# RGB Airmass Imagery: A New Tool to Diagnose Extratropical Transition of Tropical Cyclones

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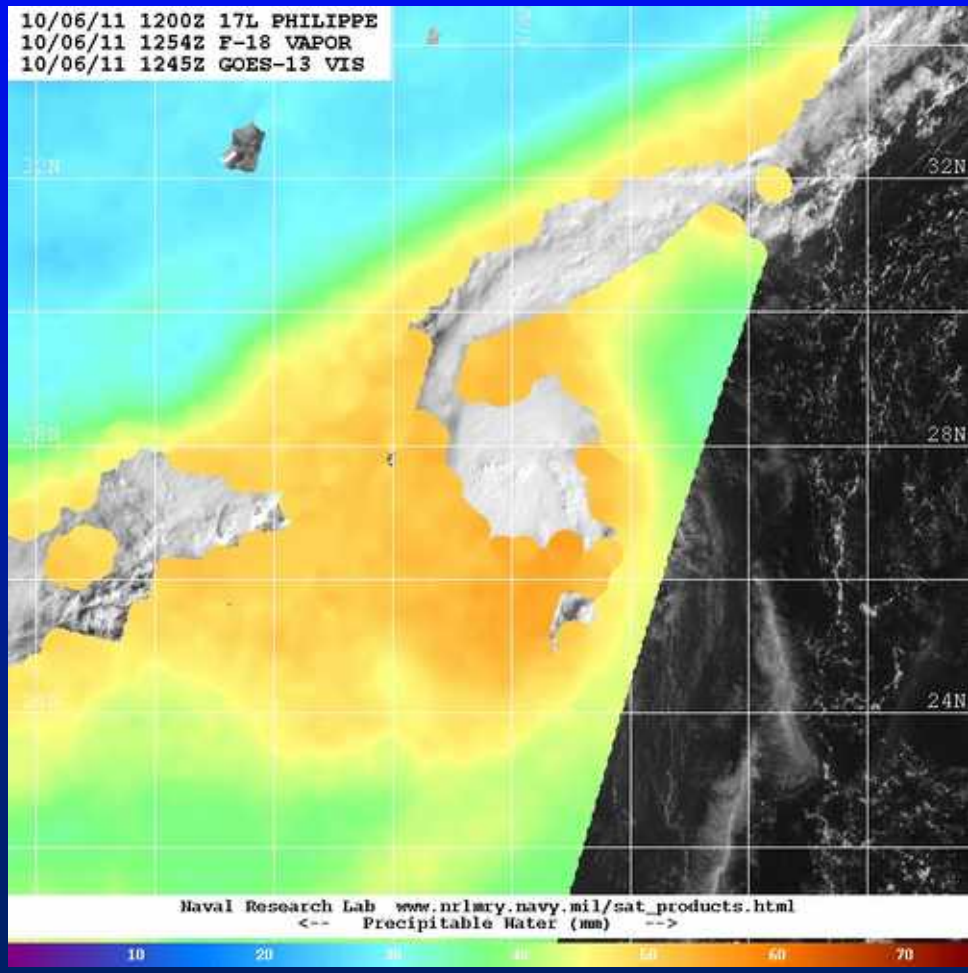
NATIONAL HURRICANE CENTER

WHERE AMERICA'S CLIMATE AND WEATHER SERVICES BEGIN

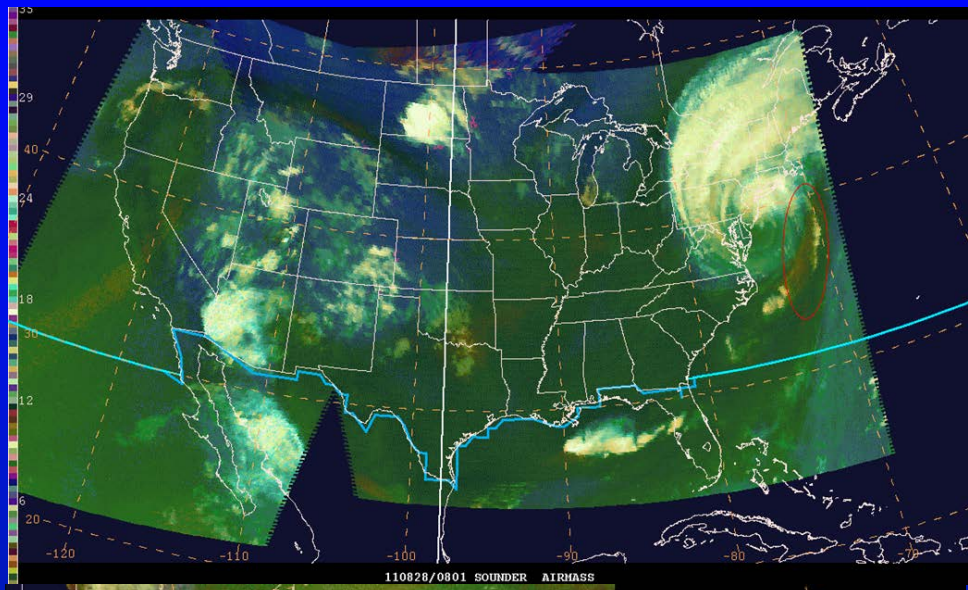
# Forecasters' satellite imagery needs for diagnosing and forecasting ET

