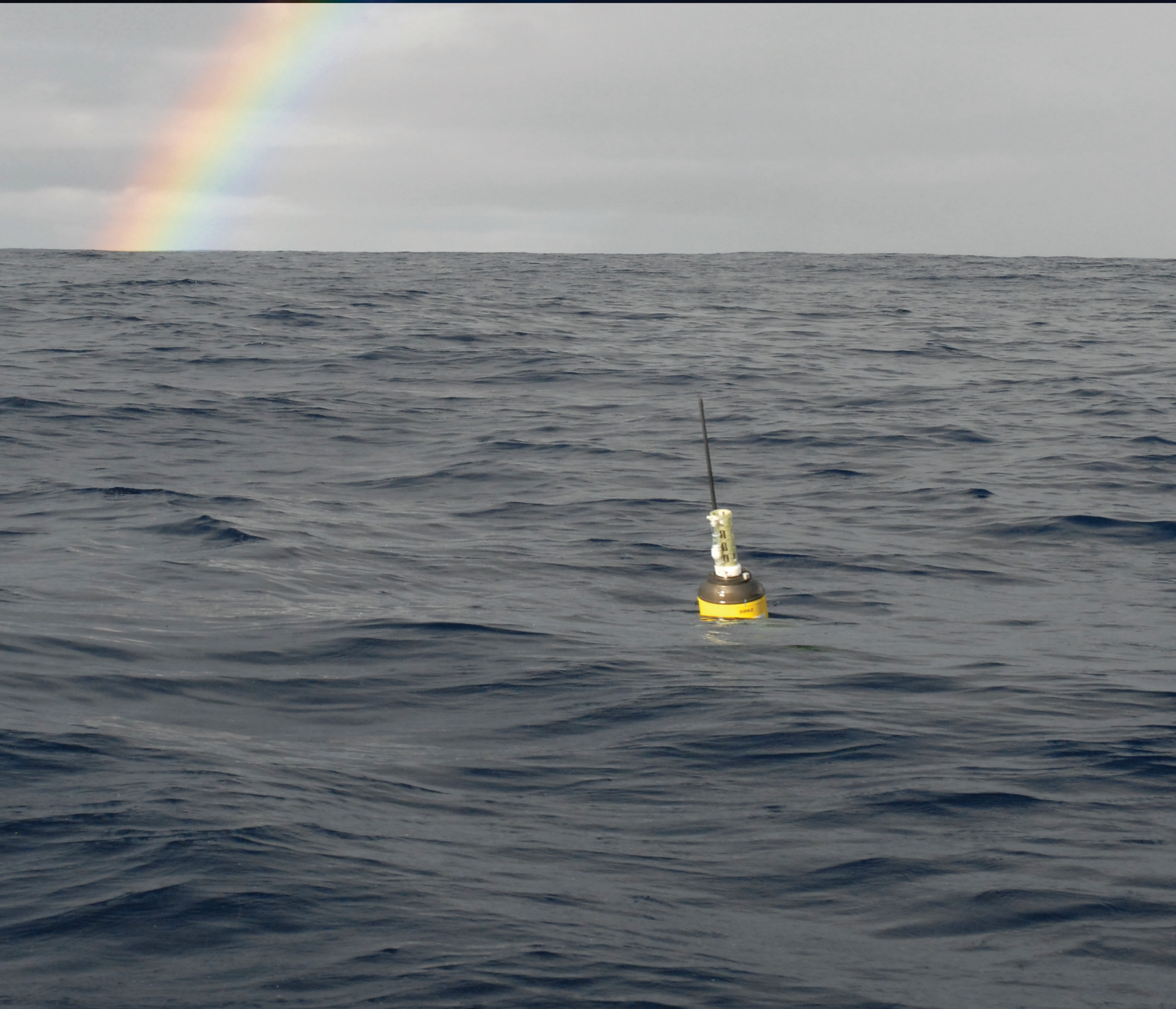
STATE OF THE CLIMATE IN 2014



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STATE OF THE CLIMATE IN 2014

