LIKELY MORE WSW/OV OVER ANSON/RICHMOND COUNTIES... OVER SOUTHEAST LOOKING TRENDS EXPECTED IN NEXT FEW HRS... RAIN RATES OF 1.1-1.2" HR ARE PROBABLE

PLEASE SEE WEB ADDRESS BELOW FOR GRAPHIC IN ABOUT 16 MIN... notice of graphic
 SEE NCEP HPC DISCUSSION AND QPVS FOR FORECAST... coordination with NCEP HPC
 THIS IS A MEMBER OF 15 POINTS... consult privately with NWS offices
 SSS/SAB WEB ADDRESS FOR PRECIP ESTIMATES: [HTTP://WWW.SSD.NOAA.GOV/PS/PCPN/](http://www.ssd.noaa.gov/PS/PCPN/) satellite precipitation home page
 ...ALL LOWER CASE EXCEPT PSP/CPW

LAT..._LOW 3632 7489 3494 7464 3415 8100 3587 8163
 NNNNN



NOAA's Operational Satellite Precipitation Home Page



click for latest messages

<http://www.ssd.noaa.gov/PS/PCPN>

NOAA's Satellite Precipitation Message Home Page

NOAA Satellite and Information Services... Office of Satellite Data Processing & Distribution

Satellite Precipitation Estimates

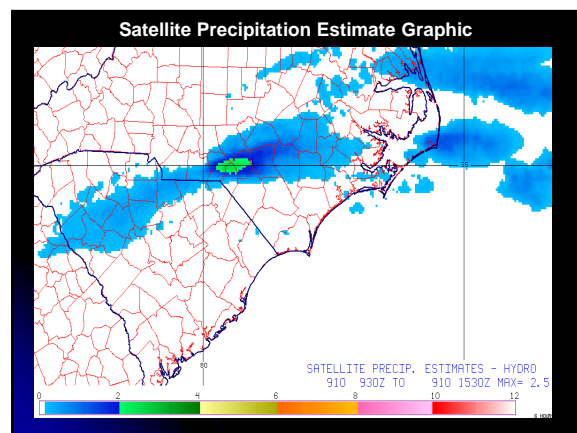
We welcome your comments.

Most Recent Ten (10) SPE Messages and Attachments:

- 09/10/08 - 1600Z - NORTH CAROLINA... SOUTH CAROLINA... - Has Message Graphic Attached (Graphic and Attachment)
- 09/10/08 - 0715Z - SOUTHERN FLORIDA...
- 09/10/08 - 0632Z - PUERTO RICO...
- 09/10/08 - 0625Z - SOUTH CAROLINA... GEORGIA
- 09/10/08 - 0432Z - SE NORTH CAROLINA... NE SOUTH CAROLINA...
- 09/09/08 - 2356Z - E NORTH CAROLINA... N SOUTH CAROLINA...
- 09/09/08 - 2202Z - E AND C NORTH CAROLINA... N SOUTH CAROLINA...
- 09/09/08 - 2143Z - N AND C MISSISSIPPI... N LOUISIANA... SE ARKANSAS...
- 09/09/08 - 2048Z - PUERTO RICO
- 09/09/08 - 1350Z - MASSACHUSETTS... NEW HAMPSHIRE... RHODE ISLAND... CONNECTICUT... NEW YORK... NEW JERSEY... PENNSYLVANIA... DELAWARE... MARYLAND... VIRGINIA... DISTRICT OF COLUMBIA...

Hydro-Estimator Products from the Center for Satellite Applications and Research.

<http://www.ssd.noaa.gov/PS/PCPN/precip.html>



NOAA's Satellite Precipitation Estimate Home Page

[README](#)

AUTOMATIC SATELLITE-DERIVED PRECIPITATION ESTIMATES

The original Auto-Estimate algorithm was developed for heavy, moist convective systems. Over time, enhancements and improvements to the program led to a complete new product, called the Hybrid-estimate, which is currently in operational use by the National Weather Service for monitoring potential flash-flood events. Precipitation rates are primarily based on the cloud-top temperature obtained from GOES 12 and GOES 13 (17°N/90°W, 17°N/120°W), 3-hour, 6-hour, and 24-hour precipitation estimates are available. Numerous other factors, including the cirrus geometry, the available atmospheric moisture, stability parameters, radar, and local topography, are used to further adjust the rain rate. For more details see [Release 5/20/09](#).

