

South American Heat Wave of January 2009

By

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A summer heat struck Argentina and subtropical South American on 18-24 January 2009. The heat affected inland areas then moved eastward to the coast. On 22 January the heat reached the

coastal regions.

High temperatures over 38C (100F) were observed in many locations. In San Antonio Oeste hit 42C (108F), Many

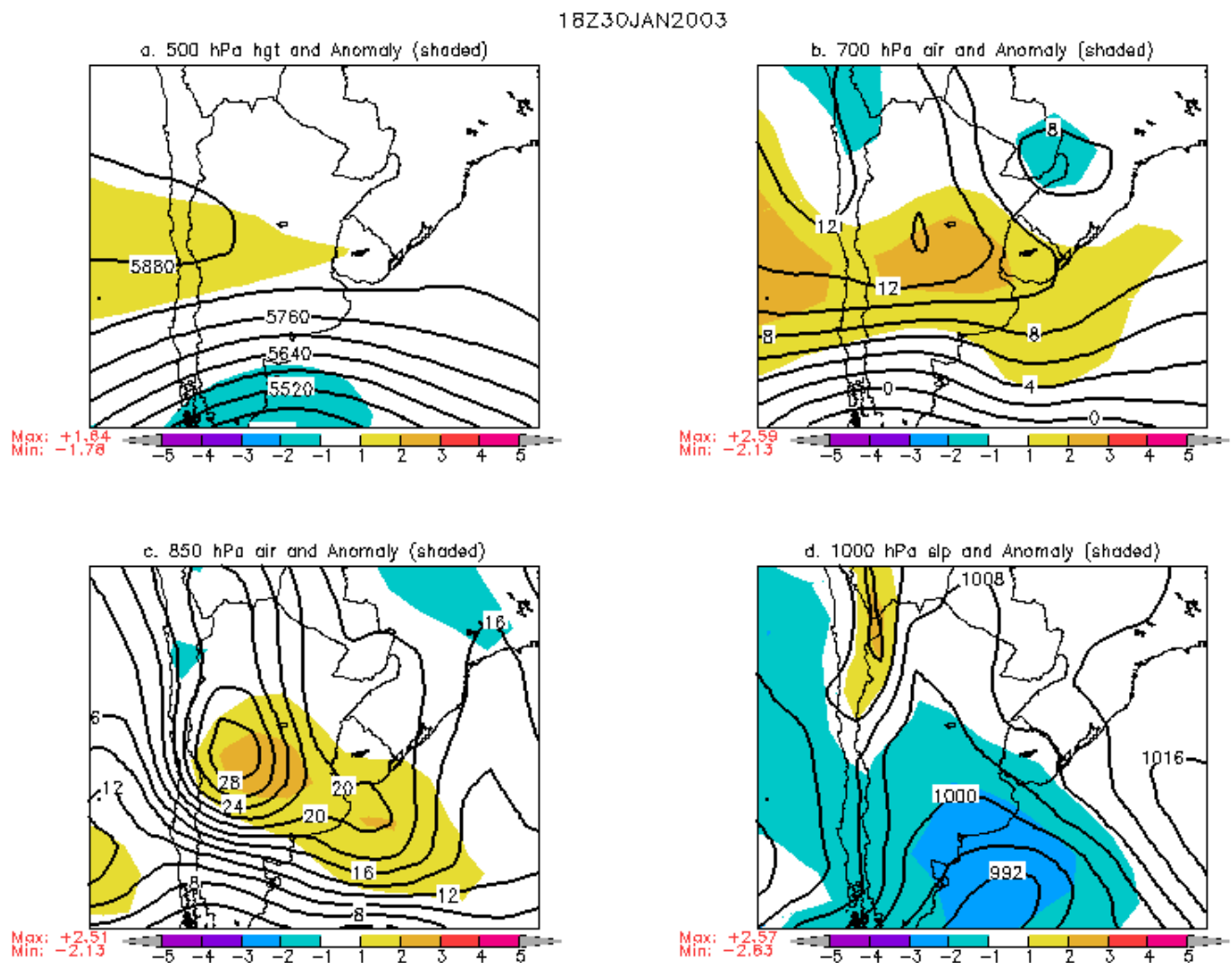


Figure 1. NCEP/NCAR re-analysis data valid at 1800 UTC 30 January 2003 showing a) 500 hPa heights (m) and height anomalies, b) 700 hPa temperatures (C) and temperatures anomalies, c) 850 hPa temperatures and temperature anomalies and d) mean sea-level pressure (hPa) and pressure anomalies.