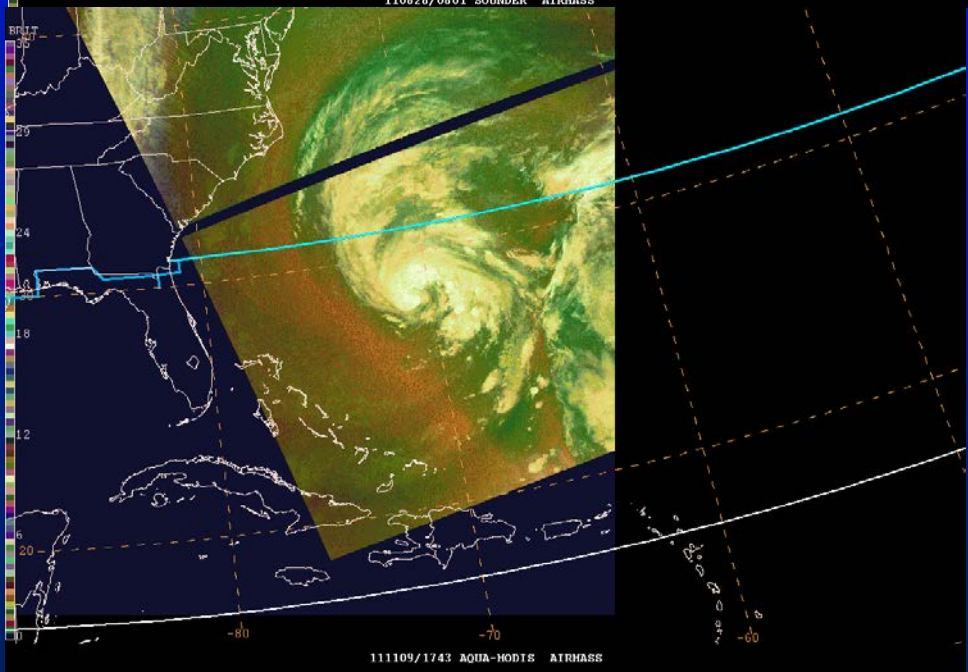
- Timely data on the moisture and thermal structure near the cyclone.
- As much information in one product as can be included without making it unreadable.
- Microwave TPW data is very useful, but does not by itself show all the necessary information.
- Best moisture and thermal data comes from sounders on low-earth-orbiting satellites that have timeliness issues. Geostationary satellite data is more desirable.



# Introducing the RGB Airmass Product

- Multispectral imagery developed by EUMETSAT using the SEVIRI imager on the METEOSAT Second Generation geostationary satellites
- It combines moisture, thermal, and ozone information.
- Similar product are derived by NASA SPoRT from the infrared sounder on the U. S. GOES satellites and from the MODIS/AVHRR instruments.
- The NHC is testing these products under the GOES-R Proving Ground program.



# THE "AIRMASS" RGB

**R = Difference WV6.2 - WV7.3**
**G = Difference IR9.7 - IR10.8**
**B = Channel WV6.2**

| | |
|---|---|
| **Applications:** | Rapid Cyclogenesis, Jet Stream Analysis, PV Analysis |
| **Area:** | Full MSG Viewing Area |
| **Time:** | Day and Night |

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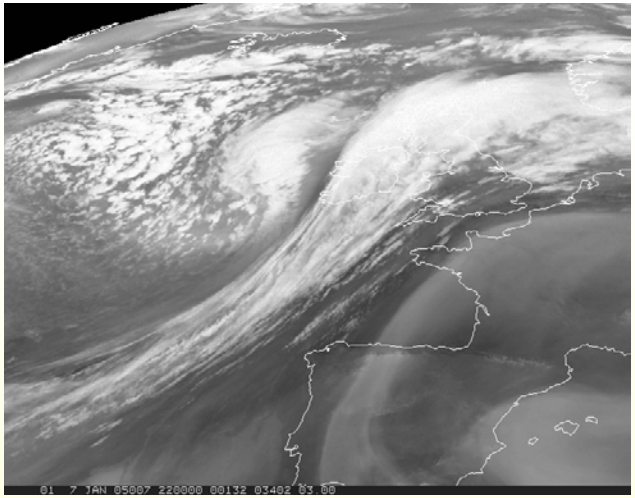
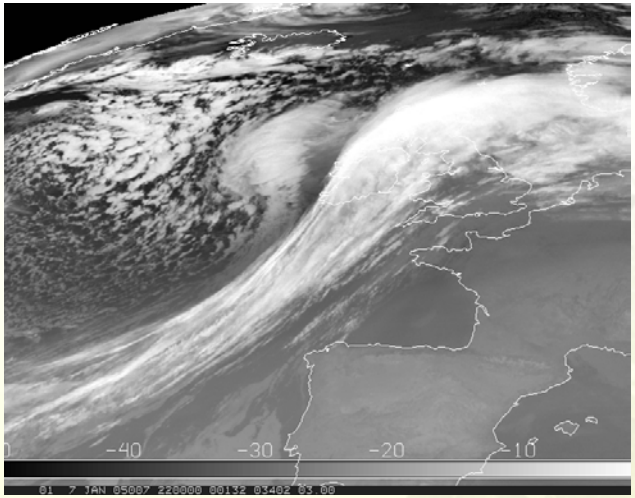
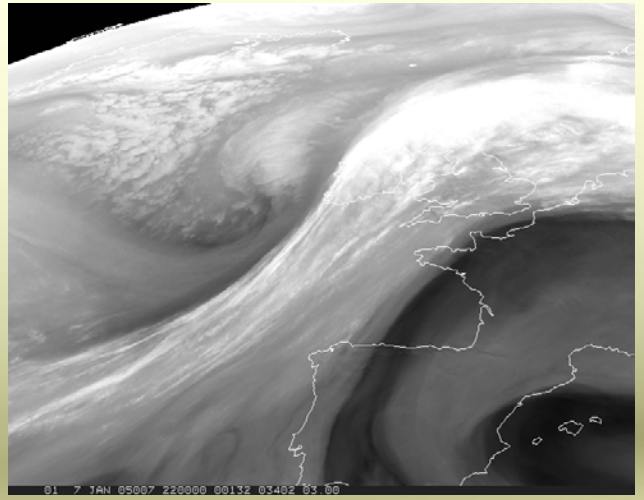
# Airmass RGB: Colour Inputs