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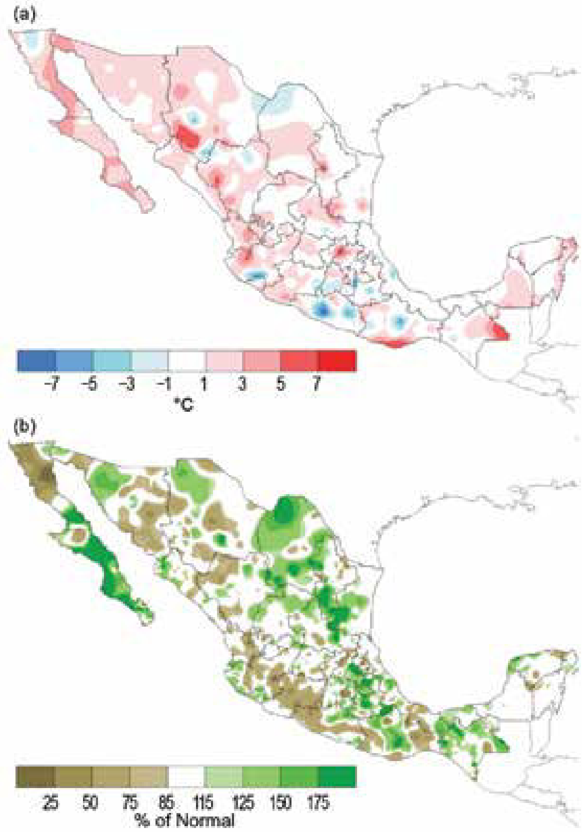

Fig. 7.8. (a) Annual mean temperature (°C) and (b) precipitation anomalies (% of normal) observed in 2014 over Mexico (base period 1971–2000). (Source: Servicio Meteorológico Nacional de Mexico.)

sula: Hurricane Norbert (2–8 September), Hurricane Odile (10–17 September), and Hurricane Polo (16–22 September). Odile was the most destructive due to its strong winds. Odile formed as a tropical storm off the coast of Michoacán on 10 September, where it moved parallel to the Mexican Pacific shoreline, strengthening to a Category 2 hurricane on the Saffir–Simpson scale on 13 September. On 14 September it reached Category 4 status, but then rapidly decreased to Category 3 as it was 45 km to the southeast of Cabo San Lucas, Baja California Sur. On 14 September, NOAA's National Hurricane Center estimated its wind speed to be 116 kt (60 m s^{-1}), with gusts of 140 kt (70 m s^{-1}). According to the Mexican Weather Service, 265 mm of rain fell in San Jose del Cabo on 14–15 September (74% of the annual average precipitation at that location). In December 2014, the Mexican Association of Insurance Institutions (AMIS) reported compensations on the order of 16 billion pesos (approximately 1 billion U.S. dollars) to repair damages caused by Hurricane Odile in Baja California Sur [see section 4f(3) for more details about Eastern North Pacific storms].

c. Central America and the Caribbean— A. Sánchez-Lugo, Ed.

1) Central America—J. A. Amador, H. G. Hidalgo, E. J. Alfaro, A. M. Durán-Quesada, B. Calderón, and C. Vega

For this region, nine stations from five countries were examined (Fig. 7.9). Stations located on the Pacific slope are: Tocumen International Airport and David, Panamá; Liberia, Costa Rica; Choluteca, Honduras; and Puerto San José, Guatemala. Stations on the Caribbean slope are: Philip Goldson International Airport, Belize; Puerto Barrios, Guatemala; Puerto Lempira, Honduras; and Puerto Limón, Costa Rica. Procedures follow Amador et al. (2011) for all variables. Anomalies are with respect to the 1981–2010 average.

(i) Temperature

Mean temperature (T_m) frequency distributions for nine stations are shown in Fig. 7.9. Most stations, with the exception of those in Panamá, experienced near-average annual temperatures. This resulted in a lower frequency of high mean temperatures in contrast to 2013 (Amador et al. 2014). The negative skewness in T_m at Philip Goldson (T_m1) and Puerto Barrios (T_m2) on the Caribbean slope reflects a larger number of cold surges than average during the winter months. On the Pacific slope, most stations recorded a higher frequency of warm T_m values to some degree during 2014.

