NATIONAL HURRICANE CENTER
TROPICAL CYCLONE REPORT

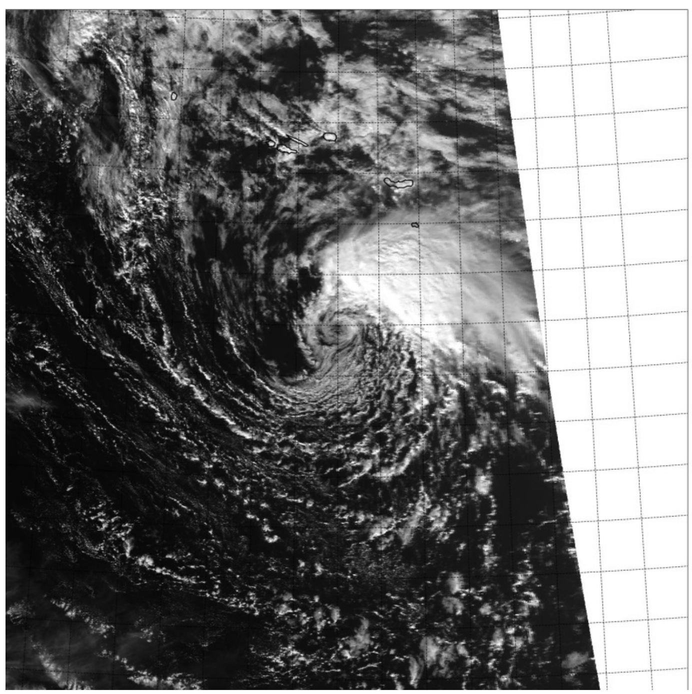
UNNAMED SUBTROPICAL STORM

(AL152013)

5 – 7 December 2013

Eric S. Blake, Todd B. Kimberlain and John L. Beven II
National Hurricane Center

7 February 2014



AQUA VISIBLE IMAGE OF THE UNNAMED SUBTROPICAL STORM AT 1530 UTC 6 DECEMBER (NASA)

As part of its routine post-season review, the National Hurricane Center (NHC) occasionally identifies from new data or meteorological interpretation a previously undesignated tropical or subtropical cyclone. The NHC re-analysis of 2013 has concluded that a short-lived low that developed south of the Azores during early December was a subtropical storm.

Unnamed Subtropical Storm

5 – 7 DECEMBER 2013

SYNOPTIC HISTORY

During the first few days of December, an upper-level trough became trapped south of a blocking ridge near and southwest of the British Isles. This disturbance cut off and intensified while the mid- to upper-level flow amplified to its west, leading to an extratropical surface low forming about 225 n mi south of the Azores around 1800 UTC 3 December. A large area of gale- and storm-force wind was associated with the newly formed low, primarily over the western semicircle of the circulation. During the next 24 h, the occluding low completed a cyclonic loop in response to the blocking high shifting westward. Moderate convection increased relatively close to the center of circulation, and the radius of maximum winds contracted somewhat while the low was embedded in a relatively low-shear environment and over water temperatures around 22°C. The system became a subtropical storm about 335 n mi south of the Azores around 0000 UTC 5 December, when convection became better organized, the frontal features associated with the low had dissipated, and the surface center was still co-located with its parent upper-level low. The "best track" chart of the cyclone's path is given in Fig. 1, with the wind and pressure histories shown in Figs. 2 and 3, respectively. The best track positions and intensities are listed in Table 1[1].

Later that day, the storm turned northward to north-northwestward and its forward speed slowed when another middle- to upper-level disturbance dropped to the west of the cyclone. Scatterometer data indicated that the radius of maximum wind continued to contract while the intensity and expanse of the wind field decreased. Convection was also forming over the low-level center, with fragmented bands rotating around the remainder of the circulation. Around 0000 UTC 6 December, the low abruptly turned eastward when strong westerly middle- and upper-level flow reached the cyclone. The cloud pattern began to resemble that of a sheared tropical cyclone around this time, with the center exposed on the western edge of a band of relatively deep convection over the eastern half of the circulation. However, westerly shear increased further during the day, and the separation between deep convection and the low-level center increased. The cyclone weakened due to the strong shear and colder water, and it degenerated into a remnant low about 90 n mi south of the Azores by 0600 UTC 7 December. The low decayed into a trough late that day.

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[1] A digital record of the complete best track, including wind radii, can be found on line at ftp://ftp.nhc.noaa.gov/atcf. Data for the current year's storms are located in the *btk* directory, while previous years' data are located in the *archive* directory.

METEOROLOGICAL STATISTICS

Observations in the unnamed subtropical cyclone (Figs. 2 and 3) include subjective satellite-based Herbert-Poteat technique intensity estimates from the Tropical Analysis and Forecast Branch (TAFB). Data and imagery from NOAA polar-orbiting satellites including the Advanced Microwave Sounding Unit (AMSU), the NASA Tropical Rainfall Measuring Mission (TRMM), the European Space Agency's Advanced Scatterometer (ASCAT), and Defense Meteorological Satellite Program (DMSP) satellites, among others, were also useful.