INSTANTANEOUS RAIN RATES [Current Archive](#)

1-HOUR TOTAL [Current Archive](#)

3-HOUR TOTAL [Current Archive](#)

6-HOUR TOTAL [Current Archive](#)

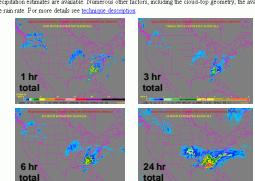
24-HOUR TOTAL [Current Archive](#)

INFRARED SATELLITE [Current Archive](#)

VISIBLE SATELLITE [Current Archive](#)

PWRH (MOISTURE CORRECTION) [Current](#)

Blowups of the instantaneous, 1-, 3-, and 6-Hour Products

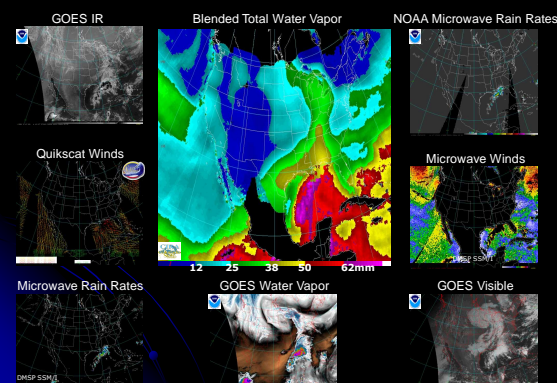


Why satellite precipitation estimates?

- Supplement radar and surface observations
- Help in areas of radar outages
- Help in areas on the edge of radar
- Help in mountainous/sparse observation areas
- Help where there maybe radar algorithm difficulties
- Inclusion in a multi-sensor rain estimate product

<http://www.orbit.nesdis.noaa.gov/smcd/emb/ff/auto.html>

Familiar, Unfamiliar and New Satellite data



GOES IR

Blended Total Water Vapor

NOAA Microwave Rain Rates

Quikscat Winds

Microwave Winds

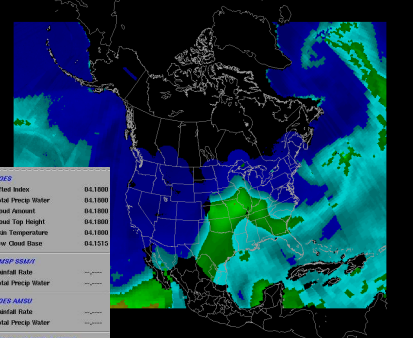
Microwave Rain Rates

GOES Water Vapor

GOES Visible

Blended TPW Products in AWIPS

Statistics	Units	Scale	SCAL
IR Window	04.1440		
Water Vapor	04.1445		
Visible	04.1450		
IR			
IR 2.13u			
IR 3.7u			
WVIR	04.1455		
IR (GOES 3.7u)			
POES Imagery			
IR Window			
Water Vapor			
IR			
IR 2.13u			
IR 3.7u			
Standard Imagery			
Derived Products Photo			
GOES			
IR 2.13u	04.1000		
IR 3.7u	04.1000		
WVIR	04.1000		
IR (GOES 3.7u)	04.1000		
Water Vapor	04.1000		
Visible	04.1000		
IR	04.1000		
IR 2.13u	04.1000		
IR 3.7u	04.1000		
WVIR	04.1000		
IR (GOES 3.7u)	04.1000		
IR Color Composite			
IR Window	04.1000		
Water Vapor	04.1000		
Visible	04.1000		
IR	04.1000		
IR 2.13u	04.1000		
IR 3.7u	04.1000		
WVIR	04.1000		
IR (GOES 3.7u)	04.1000		
COMET Module coming soon			
Percent of Normal TPW	04.1000		

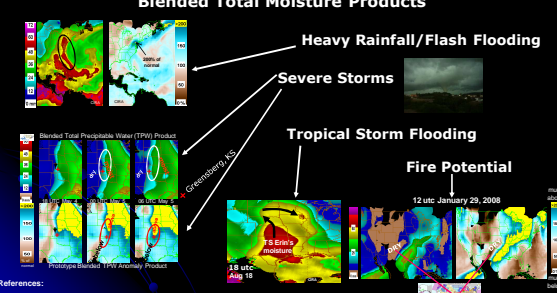


Blended Total Precip Water (mm) **18** **07:37Z 18-Mar-09**

Different Applications of Blended Total Precipitable Water Products that may be Useful for Hazard Weather