(ii) Precipitation

The start of the rainy season is identified as two consecutive pentads with at least 25 mm of precipitation followed by a third pentad with measurable precipitation. A similar approach is used to compute the end of the rainy season, but from the end of the year backwards. Compared with the 1981–2010 period, 2014 was normal in terms of the start and end dates of the rainy season for nine stations in Central America, with the exception of Puerto Lempira (P3) which saw an early start to the rainy season (it could be considered in the lower tail of the distribution at the $p = 0.05$ level). The starting and ending pentads of the rainy season for the stations were: San José (34, 61), Puerto Limón (20, 73), Liberia (48, 62), Puerto Lempira (3, 73), David (25, 54), Choluteca (25, 60), Philip Goldson International Airport (40, 62), and Puerto Barrios (1, 69). The year began with drier-than-average conditions across the region (please see Notable Events section) followed by wetter-than-average conditions—resulting in near-normal annual precipitation totals for most stations analyzed (Fig. 7.9). Other variables such as the above-normal maximum 5-day wet-period magnitude, below-normal to-

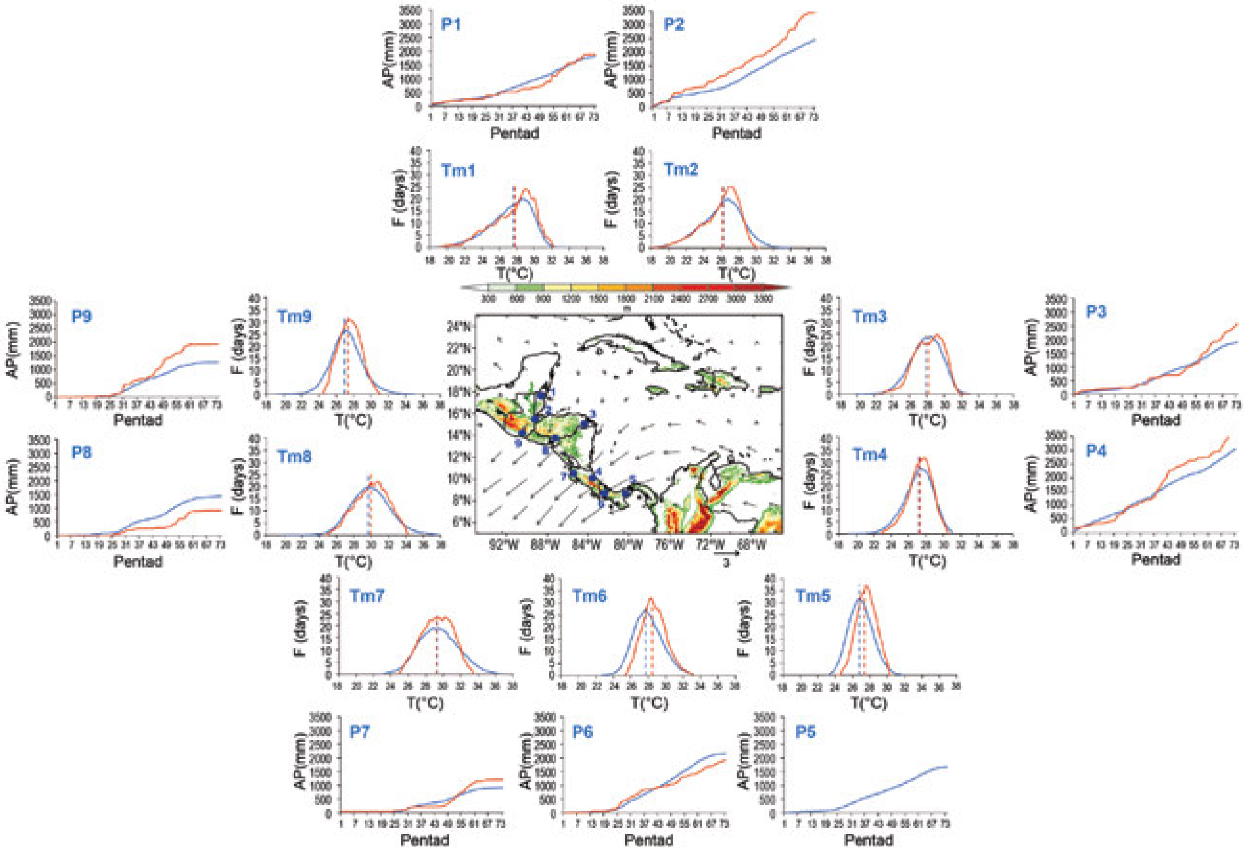

Fig. 7.9. Mean surface temperature (T_m) frequency (F) and accumulated pentad precipitation (P) time series are shown for nine stations (blue dots) in Central America: (1) Philip Goldson International Airport, Belize; (2) Puerto Barrios, Guatemala; (3) Puerto Lempira, Honduras; (4) Puerto Limón, Costa Rica; (5) Tocumen International Airport, Panamá; (6) David, Panamá; (7) Liberia, Costa Rica; (8) Choluteca, Honduras; and (9) Puerto San José, Guatemala. The blue solid line represents the 1981–2010 average values and the red solid line shows 2014 values. Vertical dashed lines depict the mean temperature for 2014 (red) and the 1981–2010 period (blue). Tocumen (station 5) does not display 2014 precipitation due to missing data. Vectors indicate July wind anomalies at 925 hPa (1981–2010 base period). Shading depicts regional elevation (m). (Source: NOAA/NCDC.)

tal number of dry pentads, and below-normal number of dry outliers (below the 25th percentile) all indicate a near-normal year. The interquartile range (IQR), which is an indicator of variability, also depicts a near-average year, except for Limón, Costa Rica (P7), which had a significant positive extreme IQR during 2014. The number of wet outliers (above the 75th percentile) during 2014 was extreme (positive) in San José (P9), Lempira (P3), Limón (P7), and Puerto Barrios (P2) at the p = 0.05 level (Online Figs. S7.1–S7.6).