Several pieces of evidence argue for classifying this system as a subtropical cyclone. First, the National Weather Service Unified Surface Analysis (Fig. 4) depicted the low as non-frontal on 5 December; this analysis seems consistent with ECMWF analyses on that date (Fig. 5). AMSU data also showed that the low had a low- to mid-level warm core (Fig. 6) on 5 December, which is also in agreement with cyclone phase-space diagrams from Florida State University (Fig. 7) that show a symmetric thermal structure (implying a lack of frontal structures). On 6 December, AMSU data depicted a more classical vertical profile of warming in the middle-to-upper troposphere on 6 December (Fig. 8) after it became more separated from its parent upper-level low. This evidence suggests the cyclone was in the process of becoming a tropical storm, but the deep convection did not stay organized for long enough to complete the transition.

The only observation of tropical-storm-force winds was in Santa Maria in the southeastern Azores. The station reported 10-minute sustained winds of 32 kt with a gust to 47 kt near 0000 UTC December 7.

CASUALTY AND DAMAGE STATISTICS

There were no reports of damage or casualties associated with this system.

FORECAST AND WARNING CRITIQUE

This system was mentioned in a Special Tropical Weather Outlook about 6 h before the system is estimated to have become a subtropical storm. However, the genesis potential was assessed to be low (formation probability less than 20%) due to a forecast of strong upper-level winds overtaking the cyclone and lower sea surface temperatures ahead. The NHC did not issue any forecasts on this system as a subtropical cyclone, in accord with NWS Directive 10-601, which allows marginal subtropical cyclones to be handled operationally as marine features.

Acknowledgements:

Derrick Herndon and Chris Velden of CIMSS provided the AMSU data. Bob Hart from Florida State University provided phase-space diagrams. The Hurricane Specialist Unit at NHC gave thoughtful reviews and helpful analyses for this report.

Table 1. Best track for the unnamed subtropical storm, 5-7 December 2013.

Date/Time (UTC)	Latitude (°N)	Longitude (°W)	Pressure (mb)	Wind Speed (kt)	Stage
03 / 1800	34.3	27.7	1002	50	extratropical
04 / 0000	33.9	27.8	1000	55	"
04 / 0600	33.1	28.9	997	55	"
04 / 1200	32.2	28.5	995	50	"
04 / 1800	31.9	27.9	995	50	"
05 / 0000	32.4	27.5	997	45	subtropical storm
05 / 0600	33.0	27.4	998	45	"
05 / 1200	33.5	27.7	998	45	"
05 / 1800	33.7	27.8	999	40	"
06 / 0000	33.9	27.9	999	40	"
06 / 0600	33.9	27.1	999	40	"
06 / 1200	34.5	26.9	999	40	"
06 / 1800	35.1	27.0	999	40	"
07 / 0000	35.8	27.1	1000	35	"
07 / 0600	36.5	27.4	1001	35	low
07 / 1200	37.1	27.8	1003	30	"
07 / 1800					dissipated
05 / 0000	32.4	27.5	997	45	minimum pressure/ maximum winds

