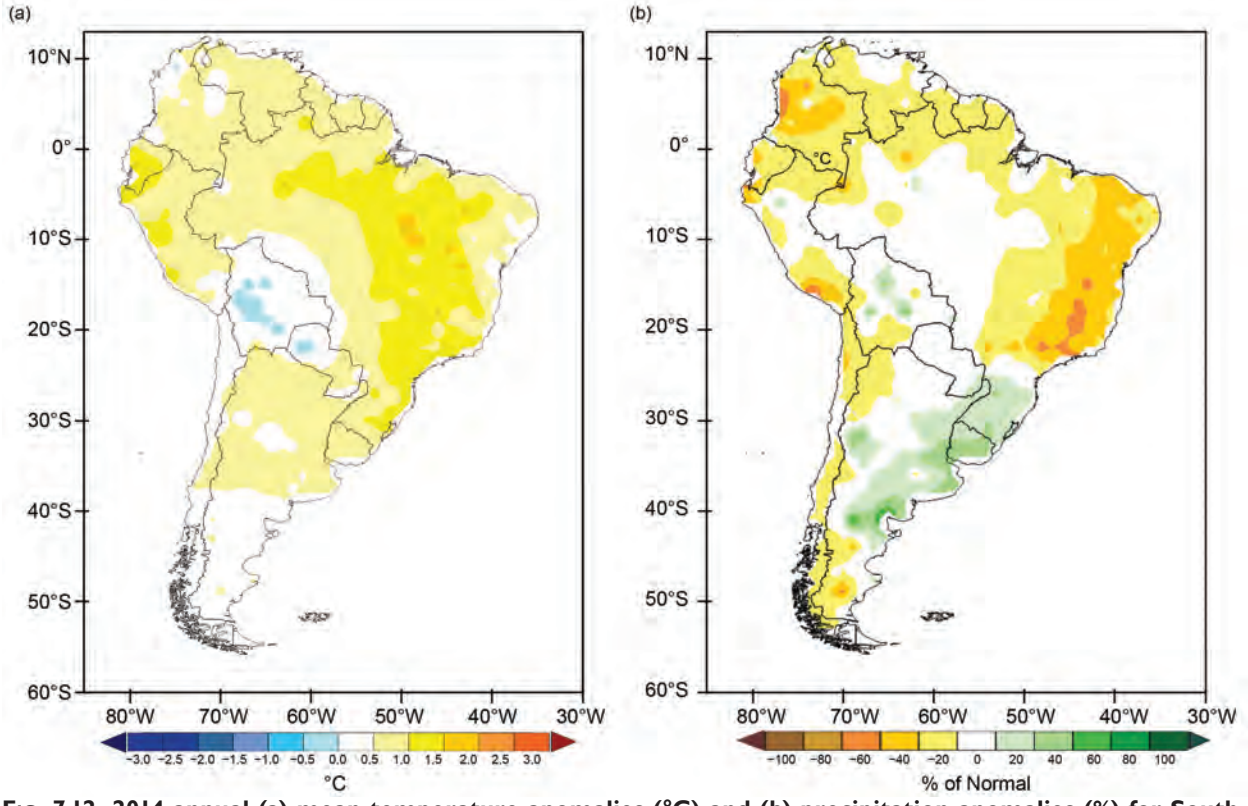

Fig. 7.12. 2014 annual (a) mean temperature anomalies (°C) and (b) precipitation anomalies (%) for South America (1961–90 base period). (Sources: Data from 630 stations provided by national meteorological services of Argentina, Brazil, Bolivia, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay, and Venezuela. The data were compiled and processed by CIIFEN, 2015.)

coastal region and the southern end of the highlands had a precipitation deficit up to 50%. The northern and central highlands and Amazonia regions recorded 110–120% of normal precipitation.

In Peru, during JFM, extreme dry conditions were observed in the northwest and the southern Andes, while wet conditions prevailed in the southern and central Amazonia region. Precipitation over northern Bolivia and the Bolivian Altiplano was above normal early in the year. North of La Paz, anomalies reached nearly three times the normal, but were near to below normal the rest of the year. Over the valleys and lowlands, precipitation was below normal for the year, as little as 68% of normal. The eastern llanos (plains) observed above-normal precipitation most of the year.

(iii) Notable events

In Peru, heavy rains produced several floods and landslides over the southern Amazonia region during the first months of the year, leaving 8000 people homeless. The government declared a state of emergency for 60 days in the affected regions. In August, heavy snow fell across the southern Peruvian Andes, killing many animals, destroying 14 000 ha of crops, and leaving 81 000 people stranded.

2) Tropical South America east of the Andes—J. A. Marengo, J. C. Espinoza, J. Ronchail, and L. M. Alves

This subsection covers Brazil, Paraguay, and sectors of northern Argentina, Peru, and Bolivia east of the Andes.

(i) Temperature

Across most of the region, monthly mean temperatures were about 1°–2°C warmer than average throughout most of the year. January and February were unusually warm, with the city of São Paulo (southeastern Brazil) experiencing its warmest January and February since 1943. The city of Rio de Janeiro (southeastern Brazil) also experienced extremely warm temperatures, including a record-high February daily maximum temperature of 40.6°C on 3 February.