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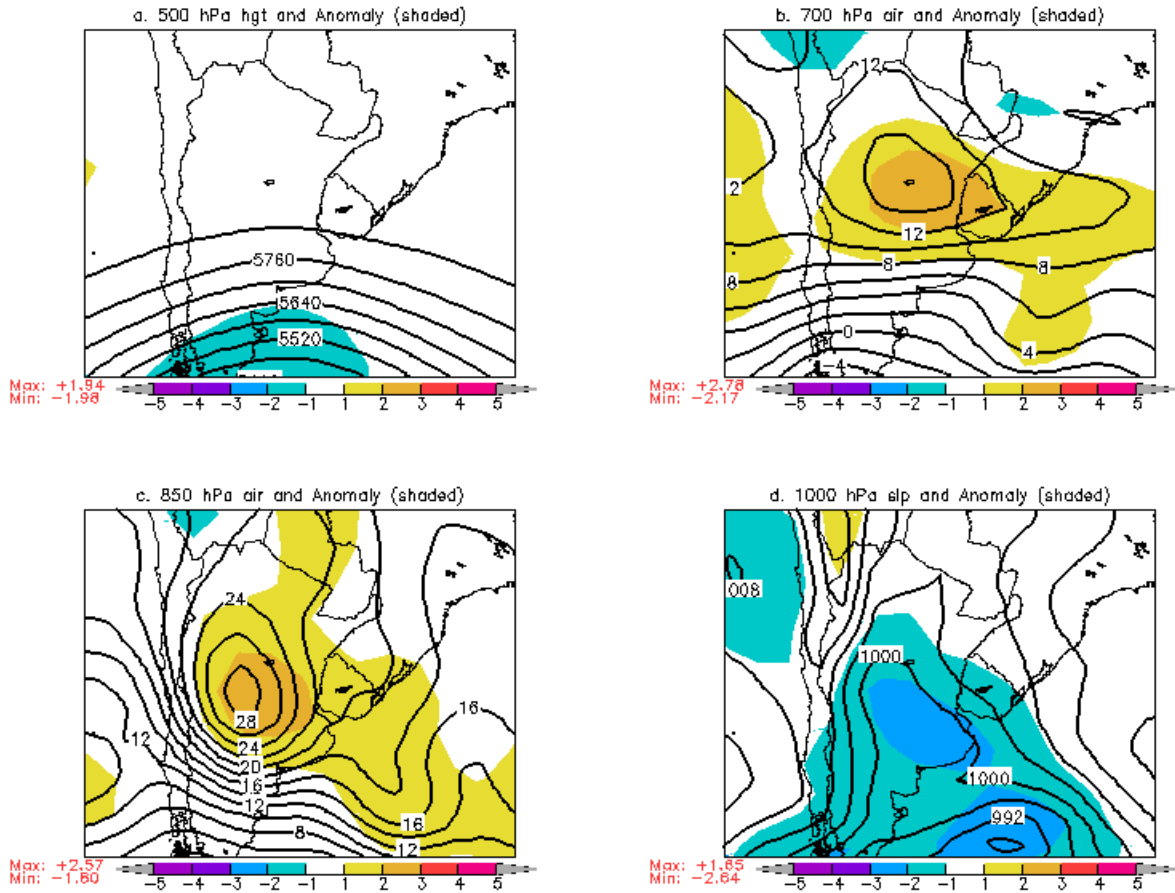


Figure 2. As in Figure 1 except valid at 0000 UTC 31 January 2003.

cities, such as Bahia Blanca, and Viedma reached 40C (104F). The hot weather prompted many people to go to the sea to escape the heat.

A similar heat wave impacted the region at the end of January 2003. That event affected most of subtropical South American to include Argentina, Uruguay, Paraguay, southern Brazil, and Bolivia. A record temperature of 44C (111F) was reached on 30 January at the Mendoza airport. (Seluchi et al 2006). This event had a strong 500 hPa ridge (Fig. 1a) with positive height anomalies over the Andes extending over Argentina, and anomalous 700 and 850 hPa temperatures over the region, mainly

east of the Andes implying enhanced subsidence may have played a role in the warm temperatures. Low pressure and a negative pressure anomaly was present over the south Atlantic and to the lee of the Andes. The hot hair moved eastward as shown in Figure 2 valid at 0000 UTC 31 January 2003.

A series of NCEP GFS 00-hour forecasts of the pattern are shown in Figures 3-7. These data show the strong 500 hPa ridge, with a closed 5880 m contour along the West Coast of South America at 20/0000, 21/000, 23/0000 and