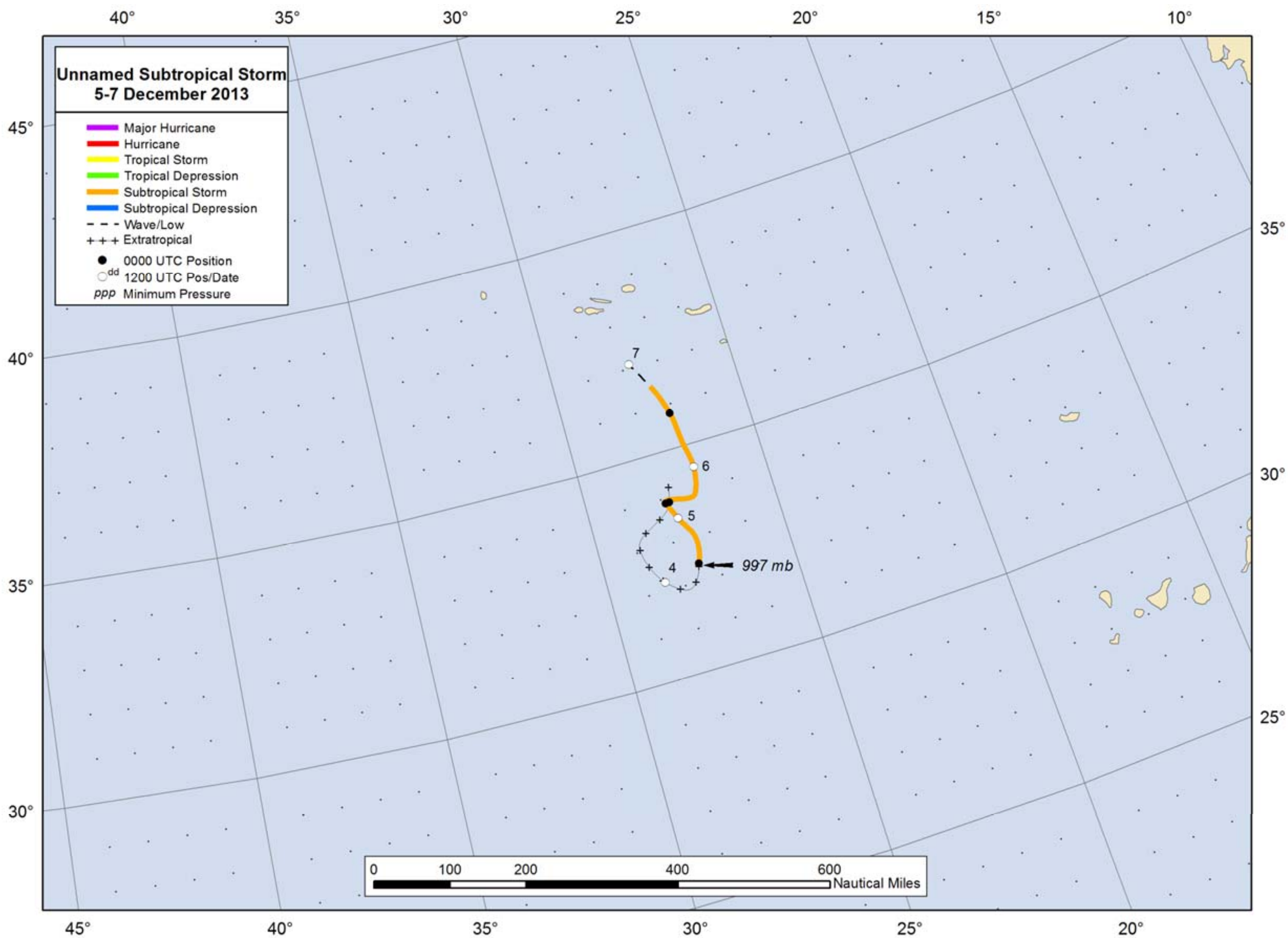

Figure 1. Best track positions for the unnamed subtropical storm, 5-7 December 2013. Tracks during the extratropical and low stages are partially based on analyses from the NOAA Ocean Prediction Center.