Temperatures during July–September were 1°–3°C warmer than normal. Eight cold surges affected South America during April–August, with southern Brazil and the Bolivian and southern Peruvian Amazon

most affected. One cold surge during 23–25 July dropped maximum temperatures from 35.2°C to 16.9°C in Cuiaba (central Brazil), with minimum temperatures as low as 12.0°C occurring over southern Peruvian Amazon. During the same episode, many places in the highlands of southern Brazil observed temperatures dropping to 0°C, and São Paulo experienced several days with maximum temperatures below 15°C—the lowest maximum temperature since 1962.

(ii) Precipitation

Precipitation deficits were observed between January and March over southeastern Brazil (150–200 mm month^{-1} below normal) and between January and May over northeastern Brazil (50–150 mm month^{-1} below normal), continuing the region's severe drought that started in 2012. An atmospheric blocking and a high pressure system in large parts of tropical Brazil and the tropical South Atlantic, together with an absence of the South Atlantic convergence zone (SACZ) during summer, were responsible for the lack of precipitation over most of subtropical South America east of the Andes. As a consequence, a record dry spell of 45 consecutive days occurred during the December–February peak of the rainy season. The warm temperatures and dry conditions in southeastern Brazil led to positive 500-hPa height anomalies during the peak of the rainy season. This feature has been detected during previous dry episodes (Fig. 7.13a). Meanwhile, exceptional positive rainfall anomalies were observed in January and February 2014 in southwestern Amazonia (see "Notable events"). Rainfall extremes during March–May in parts of northern Northeast Brazil were due to an anomalously southward position of the intertropical convergence zone. In June, two frontal systems brought copious rain (100 mm above normal) to parts of Santa Catarina and Rio Grande do Sul states, affecting nearly 400 000 people (http://reliefweb.int/map/columbia/16-June-2014-south-america-severe-weather-and-floods). Wet conditions prevailed all year in southern Brazil (50–100 mm above normal), while above-normal precipitation was observed over Bolivia, Paraguay, and northern Argentina between March and July. A September frontal system produced intense rainfall in southern Brazil. In November two weak SACZ episodes produced beneficial rainfall in southeastern Brazil. The rainfall totals associated with these systems were not sufficient to end drought conditions in the region.

Above-normal precipitation observed in March–July, caused the Parana and Paraguay Rivers to overflow in rural and urban locations in Paraguay, affecting almost 160 000 people, with the national capital Asunción among the worst impacted. Bolivia's Santa Cruz department was impacted by an October dry spell, affecting 51 180 people and 20 344 hectares of crops/farmland (http://reliefweb.int/disaster/dr-2014-000147-bol).

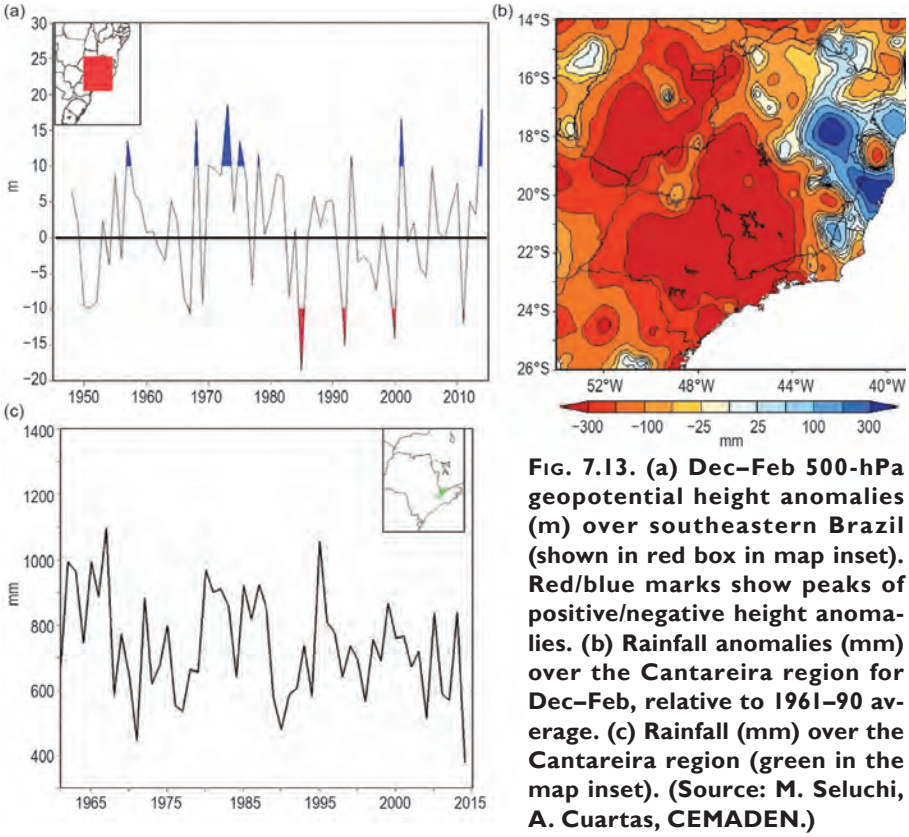

Fig. 7.13. (a) Dec–Feb 500-hPa geopotential height anomalies (m) over southeastern Brazil (shown in red box in map inset). Red/blue marks show peaks of positive/negative height anomalies. (b) Rainfall anomalies (mm) over the Cantareira region for Dec–Feb, relative to 1961–90 average. (c) Rainfall (mm) over the Cantareira region (green in the map inset). (Source: M. Seluchi, A. Cuartas, CEMADEN.)