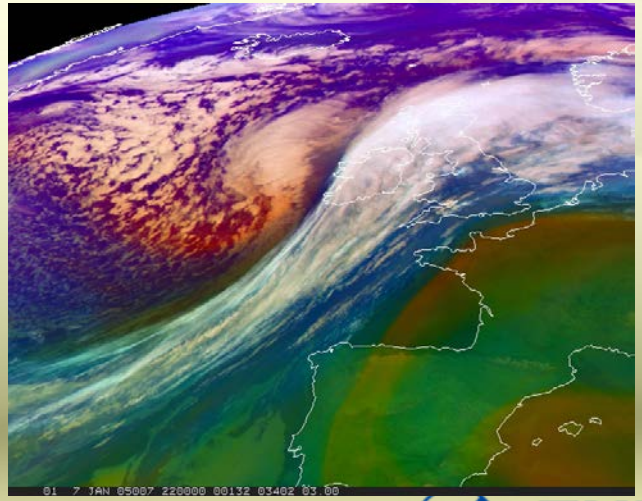
**Red = WV6.2 - WV7.3**




**Green = IR9.7 - IR10.8**



**Blue = WV6.2i**



**RGB**

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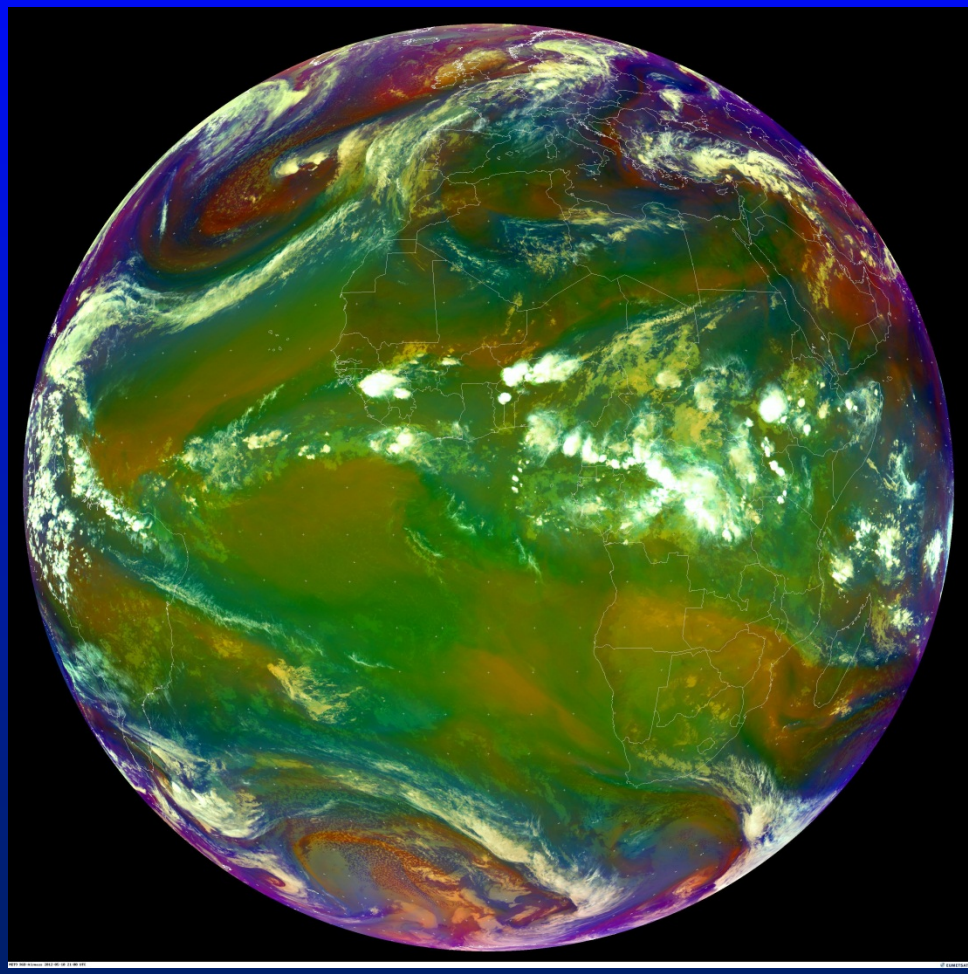
# Some Principles of the Airmass Imagery

- 10.8 µm channel provides cloud top/surface temperature information (standard IR window channel).
- 6.2 and 7.3 µm channels provide moisture information (water vapor channels).
- 9.7 µm channel provides ozone information which can reveal stratospheric air intrusions and potential vorticity anomalies.



# Airmass RGB: Interpretation of Colours

Thick, high-level clouds

Thick, mid-level clouds

Thick, low-level clouds

(warm airmass)

Thick, low-level clouds

(cold airmass)

| Jet (high PV) | Cold Airmass | Warm Airmass | Warm Airmass |
|---|---|---|---|
| | | High UTH | Low UTH |

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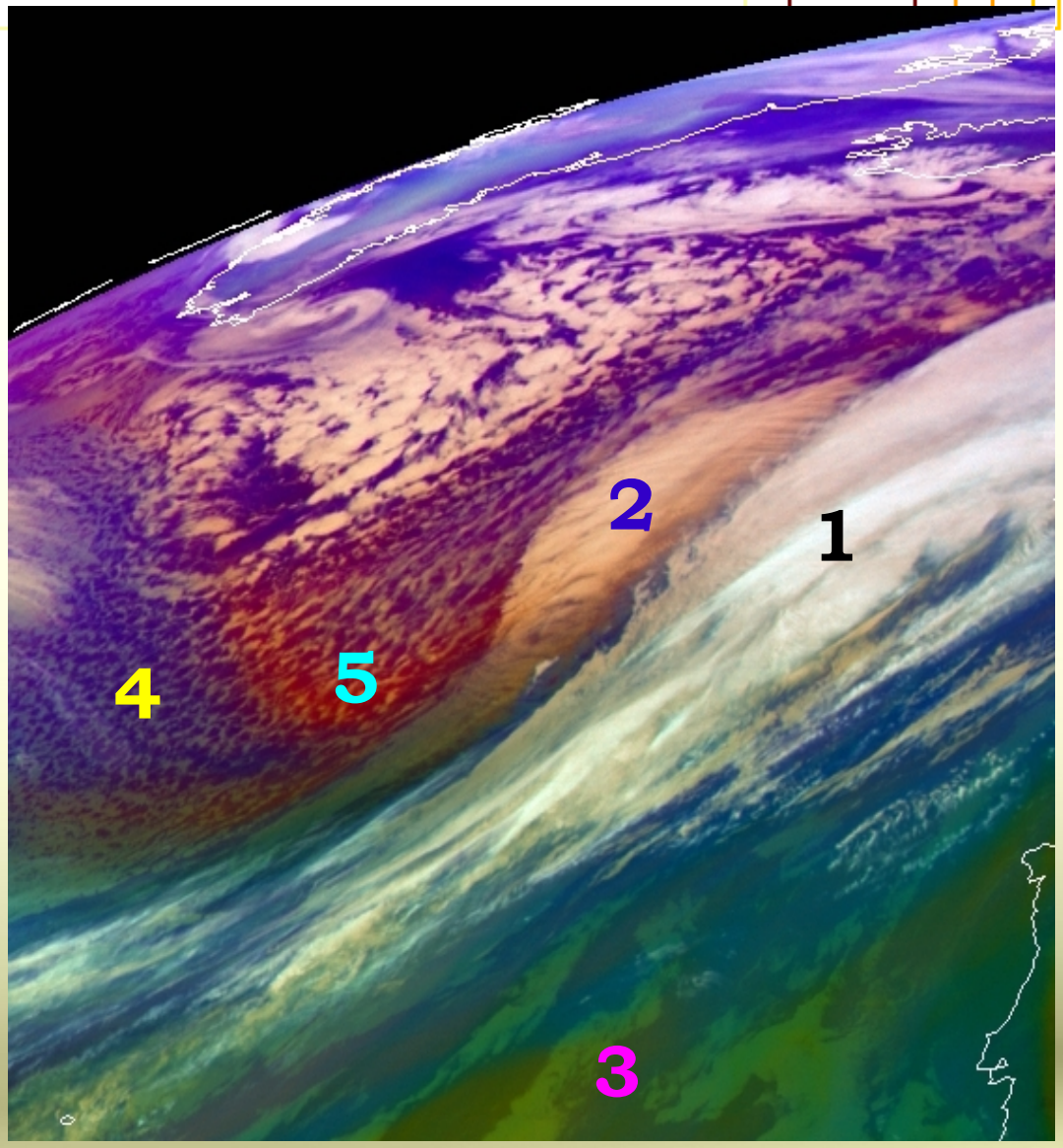
# Airmass RGB: Colour Interpretation