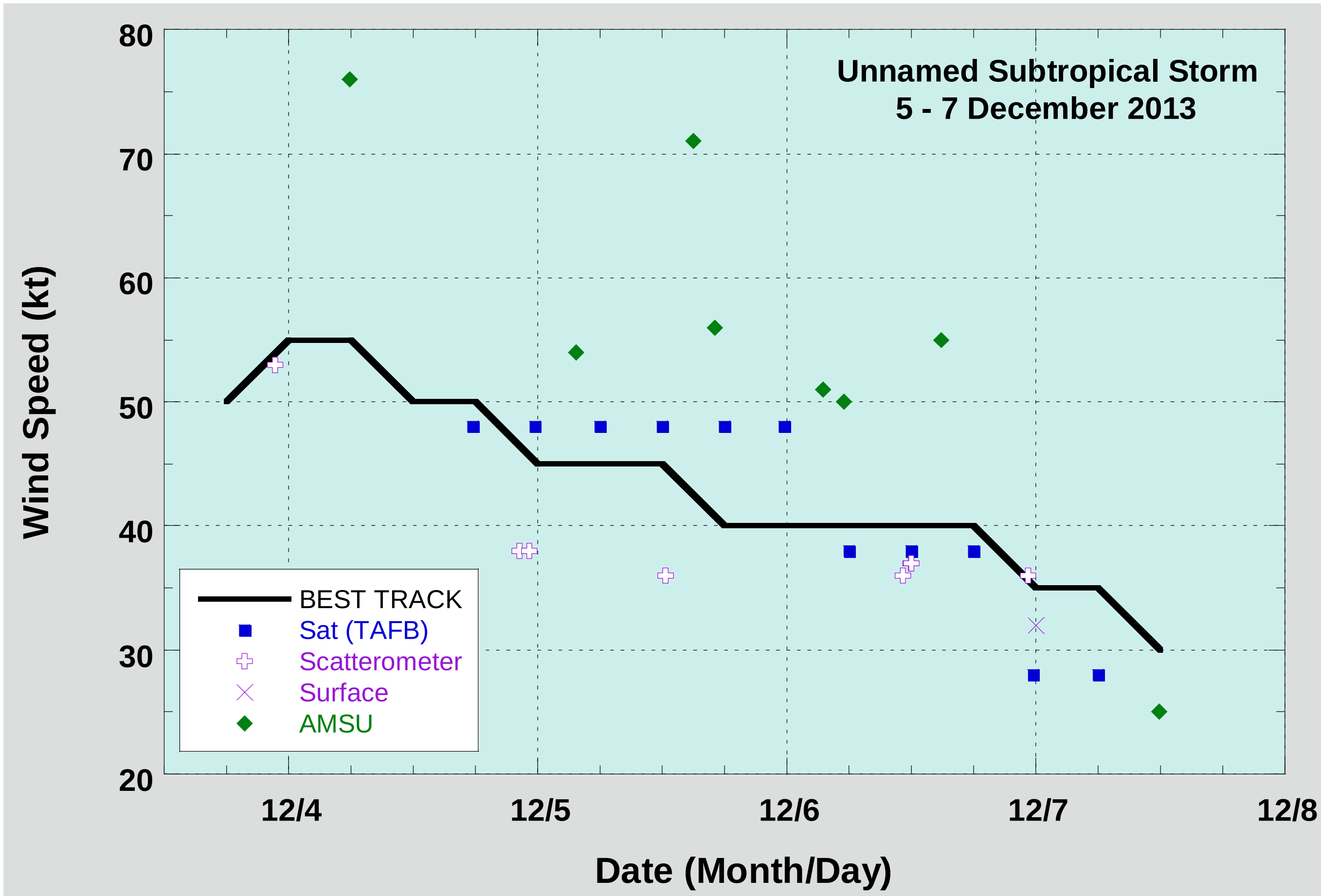

Figure 2. Selected wind observations and best track maximum sustained surface wind speed curve for the unnamed subtropical storm, 5-7 December 2013. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. Dashed vertical lines correspond to 0000 UTC.

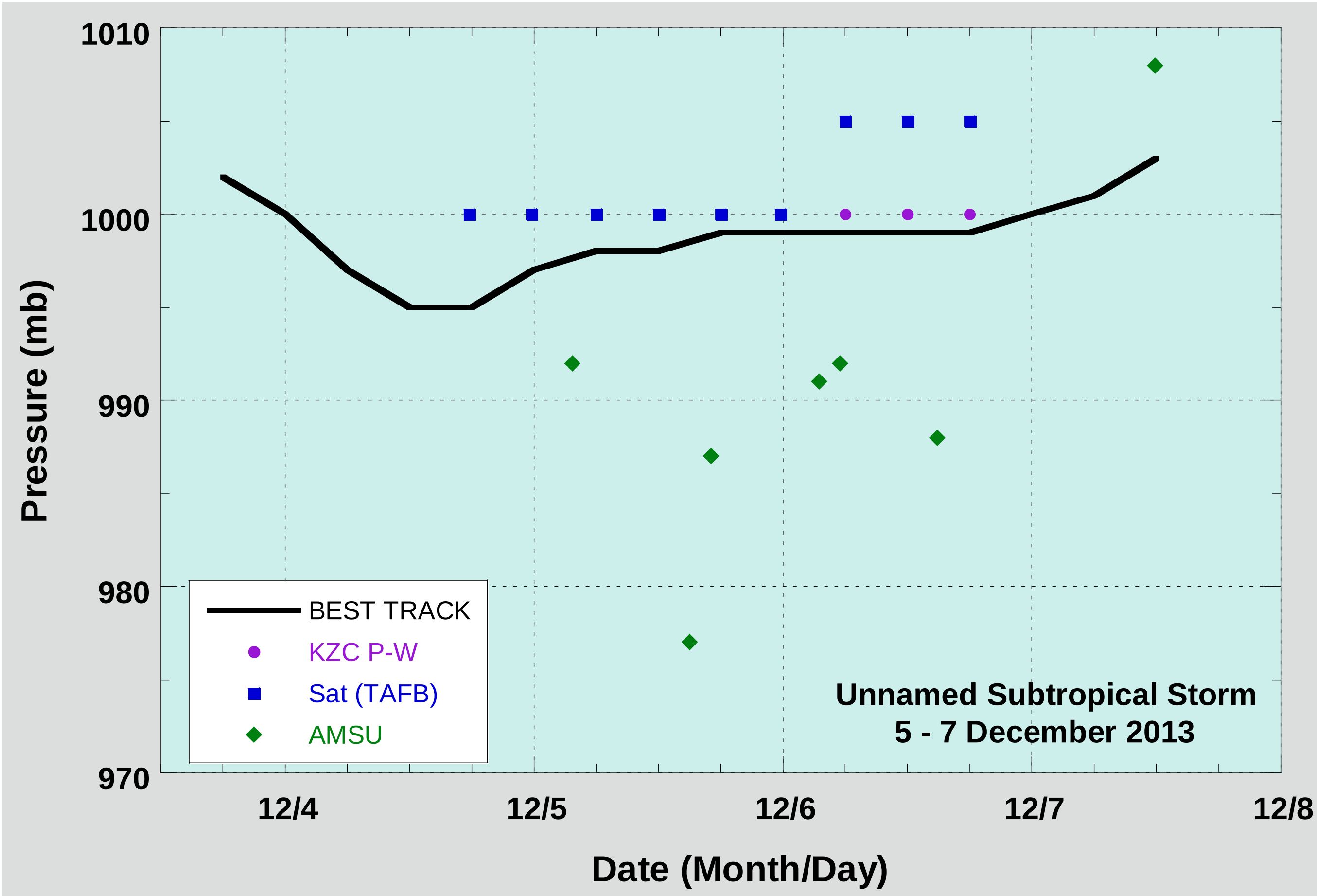

Figure 3. Selected pressure observations and best track minimum central pressure curve for the unnamed subtropical storm, 5-7 December, 2013. AMSU intensity estimates are from the Cooperative Institute for Meteorological Satellite Studies technique. KZC P-W refers to pressure estimates derived using the Knaff-Zehr-Courtney pressure-wind relationship. Dashed vertical lines correspond to 0000 UTC.