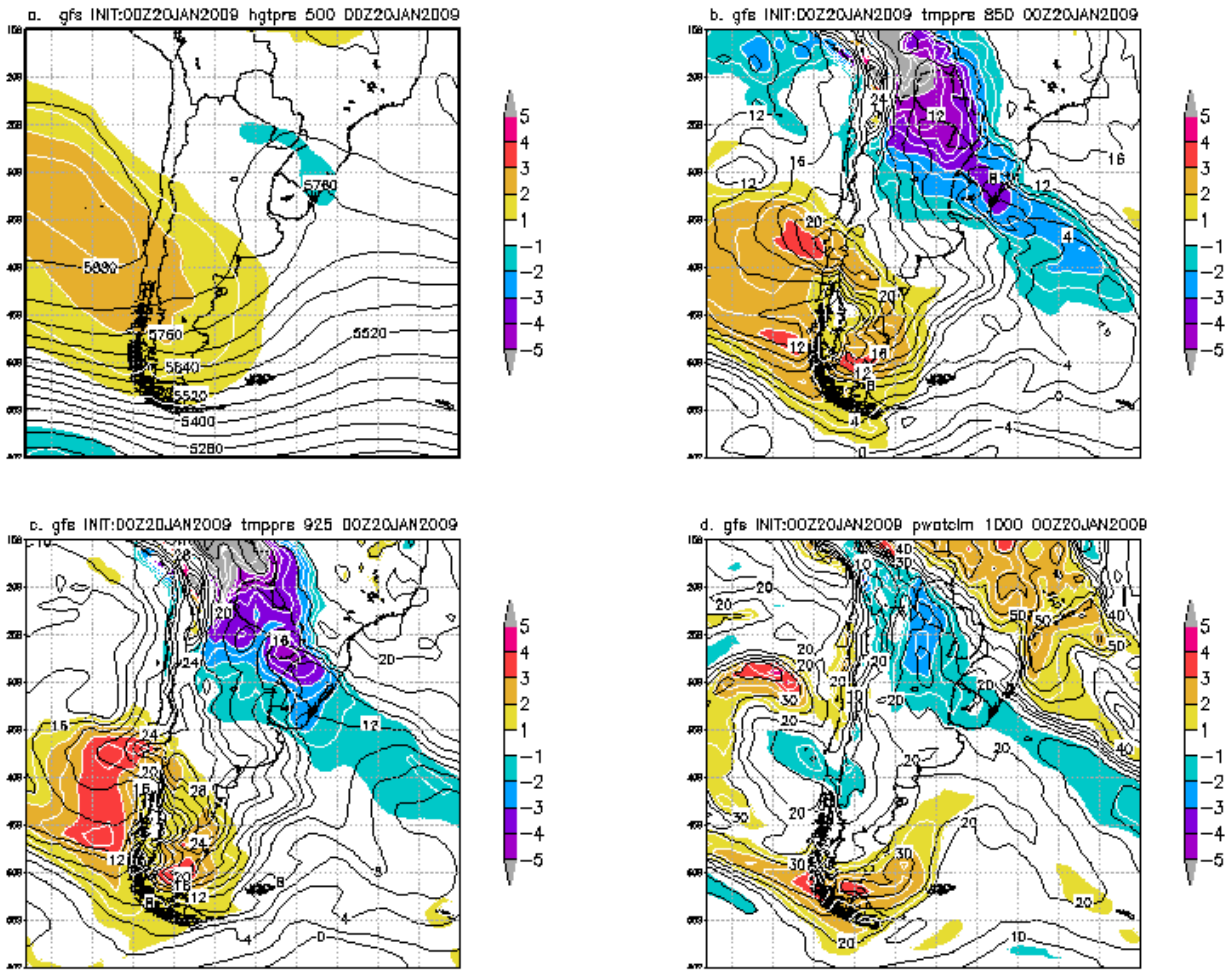


Figure 3. As in Figure 1 except showing GFS 00-hour forecasts initialized at 0000 UTC 20 January 2009. Data shown include a) 500 hPa heights and height anomalies, b) 850 hPa temperatures and temperature anomalies, c) 925 hPa temperatures and temperature anomalies, and d) precipitable water and precipitable water anomalies.

24/0000 UTC. On the 24th, there was a closed 5880 m contour on both coasts.

The GFS 925 and 850 hPa temperature anomalies showed the above normally warm air extending from the east slopes of the Andes to the Atlantic. The warmest air was focused over Argentina. Unlike many eastern United States heat waves, the precipitable water values appeared to be close to normal over much of the affected region. This heat event was focused farther south than the event of January 2003.

The pattern of sub-tropical heat waves appears to be clearly defined by a 500 hPa ridge and a close 5880 m contour. In the eastern United States, heat waves typically require a 5940 m closed contour. The heat waves also appear to require anomalously warm 850 hPa temperatures. The pattern if readily defined should be observable in forecast data.

Figures 8-10 show NCEP GEFS forecasts of the event from forecasts initialized at 1200 UTC 22 January