1 = high clouds
2 = mid-level clouds
3 = warm airmass, high tropopause
4 = cold airmass, low tropopause
5 = dry descending stratospheric air

MSG-1
07 January 2005
15:00 UTC
RGB Composite
R = WV6.2 - WV7.3
G = IR9.7 - IR10.8
B = WV6.2

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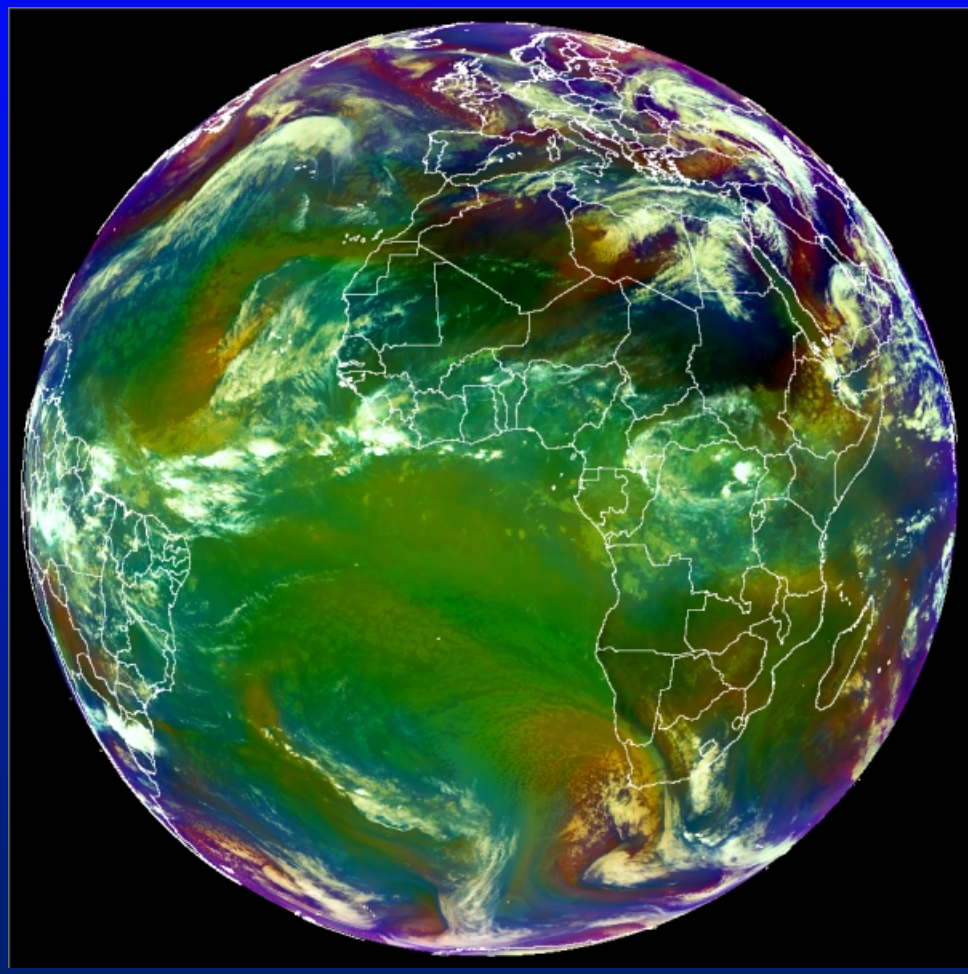
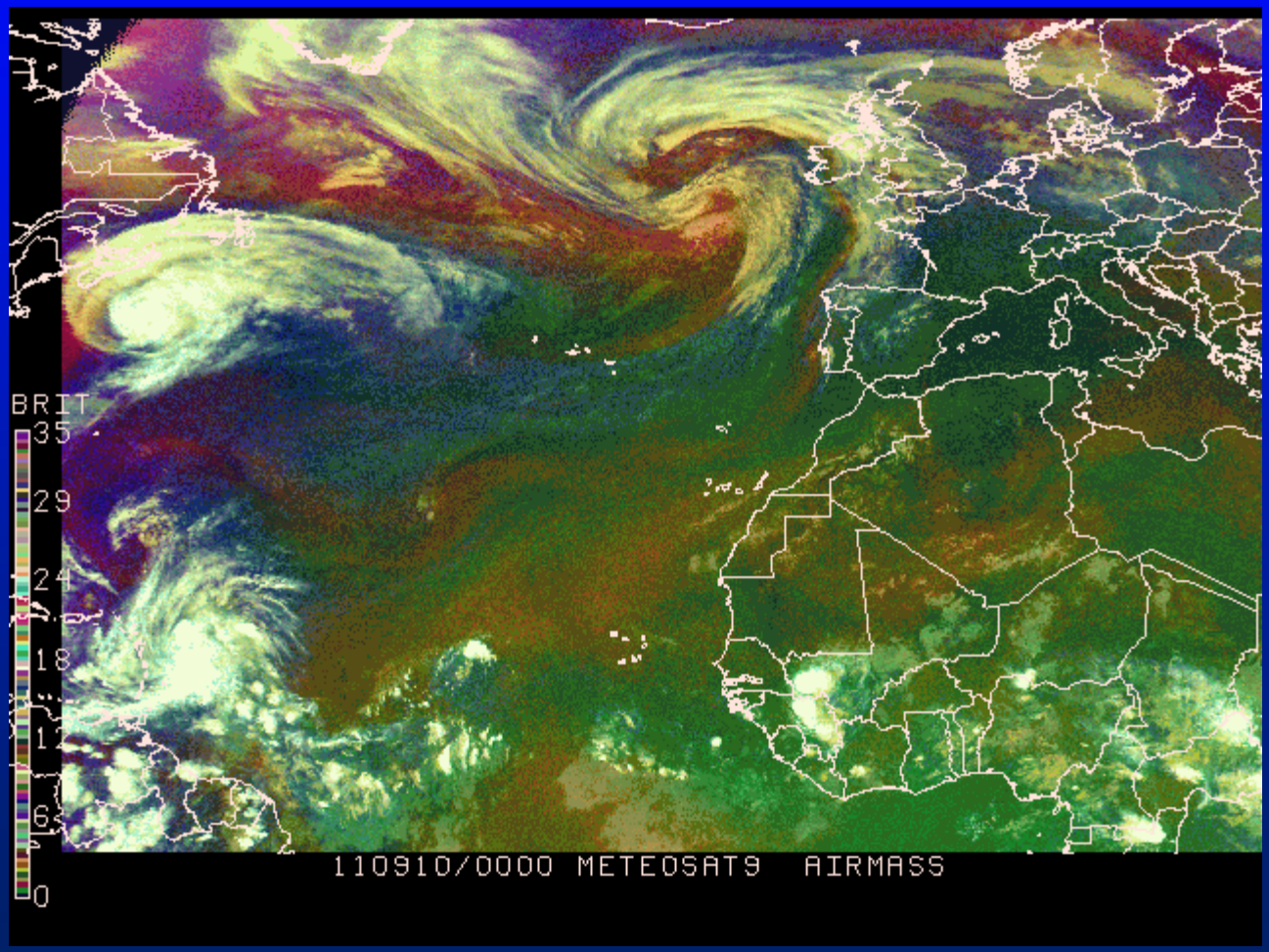
# Some Notes on the Airmass Imagery