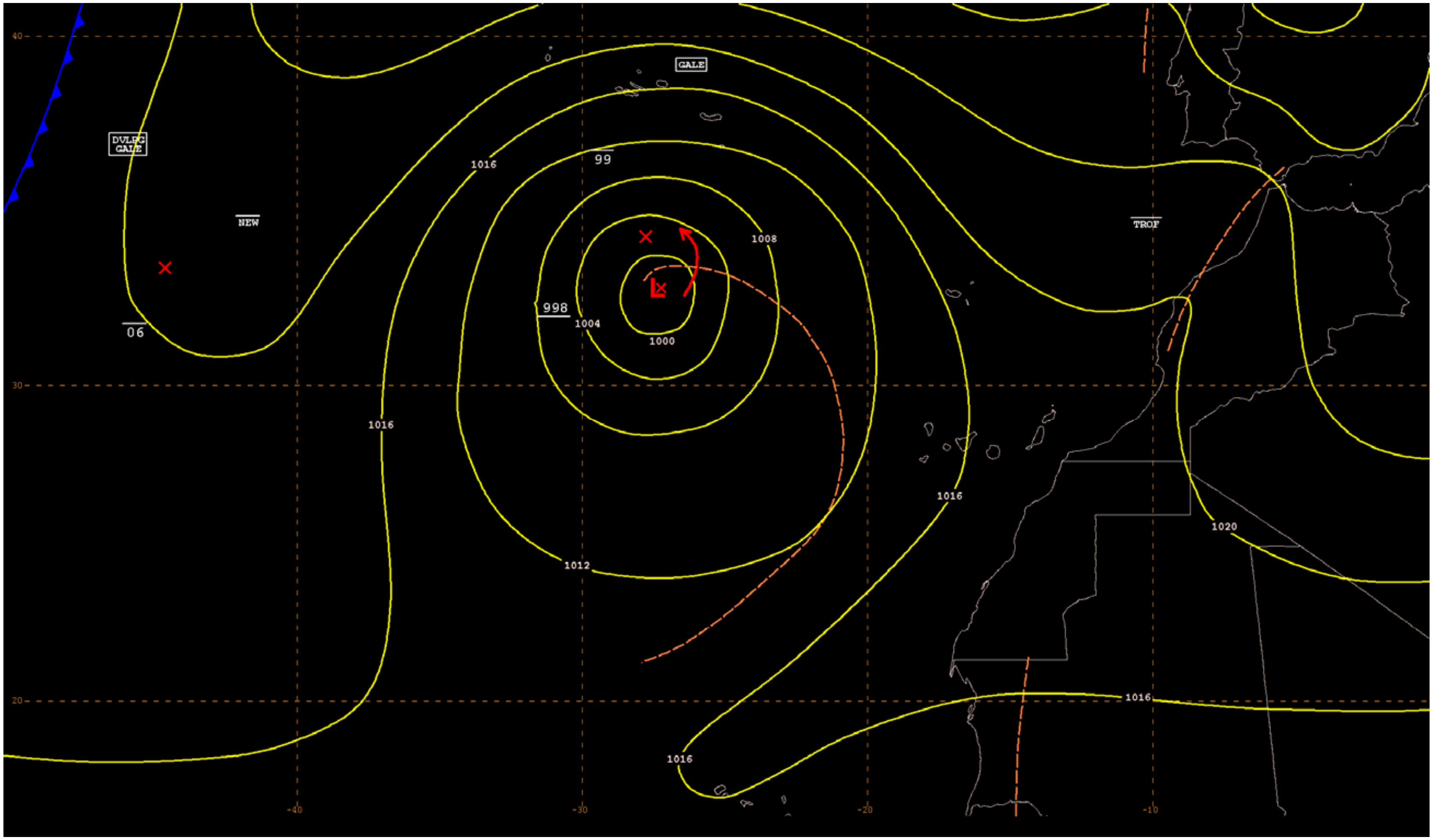

Figure 4. National Weather Service Unified Surface Analysis from 0600 UTC 5 December 2013.