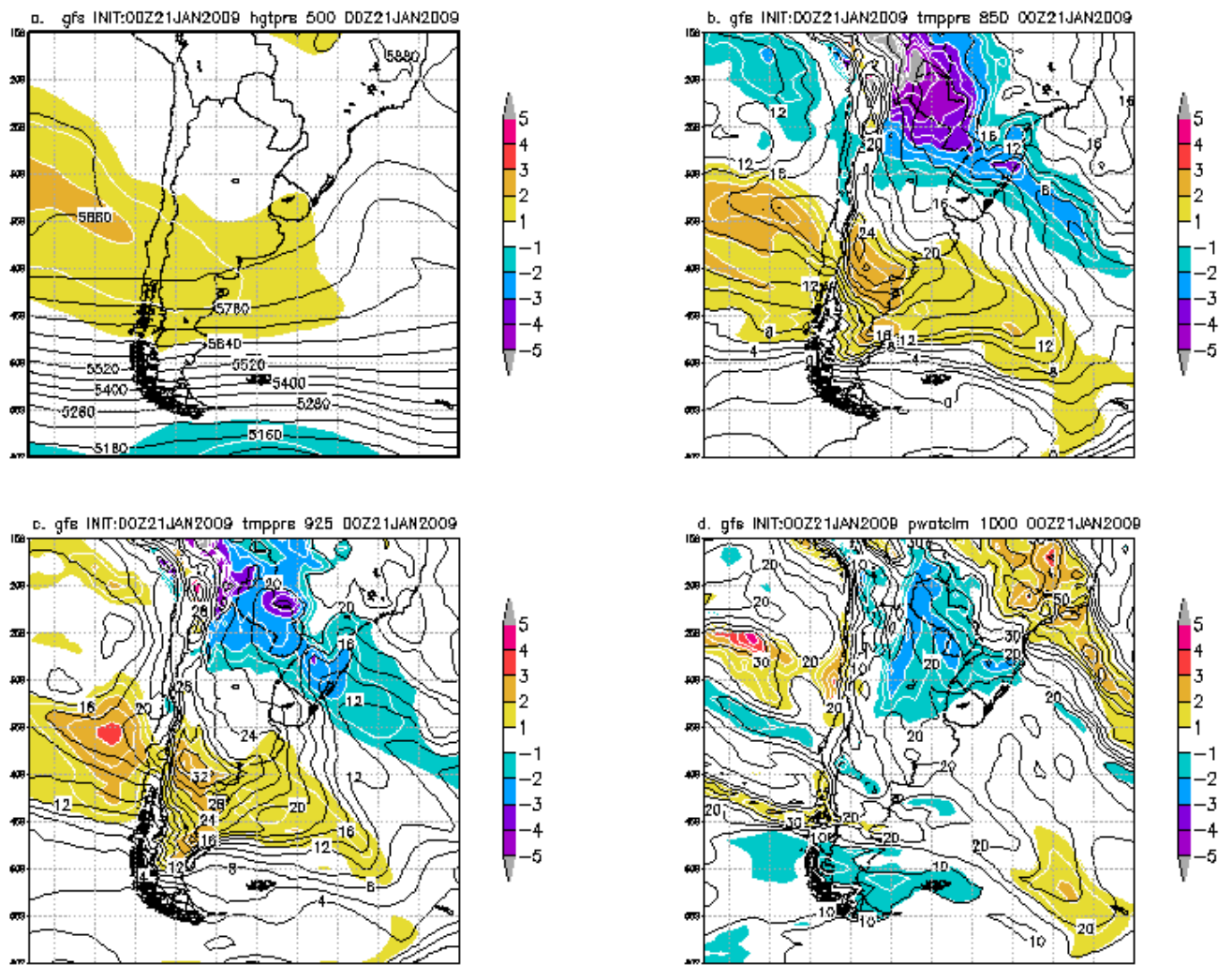


Figure 4. As in Figure 3 except valid at 0000 UTC 21 January 2009.

2009. Other cycles were examined but each produced a similar result and thus one set of forecast from one cycle are shown.

The GEFS clearly predicted anomalous 500 hPa heights (Fig. 8) to include a close 5880 m contour off the coast of Argentina. Comparisons with Figures 6a & 7b suggest these were excellent forecasts. The spaghetti plots suggest that there was high confidence in the forecast as all the members showed the salient features in the same locations.

The 850 hPa temperatures and anomaly forecasts are shown in Figure 9. These forecast compared well with the 850 hPa

and temperature anomalies shown in Figures 6b & 7b. Again, there was strong agreement between members, thus a confidence forecast. Interestingly the warm and cold anomalies were well predicted by the GEFS.

Figure 10 shows 2m temperature probability forecast valid at 1800 and 0000 UTC 23, 24 and 25 January 2009. These data show the GEFS predicted a large area of 30C (86F) or greater values over much of subtropical South America. The warmest values were forecast at 1800 UTC on both days with lower values at 0000 UTC. The contours are every 5C and the 1800 UTC forecasts contain closed 40C (104F)

Wikipedia

Seluchi, M.E, F.A Norte, J.L. Gomes, and S.C Simonelli, 2006: *SYNOPTIC AND THERMODYNAMIC ANALYSIS OF AN EXTREME HEAT WAVE OVER*

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Proceedings of 8 ICSHMO, Foz do Iguacu, Brazil, April 24-28, 2006, INPE, p. 2009-2010.