Quiescent conditions were observed for Central America during the first quarter of 2014. Regionally, most of the relevant moisture uptake activity was concentrated in the Lloró region in Colombia (South America). The decrease of moisture exports from the Pacific became more noticeable during the first peak of the rainy season, leading to drier-than-normal conditions for the easternmost Pacific basin. An increase in the water vapor flux from the Caribbean Sea favored an intensification of the Pacific–Caribbean rainfall seesaw for most of 2014. Linked to the enhancement of the Caribbean low-level jet (CLLJ, Amador 1998), the water vapor flux increased during the summer period for most stations. The warm ENSO-like conditions dominated the moisture flux fields.

(iii) Notable events

Despite not meeting the official criteria for an El Niño event during 2014, positive SST anomalies were recorded over the Niño 3.4 region (see section 4b), especially after late boreal spring. However, stronger-than-average CLLJ 925-hPa winds during July (inserted arrows in Fig. 7.9) were consistent with an El Niño (Amador et al. 2006).

Tropical storm activity during 2014 was near-average for the Caribbean basin (6°–24°N, 92°–60°W). There were four named storms (Bertha, Cristobal, Gonzalo, and Hanna), two of which became hurricanes and one reached major hurricane status [see section 4f(2) for more details].

The drier-than-normal conditions over most of the region are associated with the warm SST observed in the equatorial tropical Pacific Ocean. Precipitation deficits were observed over the isthmus, especially during the first six months with a marked midsummer drought (Magaña et al. 1999) focusing on the northern countries of Central America (see P7 and P8 in Fig. 7.9) and severely impacting the agricultural sector and hydrologic sectors. Conversely, an intense CLLJ during summer (see wind anomalies in Fig. 7.9) associated with El Niño conditions (Amador 2008) and related to cold SST in the tropical North Atlantic, were associated with intense rainfall on the Caribbean slope of Nicaragua, Costa Rica, and Panamá.

Heavy rainfall events during the second half of 2014, possibly associated with weaker trade winds and a decrease in the vertical wind shear over the Caribbean, had severe impacts in several locations. During the first peak of the rainy season (June), convective storms triggered landslides, claiming at least 14 lives in Guatemala and affecting about 5000 people. On 5 July, a tropical wave produced abundant rain and floods in western Nicaragua, near the Caribbean slope, causing three fatalities, affecting more than 1000 residents, and damaging 200 houses. On 18–19 August, 9 people died and 31 houses were damaged due to heavy rains in Chiriquí, Panamá. By the end of August, authorities from San Juan de Limay, Nicaragua, reported that one person died after an active rainfall event. In September, several municipalities of Guatemala (El Progreso, Zacapa, Chiquimula, Jalapa, Jutiapa) claimed that drought had affected 80–90% of the bean and corn harvests. In late September and early October, floods and landslides were responsible for several fatalities across Honduras, El Salvador, and Nicaragua.