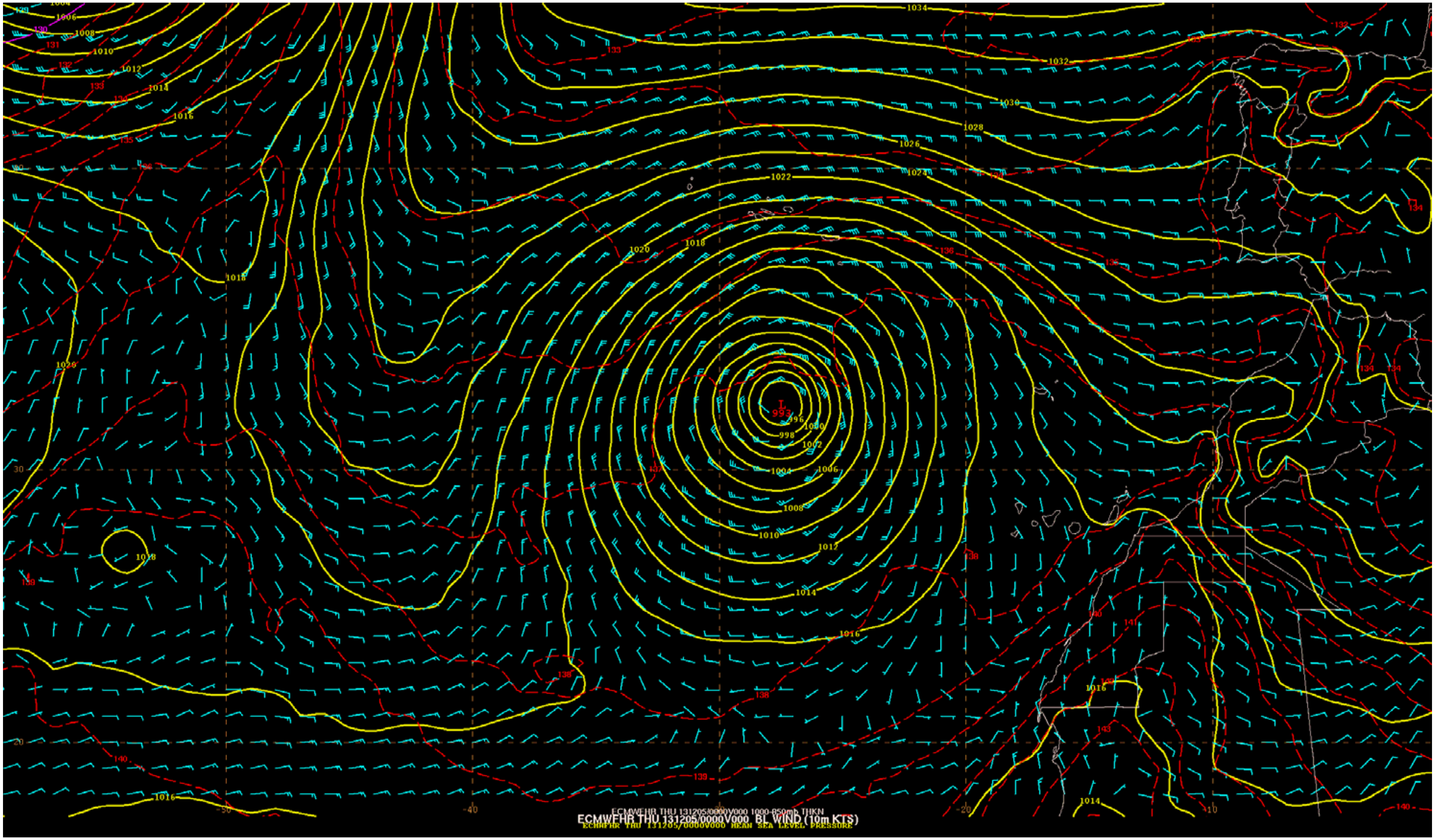

Figure 5. 0000 UTC 5 December 2013 ECMWF surface analysis, with isobars (solid yellow contours, mb), 10-m winds (barbs), and 1000-850 mb thickness (dashed red contours, dam).