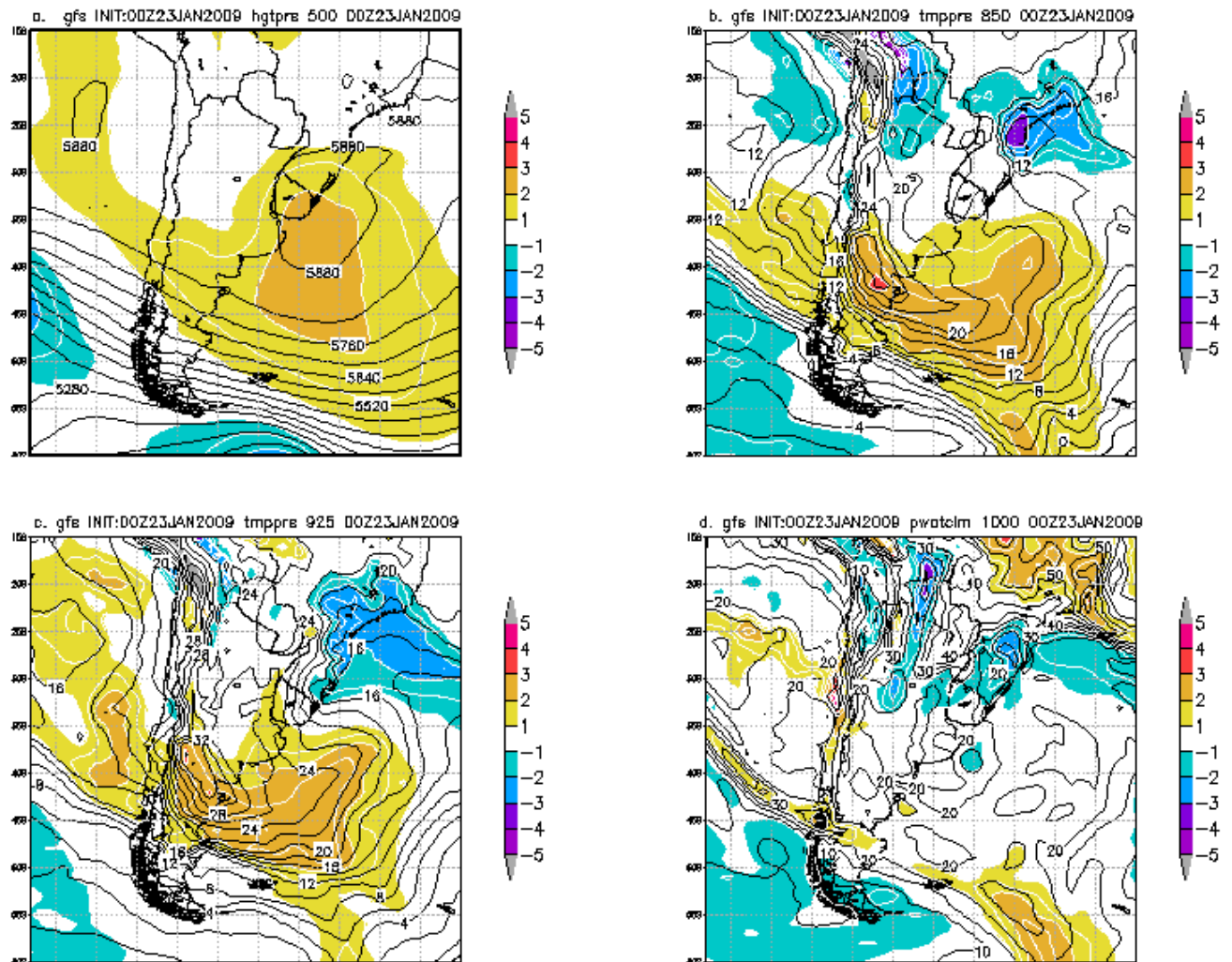
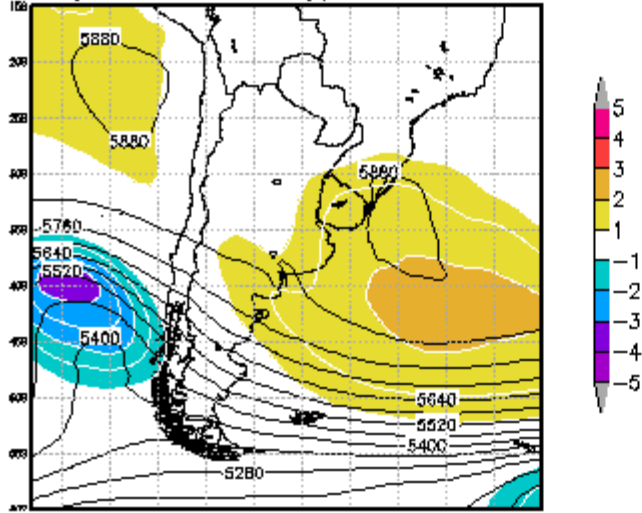
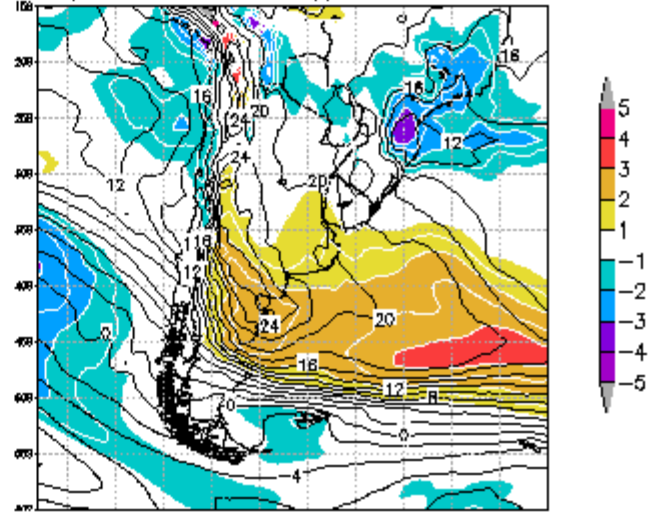


Figure 6. As in Figure 3 except valid at 0000 UTC 23 January 2009.