Blended Total Moisture Products

- Heavy Rainfall/Flash Flooding
- Severe Storms
- Tropical Storm Flooding
- Fire Potential

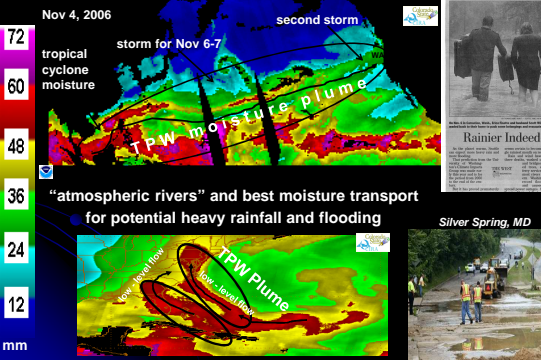


References:

- <http://stepsanone.nesdis.noaa.gov/Presentations/Conferences/AMS2009.ppt>
- http://stepsanone.nesdis.noaa.gov/Publications/23Hydro_Jan_2009_extended_abstract.pdf

Application and Use of Blended Total Precipitable Water (TPW) Product

Nov 4, 2006



storm for Nov 6-7

second storm

tropical cyclone moisture

TPW moisture plume

"atmospheric rivers" and best moisture transport for potential heavy rainfall and flooding