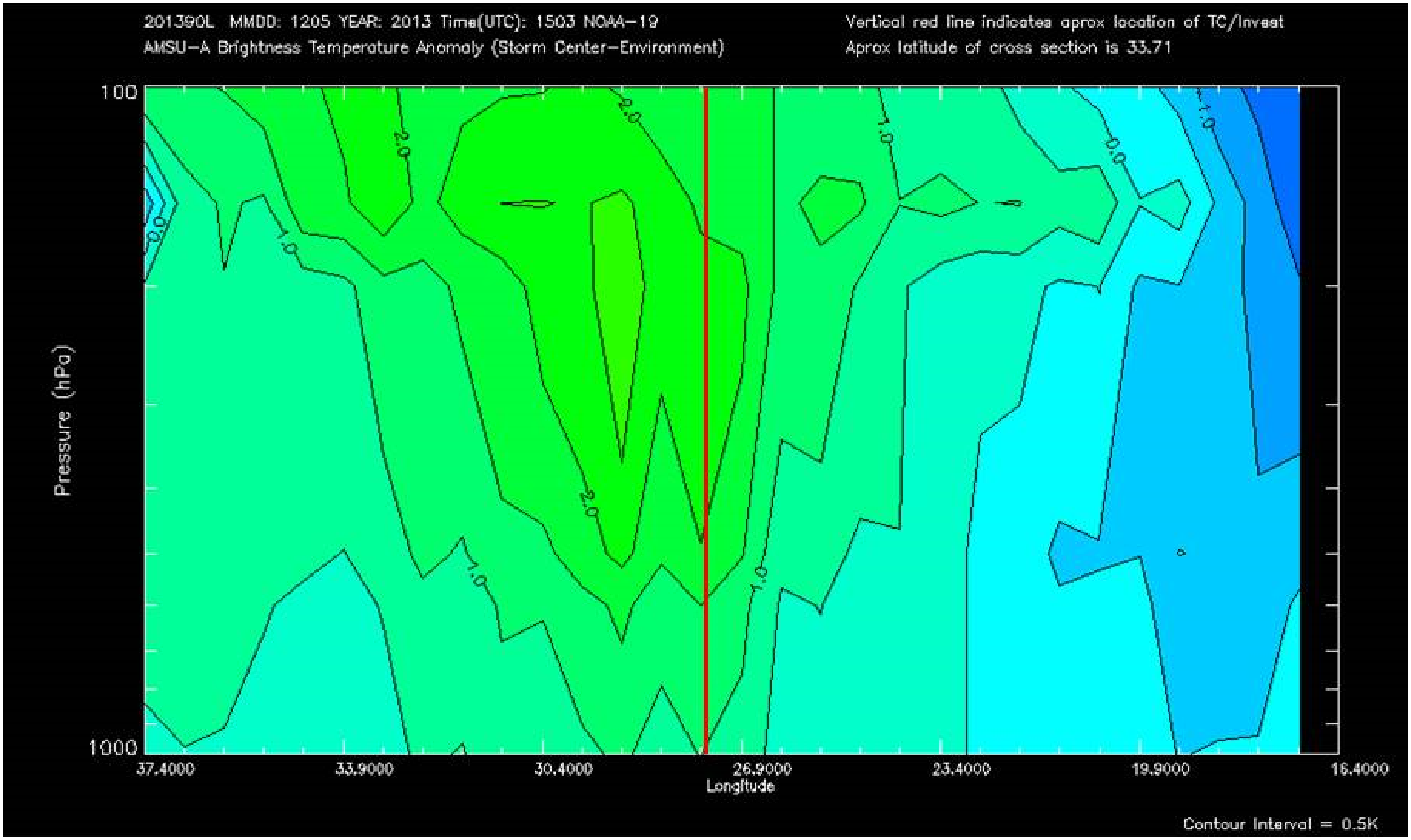

Figure 6. AMSU vertical cross-section of temperatures anomalies near the storm at 1503 UTC 5 December 2013. The red line denotes the center of the system. Figure courtesy CIMSS.