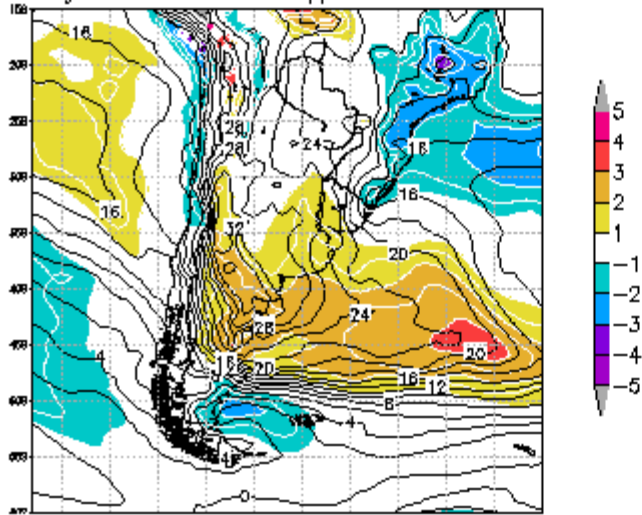
a. gfs INIT:00Z24JAN2009 hgtpre 500 D0Z24JAN2009



b. gfs INIT:00Z24JAN2009 tmppre 850 D0Z24JAN2009



c. gfs INIT:00Z24JAN2009 tmppre 925 D0Z24JAN2009



d. gfs INIT:00Z24JAN2009 pwatclm 1000 D0Z24JAN2009

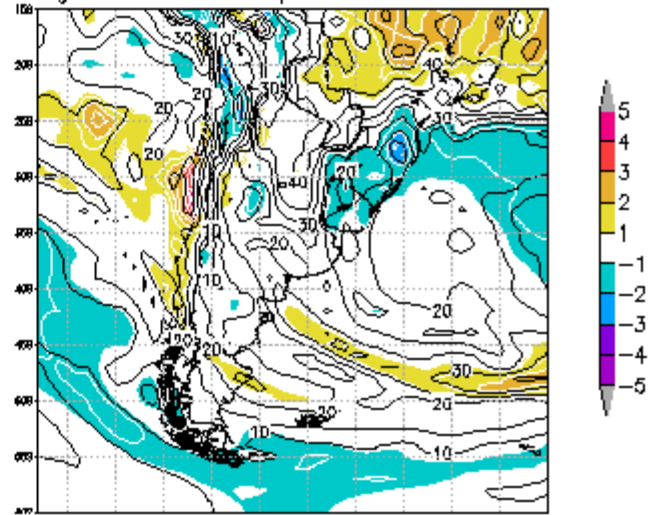


Figure 7. As in Figure 3 except valid at 0000 UTC 24 January 2009.