Silver Spring, MD

mm

72

60

48

36

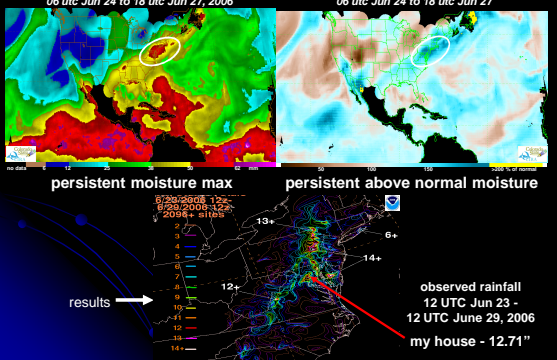
24

12

Additional Heavy Rainfall/Flash Flood Signatures

Blended TPW Loop 06 utc Jun 24 to 18 utc Jun 27, 2006

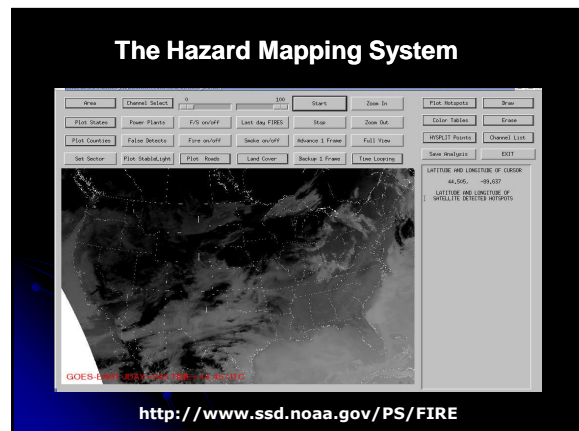
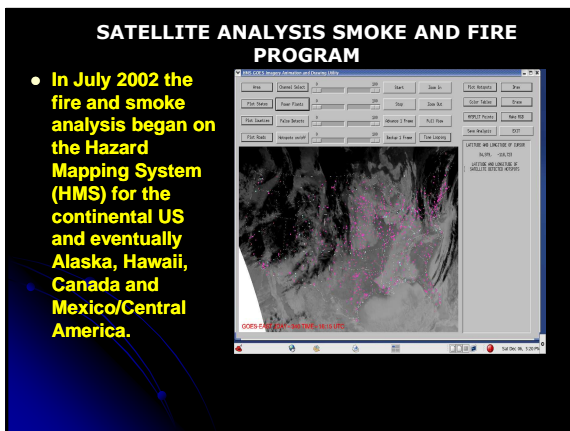
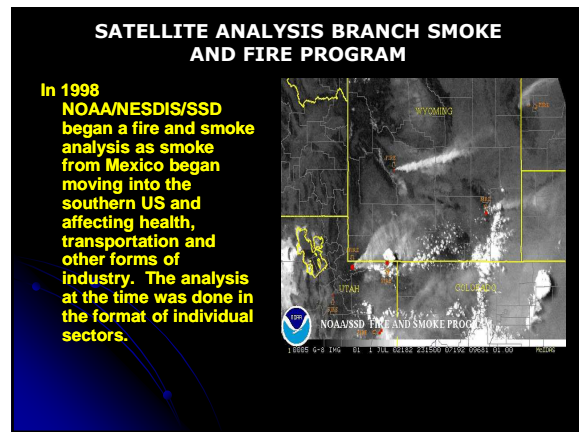
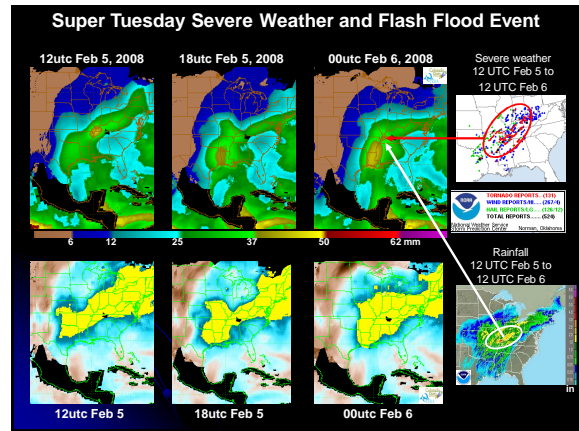
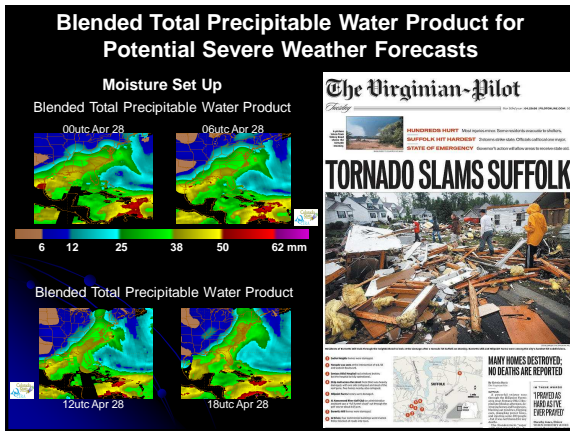
Blended TPW Anomaly Loop 06 utc Jun 24 to 18 utc Jun 27



persistent moisture max

persistent above normal moisture

observed rainfall 12 UTC Jun 23 - 12 UTC June 29, 2006 my house - 12.71"



SATELLITES CURRENTLY USED FOR FIRE AND SMOKE DETECTION

- GOES 12 and GOES 11 and soon GOES 13
- NOAA 15, 17, 18 and 19
- MODIS AQUA AND TERRA

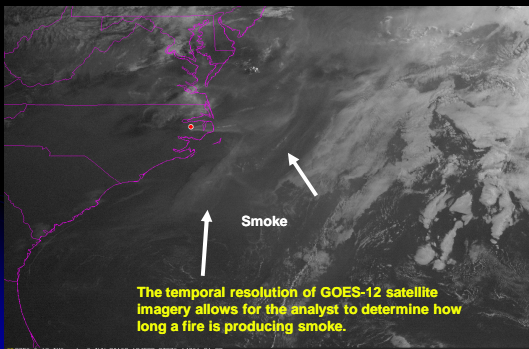
Over 100 looks per day in areas of GOES-East and GOES-West overlap.

Two looks per satellite per day with Polar spacecraft in mid latitudes – more at high latitudes

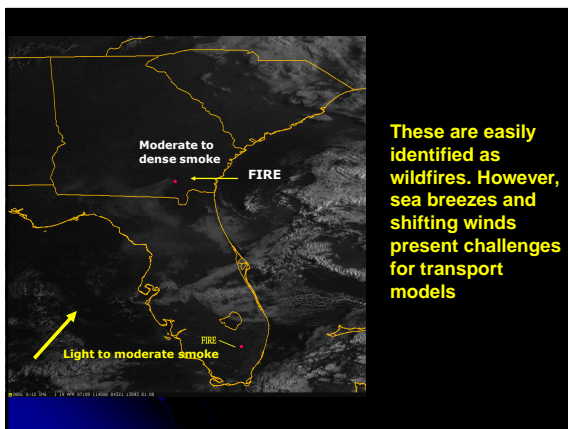
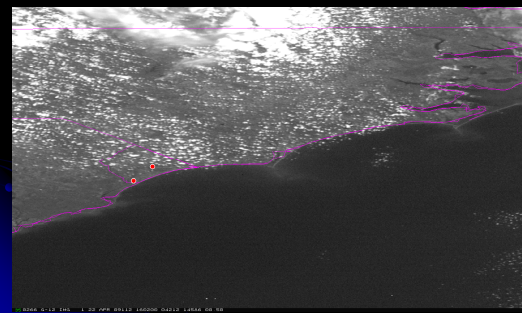
**THE FIRE AND SMOKE ANALYST
THEIR JOB**