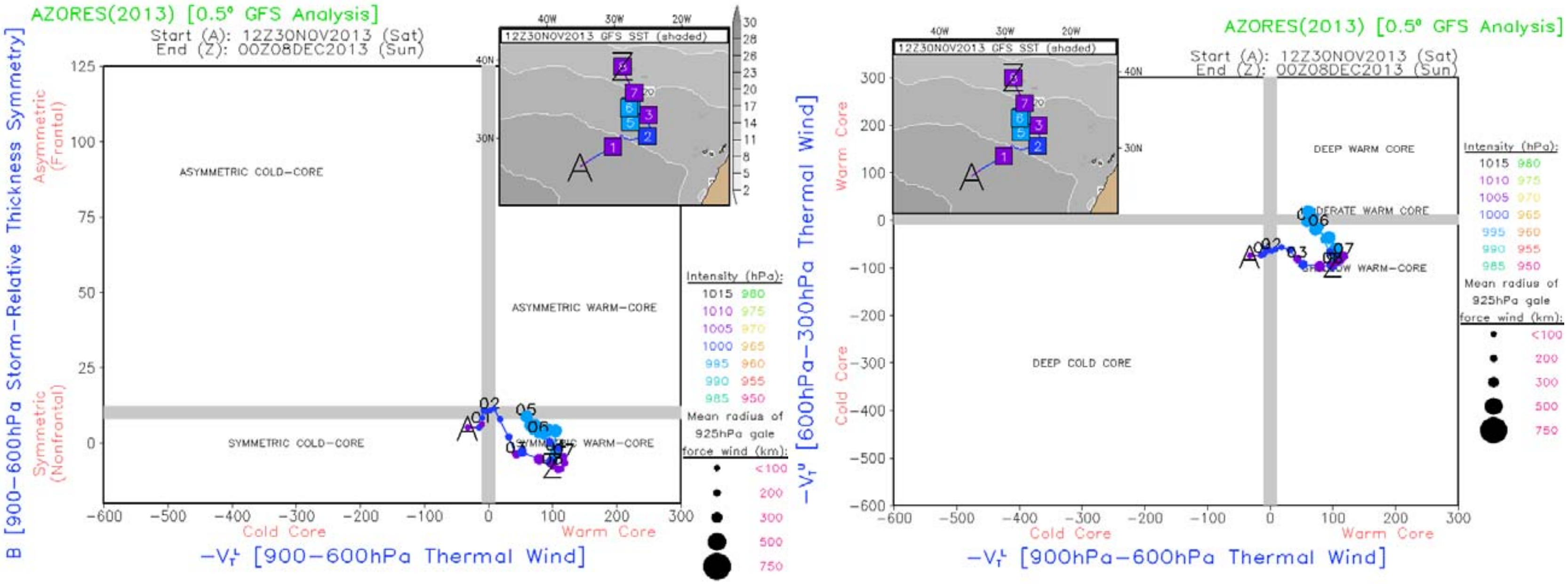

Figure 7. Cyclone phase-space diagrams from the Global Forecast System (GFS) model showing the symmetric, moderate warm-core nature of the system. Courtesy of Bob Hart (Florida State University).

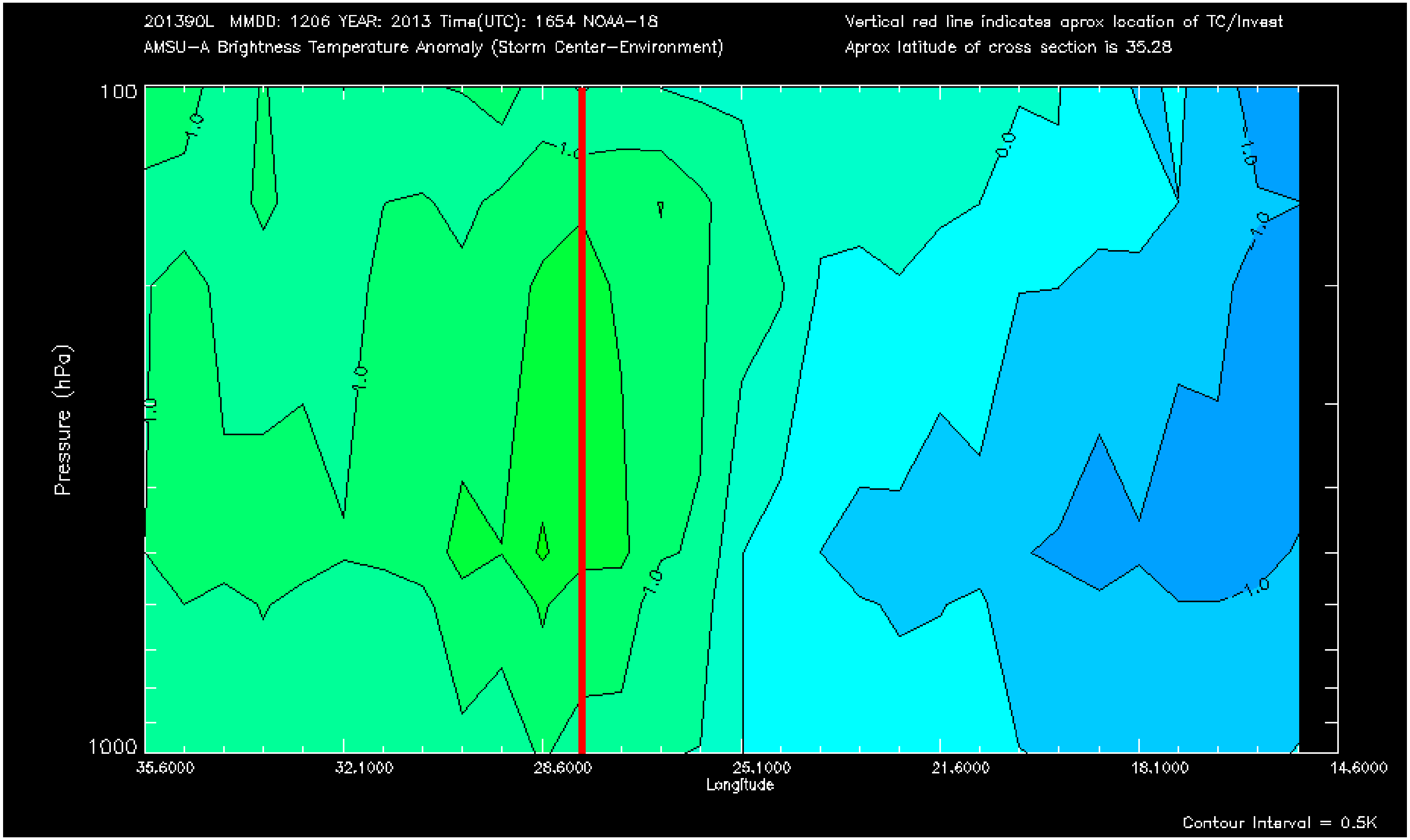

Figure 8. AMSU vertical cross-section of temperatures anomalies near the storm at 1654 UTC 6 December 2013. The red line denotes the center of the system. Figure courtesy CIMSS.