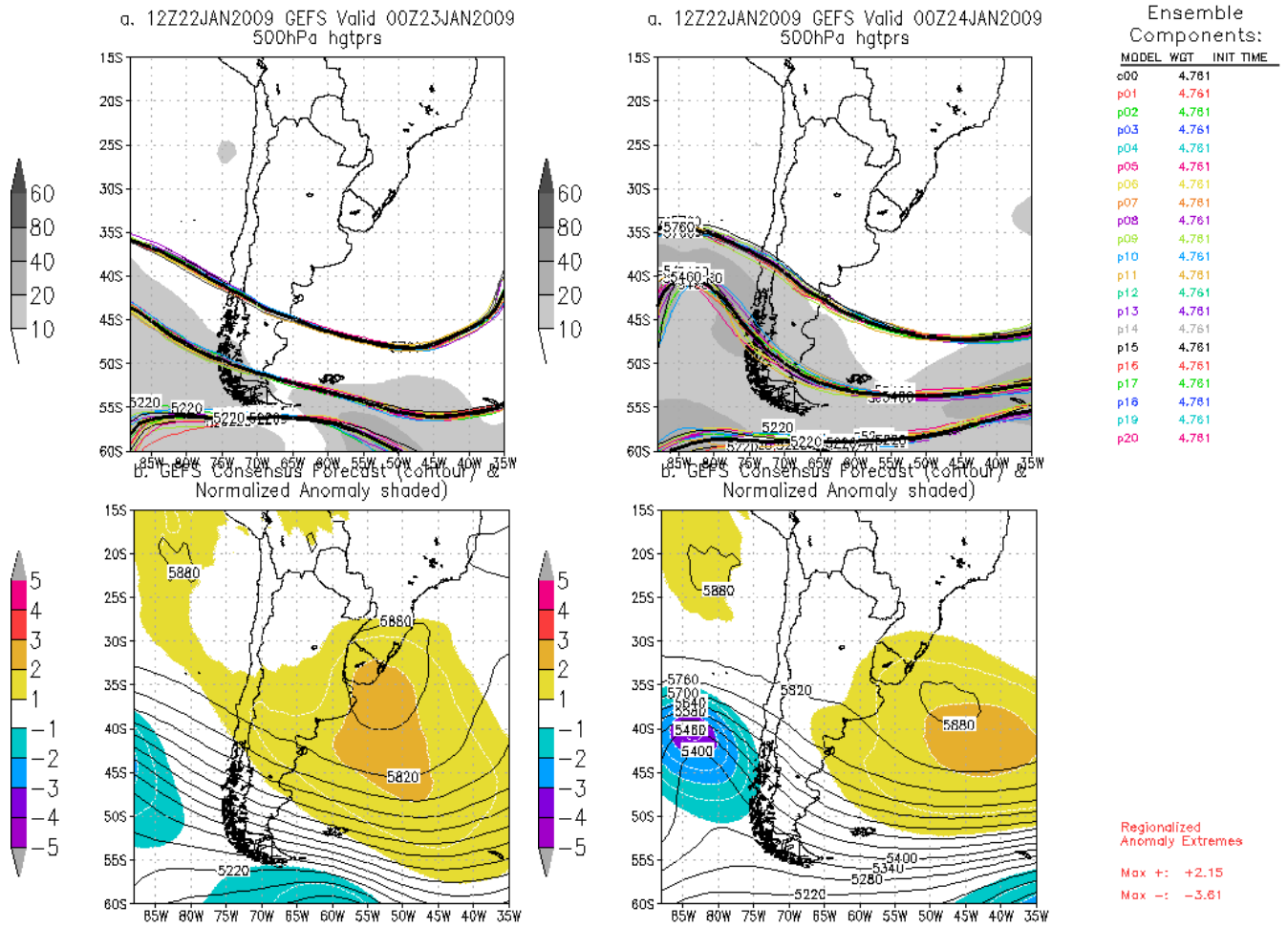


Figure 8. NCEP GEFS forecasts of 500 hPa heights from GEFS initialized at 1200 UTC 22 January 2009. Forecasts are valid at 0000 UTC 23 and 24 January 2009. Upper panel show each of the 21-member ensembles. 5220, 5460, and 5760 m contours and the spread about mean. Lower panels show the ensemble mean pattern and the anomalies.