2) The Caribbean—T. S. Stephenson, M. A. Taylor, A. R. Trotman, V. Marcellin-Honore', A. O. Porter, M. Hernández, I. T. Gonzalez, D. Boudet, J. M. Spence, N. McLean, J. D. Campbell, A. Shaw, A. P. Aaron-Morrison, K. Kerr, G. Tamar, R. C. Blenman, D. Destin, S. Joyette, B. Jeffers, and K. Stephenson

The Azores high pressure and above-average North Atlantic sea surface temperatures dominated conditions over the Caribbean. This resulted in normal to below-normal annual rainfall and normal to above-normal annual temperatures over most of the region (Fig. 7.10). The base period for comparisons is 1981–2010. Temperature and precipitation rankings provided in the subsections below for each of the following territories are relative to the beginning of their records in parenthesis: Cuba (1951), Dominica (1971), Jamaica (1881), Puerto Rico (1898), St. Croix (1972), St. Thomas (1953), Trinidad (1946), and Tobago (1969).

(i) Temperature

Some islands experienced anomalously high temperatures throughout the year. Cuba and Puerto Rico recorded their sixth and eighth highest annual average temperature on record at 25.2°C and 25.3°C, respectively. San Juan (Puerto Rico) and St. Croix observed their third (27.8°C) and eighth (27.4°C) warmest year, respectively.

With respect to monthly temperatures, Cuba recorded its third warmest February (24.9°C), seventh warmest April (26.1°C), third warmest July (27.5°C), fifth warmest August (28.5°C), and third warmest September (28.2°C). San Juan had its warmest January (26.8°C), third warmest February (26.3°C), third warmest March–May (26.6°C) and third warmest June–August (29.1°C). St. Croix recorded its seventh warmest January (26.1°C) and fourth warmest February (26.4°C). St. Thomas experienced its eighth

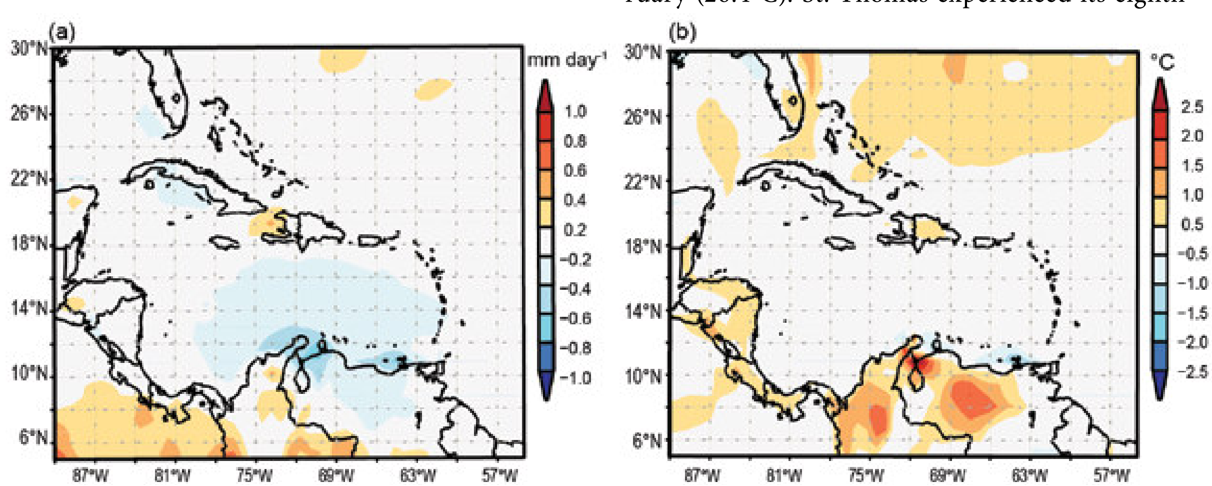

Fig. 7.10. 2014 annual (a) rainfall (mm day^{-1}) and (b) temperature (°C) anomalies across the Caribbean basin. Anomalies are with respect to 1981–2010 mean. (Source: ERA-Interim.)