- The EUMETSAT users guide is heavily weighted toward mid-latitude weather. The tropical interpretation is still being worked out.
- The imagery has a limb effect that affects the colors as a function of distance from the satellite sub-point.
- NHC computers systems do not yet have the graphics capabilities to display this imagery in its native resolution, which is an issue in the following animations created by SPoRT ☺.

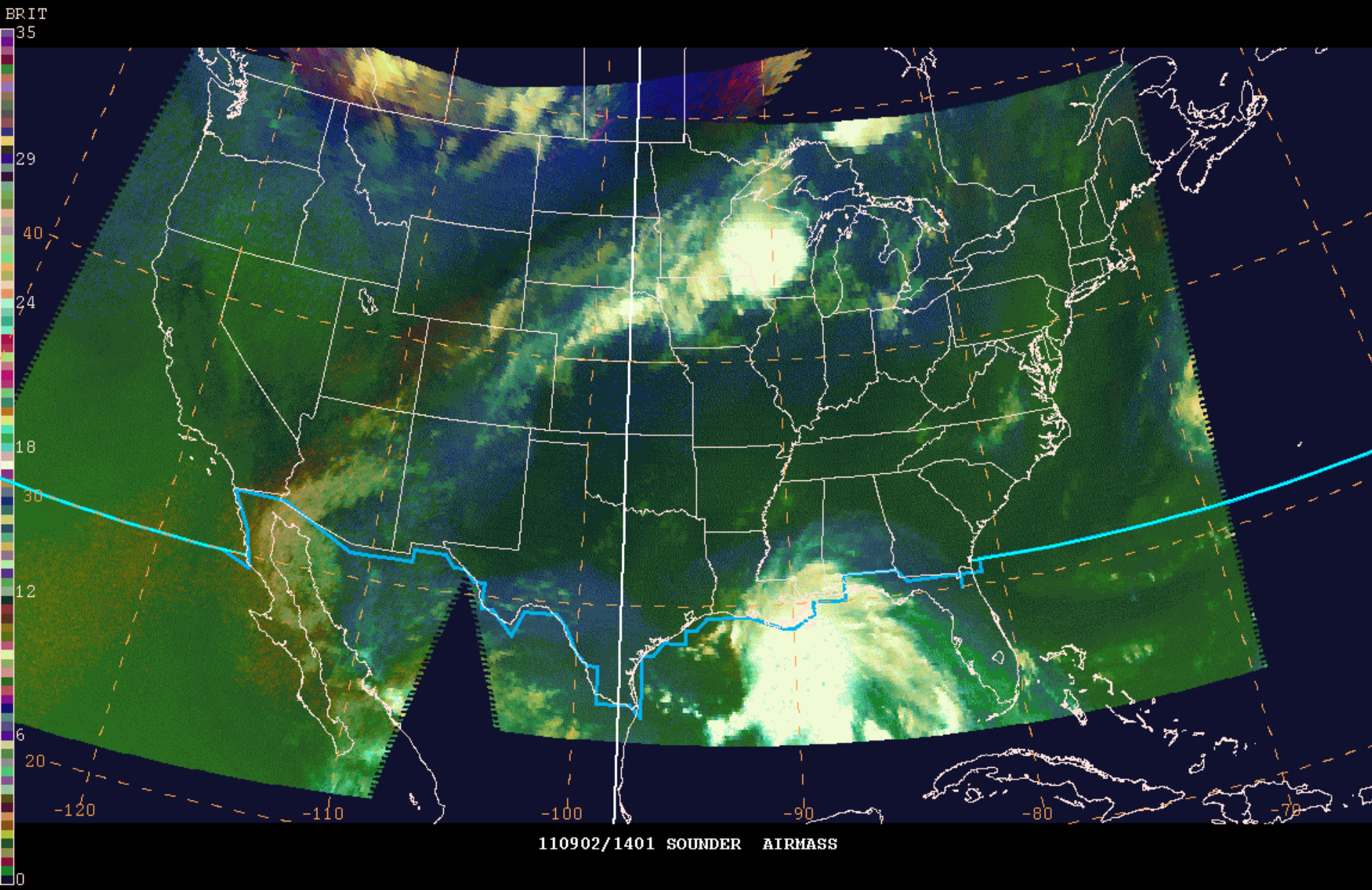


# RGB Imagery of Katia undergoing ET

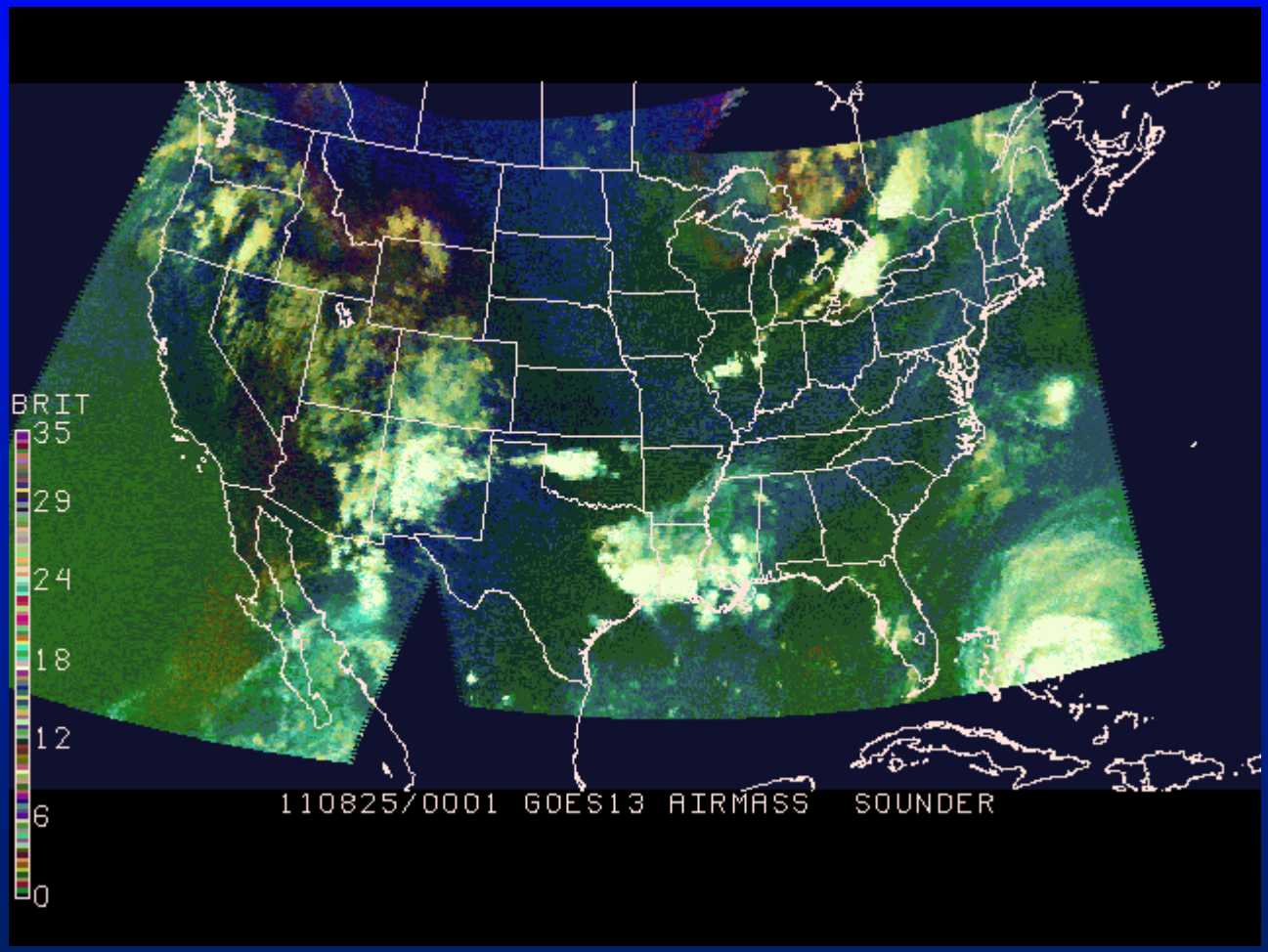



Although it did not look very impressive, ex-Katia brought storm-force winds to the British Isles.