- Quality checks the fire points produced by the ABBA, FIMMA and MODIS algorithms by looking at the associated satellite data.
- Draws in the smoke produced by the fires. The analyst can identify the smoke as thin, moderately dense or dense with an assigned numerical value for each plume.
- Provides locations of significant smoke producing fires as input to the Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model which provides a 48 hour forecast movement of the smoke that is used in NWS AQ forecast.

Evans Fire in Eastern North Carolina



2009 Horry County Wildfires in Eastern South Carolina



Analyst can determine the duration of the smoke being produced by the fire



HMS GRAPHICAL OUTPUT IN A STATIC JPG AND GIS

<http://www.ssd.noaa.gov/PS/FIRE/hms.html>

<http://www.firedetect.noaa.gov/viewer.htm>

HMS output in KML format

<http://www.ssd.noaa.gov/PS/FIRE/kml.html>

HYSPLIT SMOKE - DAY 1 FORECAST

<http://www.arl.noaa.gov/smoke/forecast.html>

Points for significant smoke producing fires are provided daily by NESDIS analysts for inclusion as smoke emission sources into the Air Resources Lab (ARL) HYSPLIT model

www.weather.gov/aa/

Overall – the product provides areas of potential air quality concerns

The Summer of 2008 California Wildfires

SMOKE TEXT PRODUCT

Friday, September 14, 2007 DESCRIPTIVE TEXT NARRATIVE FOR SMOKE/DUST OBSERVED IN SATELLITE IMAGERY THROUGH 0120Z September 15, 2007

Idaho/Montana to the Central US and Great Lakes Region/Southeastern Canada:
A very large region of smoke was observed originating from the wildfires in Idaho and western Montana and possibly also from the large north central Washington fire. The smoke extended eastward across Wyoming and then southeastward into the Central Plains and mid-Mississippi Valley. The smoke then turned more to the northeast as it became entrained into a frontal system and covered the Ohio Valley along with the central and eastern Great Lakes region before spreading into southeastern Canada south of Hudson Bay. Early in the day the smoke was at least moderately dense and even locally dense along the frontal boundary which extended at that time from northern Missouri to Michigan. The smoke was also dense closer to the fire sources over central Idaho, western Montana, and northern Wyoming, Southern Canada/North Central US. A swath of very thin smoke from an unknown source moved south-southeastward across the south central Canadian provinces of Manitoba and southwestern Ontario into North Dakota during the morning and over South Dakota and Minnesota during the afternoon. It is possible (but definitely not certain) that the smoke was transported a very long distance from the large fires burning in north central Alaska. Also, several moderately dense to even locally dense smoke plumes were observed moving eastward across the southern portion of Manitoba Province in south central Canada. The fires were scattered around south central Canada and North Dakota, but particularly concentrated in southern Manitoba.

Florida: Fires along the east coast of Florida just northwest of Cape Canaveral were emitting a plume of moderately dense to locally dense smoke which moved mainly to the northeast and out over the Atlantic Ocean.

Southeastern Missouri/Western Tennessee:
Numerous agricultural burns over southeastern Missouri were producing an area of thin smoke with embedded patches of moderately dense smoke which spread to the southeast into western Tennessee, just to the north and northeast of Memphis.

Utah:
Several fires were detected in Utah during the day, but widespread cloudiness hindered smoke detection from satellite imagery. One plume which did appear for a time extended to the northeast from a fire in Tooele County in northwestern Utah. The moderately dense to dense smoke plume moved across the Great Salt Lake and very close to Salt Lake City and Ogden.

**UNCA Severe Weather Workshop
Asheville, North Carolina**

Thank you!

For additional information please contact

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