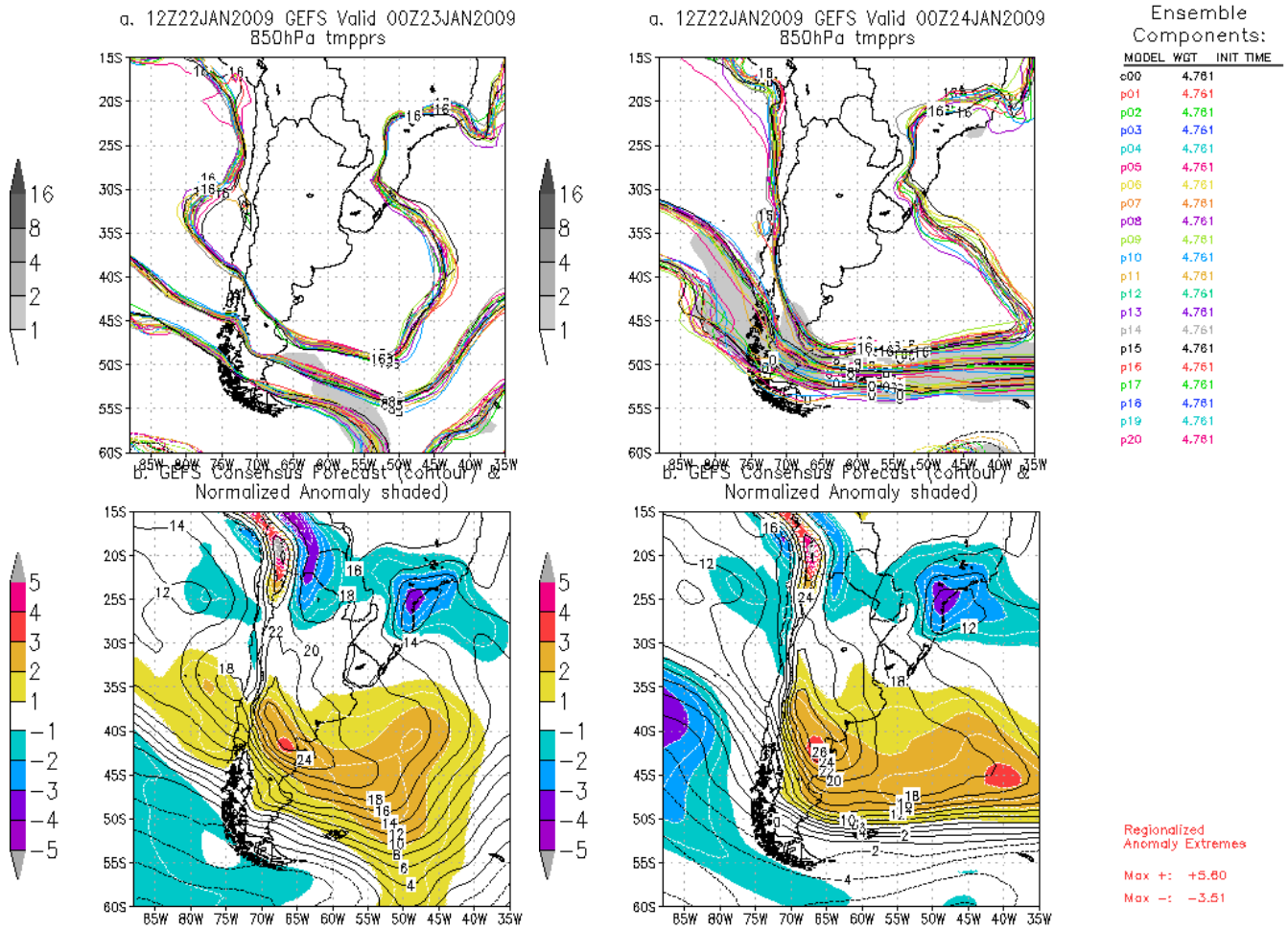


Figure 9. As in Figure 8 except showing 850 hPa temperatures from GEFS initialized at 1200 UTC 22 January 2009. Forecasts are valid at 0000 UTC 23 and 24 January 2009. Upper panel show each of the 21-member ensembles. -8, 0, 8, and 16C contours and the spread about mean. Lower panels show the ensemble mean pattern and the anomalies.

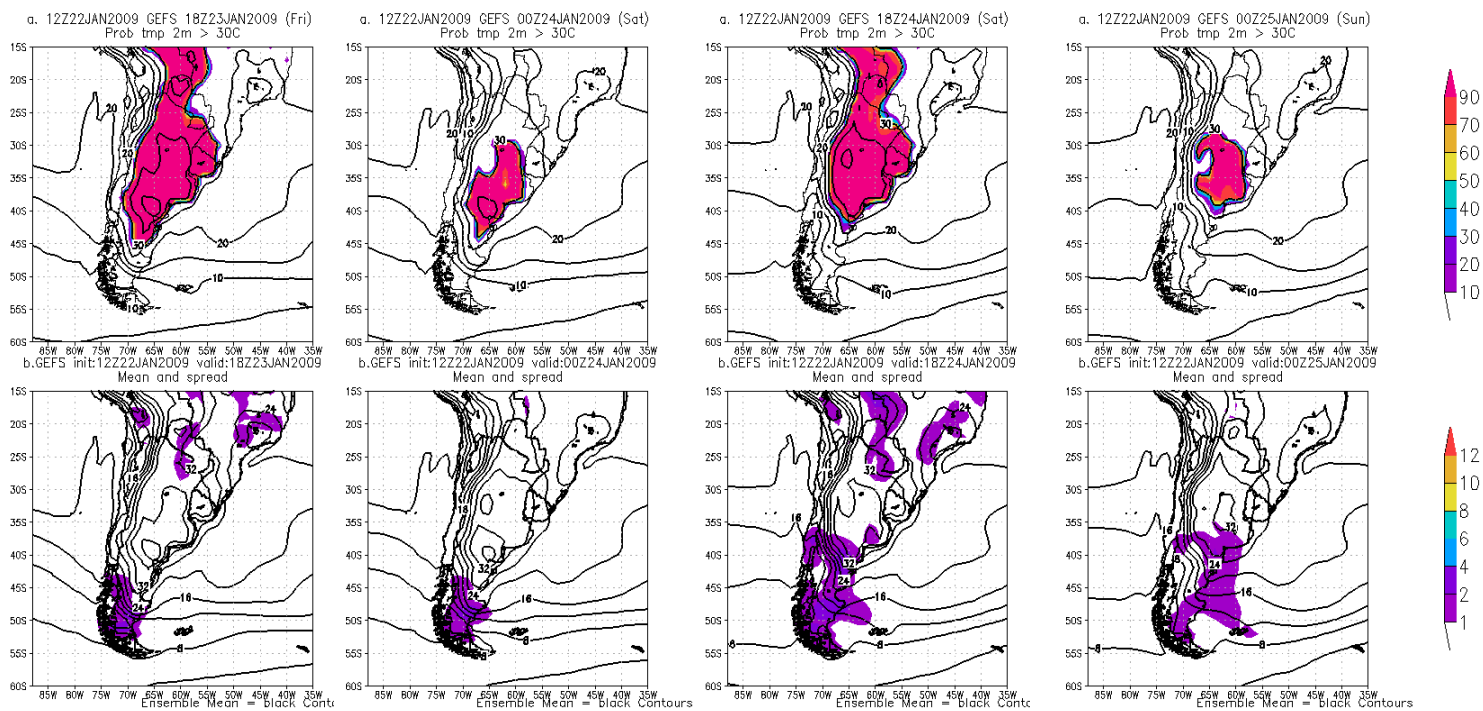


Figure 10. As in Figure 8 except showing (upper panels) the probability of 2m temperatures greater than or equal to 30C and the ensemble mean contoured every 5C. Lower panels show the ensemble mean and the spread about the mean. Forecasts are valid at (left) 1800 UTC 23 January, (left-center) 0000 UTC 24 January, (right-center) 1800 UTC 24 January and (right) 0000 UTC 25 January 2009.