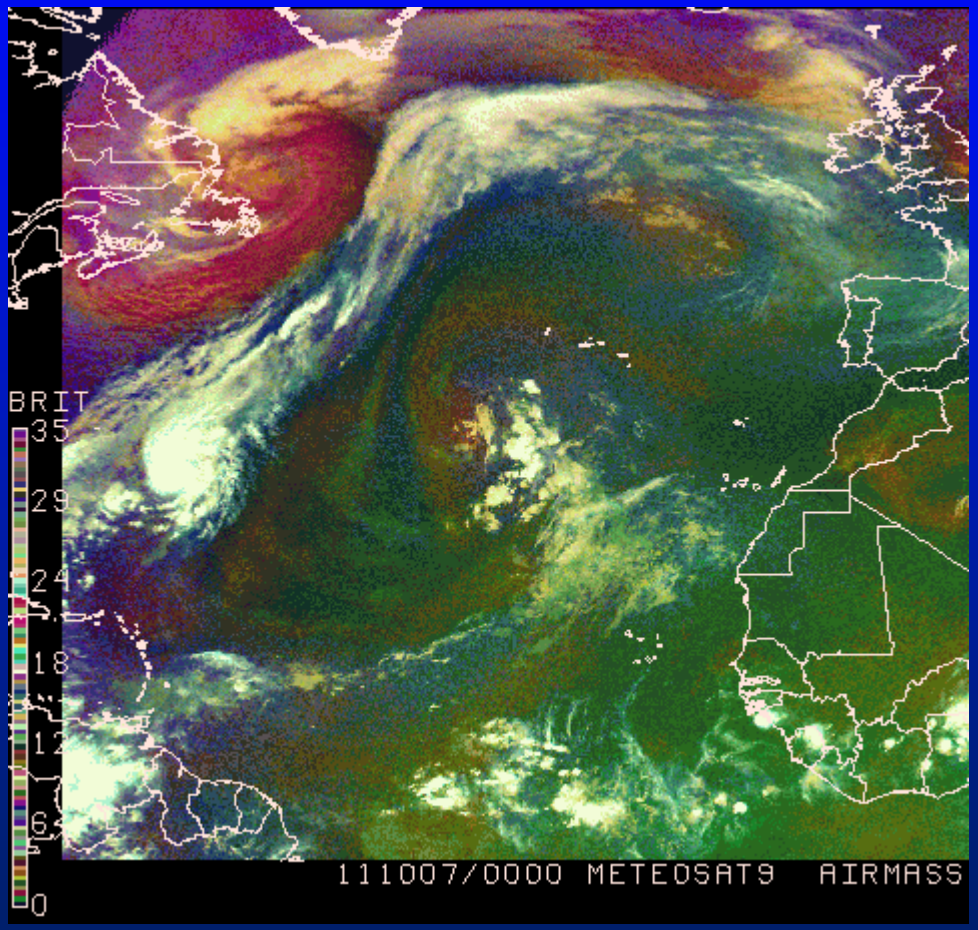
# RGB Imagery of Lee – T to ST to ET



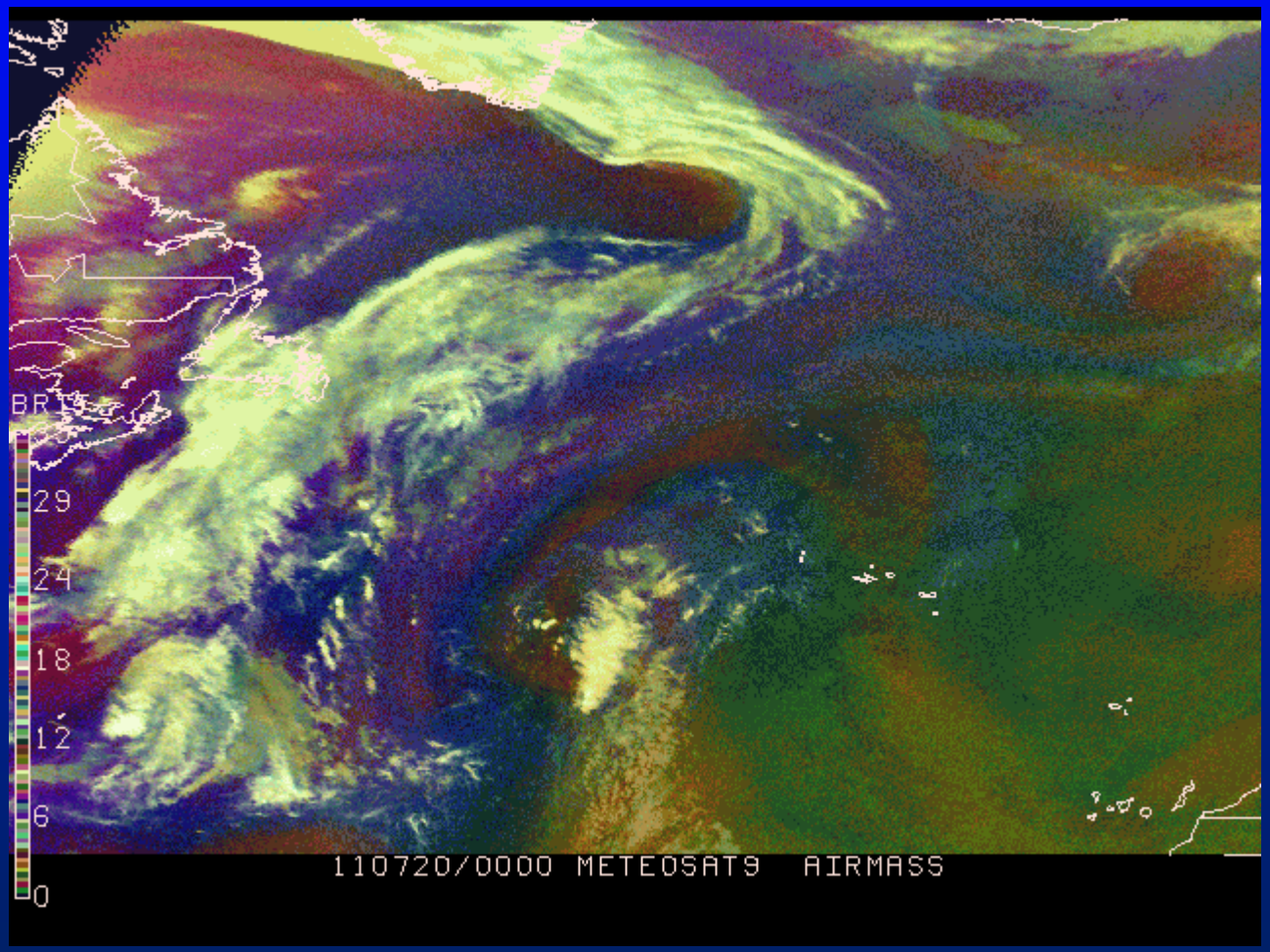
# RGB Imagery of Irene undergoing ET



# RGB Imagery of Philippe undergoing ET

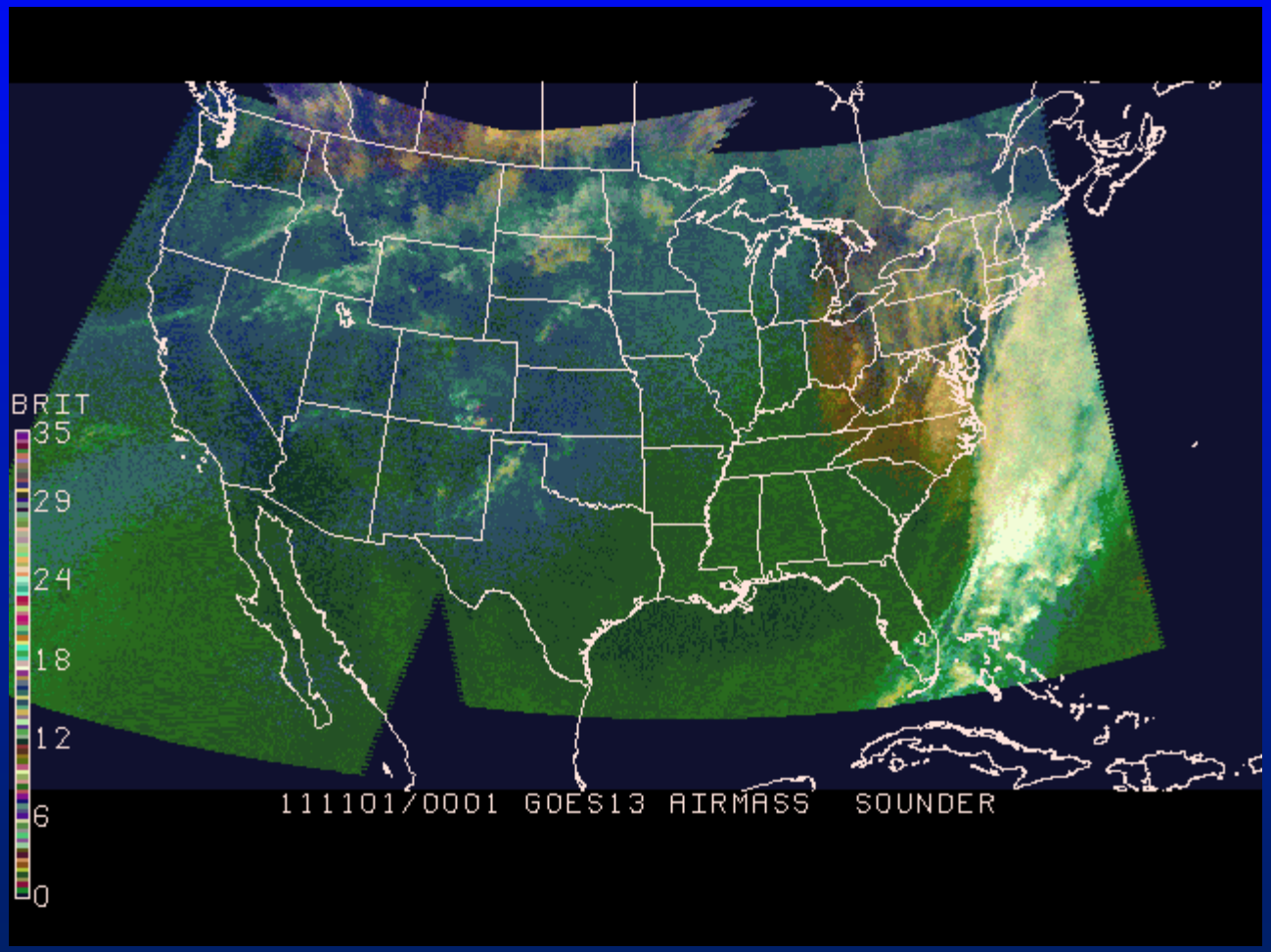


# A counter-example: RGB Imagery of Cindy <u>not</u> undergoing ET

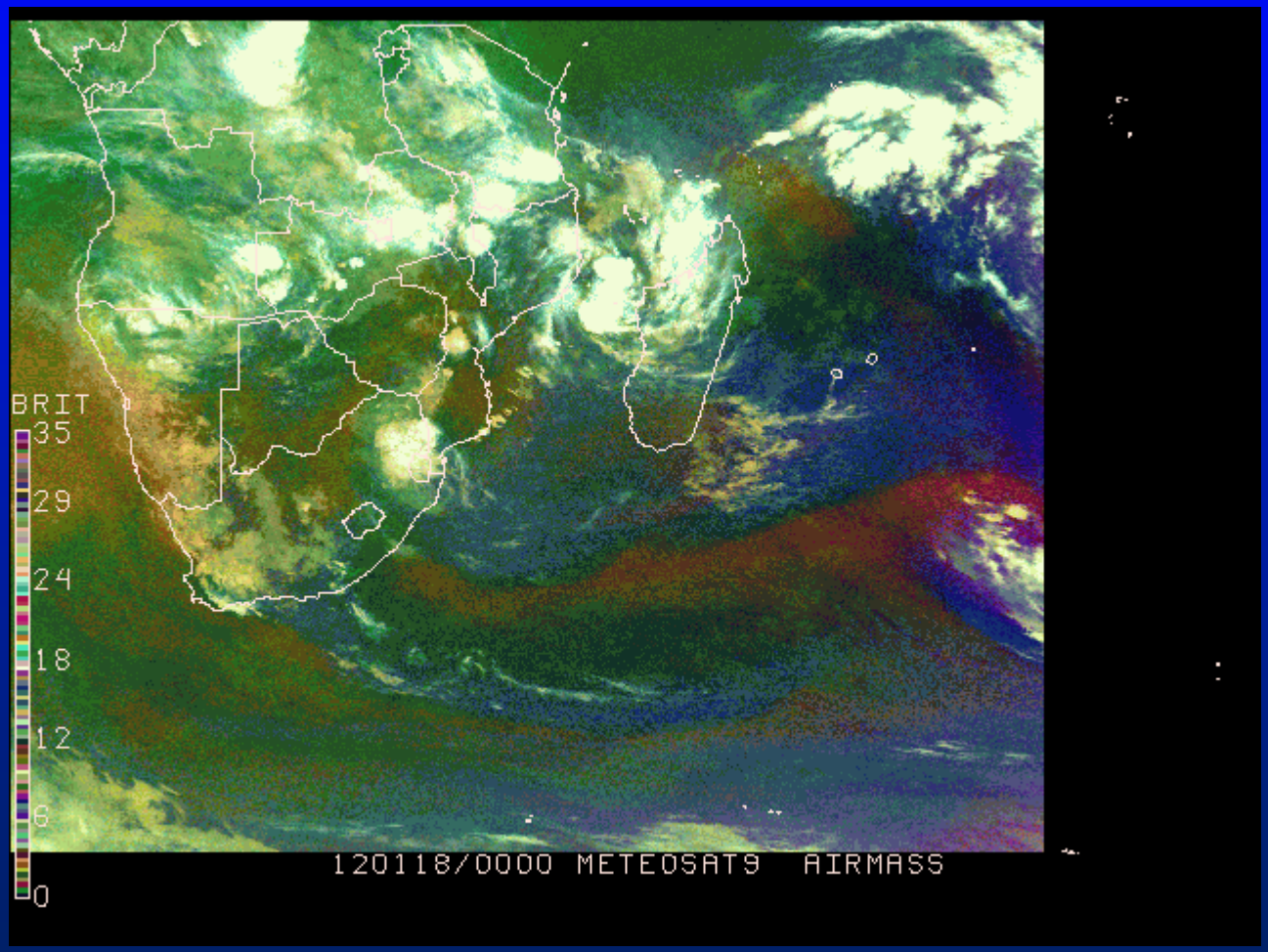



**This was a busted forecast of ET starting with the author's first forecast!**

# A reverse example: RGB Imagery of the tropical transition of Sean



# In the Southern Hemisphere, Ethel and Funso undergoing ET



# Summary

- RGB airmass imagery can aid forecasters in diagnosing ET, as well as other thermal and moisture issues associated with TCs.
- NHC forecasters are still learning the strengths and weaknesses of this data type.
- The next generation of geostationary weather satellites (e. g. the U. S. GOES-R series) will carry instruments that should make this and many other types of multispectral imagery available globally.
- EUMETSAT Web Site: www.eumetsat.int
- SPoRT Web Site: weather.msfc.nasa.gov/sport/
- GOES-R Proving Ground Web Site: www.goes-r.gov/users/proving-ground.html