Fig. S1.1. Equatorial depth-longitude section of ocean temperature anomalies for (a) DJF 1996/97, (b) MAM 1997, (c) JJA 1997 and (d) SON 1997. Contour interval is 1°C. The dark line is the 20°C isotherm. Data are derived from an analysis system that assimilates oceanic observations into an oceanic GCM (Ji et al. 1995). Anomalies are departures from the 1983–92 base period means. [Source: Fig. 25 from Bell and Halpert, 1998; http://www1.ncdc.noaa.gov/pub/data/cmb/bams-sotc/climate-assessment-1997.pdf]. Comparison figure for Fig. 4.6 which shows similar plots for 2015.
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**Fig. S2.1.** ERA-Interim surface air temperature (2 m) annual anomaly for 2015 relative to the 1981–2010 base period.

**Fig. S2.2.** HadCRUT4 surface temperature (~2 m air temperature over land, sea surface temperature over ocean) annual anomaly for 2015 relative to the 1981–2010 base period.
Fig. S2.3. NASA GISS surface temperature (~2 m air temperature over land, sea surface temperature over ocean) annual anomaly for 2015 relative to the 1981–2010 base period.
Fig. S2.4. Latitude–time cross section of lower tropospheric temperature anomalies (°C) relative to 1982–2010 from ERA-Interim.
Fig. S2.5. MERRA monthly mean anomalies of lower stratospheric temperature in 2015 (base period: 1981–2010).
Fig. S2.6. 2015 in situ and satellite-derived lake summer (Jul–Sep in Northern Hemisphere, Jan–Mar in Southern Hemisphere) surface temperature anomalies relative to 1991–2010 for (a) North America, (b) Europe, and (c) Australia and New Zealand.
As a result of the poor spatial coverage for some of the observed indices in GHCNDEX, we also refer to the spatial distribution of the indices from the ERA-Interim reanalysis product (Dee et al. 2011). The shorter temporal coverage of ERA-Interim (1979–2015) means that the climatological period used to calculate percentiles used for some of the indices cannot be consistent with the observed dataset. Therefore the comparisons in the relative increases in the number of warm/cool days (TX90p, TX10p) cannot be made directly. However the general patterns of anomalies, as well as globally and regionally averaged time series, should allow some similar conclusions to be drawn.

Fig. S2.7. Global average time series of the number of (a) warm days (TX90p) and (b) cool days (TX10p) over land. (Source: ERA-Interim Reanalysis). Note that for ERA-Interim the percentile exceedances were calculated relative to the 1981–2010 base period as opposed to the 1961–90 base period used in GHCNDEX. The coverage of ERA-Interim is complete for the entire globe; global land area is analyzed here (see Fig. S2.8). The dashed line shows a 5-year binomial smoothed time series.
Fig. S2.8. ERA-Interim numbers of (a) warm days (TX90p) and (b) cool days (TX10p), anomaly in 2015 from the 1981–2010 average (unit: days).
Fig. S2.9. Seasonal anomalies of the (a)–(d) hottest days (TXx) and (e)–(h) coldest nights (TNn) for 2015 (in °C). (Data: GHCNDEX, anomalies calculated relative to the 1961–90 average.)
Fig. S2.10. ERA-Interim 2015 annual average surface specific humidity anomalies (base period: 1981–2010).

Fig. S2.11. MERRA-2 2015 annual average surface specific humidity anomalies (base period: 1981–2010).
Fig. S2.12. HadISDH annual average surface relative humidity anomalies (base period: 1981–2010).
Fig. S2.13. Total column water vapor anomalies from JRA-55 (relative to 1981–2010) for Sep–Dec (a) 1997 and (b) 2015.
Fig. S2.14. Anomalies of microwave upper tropospheric humidity estimates for 2015 compared to the 2001–10 average.

Fig. S2.15. Annual global cloudiness anomalies (base period: 1981–2010) from the PATMOS-x record calculated using the same method as Plate 2.1m but zonally for each degree latitude.
**Fig. S2.16.** PATMOS-x seasonal average cloudiness anomalies for (a) DJF 2014/15 and (b) MAM, (c) JJA, and (d) SON 2015 (base period: 1981–2010).
Fig. S2.17. 2015 monthly soil moisture anomalies, derived from the ESA CCI soil moisture dataset (base period: 1991–2014). Gray areas are masked.
Fig. S2.18. Comparison of analysis for State of the Climate in 2014 (shading) and updated analysis extended to 2015 (black lines), for the percentage of global land area (excluding ice sheets and deserts) indicating moderate, severe, and extreme drought conditions. Differences arise principally through the inclusion of additional meteorological observations, especially precipitation, in the CRU TS3.24 dataset. Grid cell values in this dataset are relaxed towards their climatological normals (i.e., zero anomalies) the greater their distance from station observations, which can lead to an underestimate of anomalous conditions (both drought and wetter conditions). The relaxation distance is related to each variable's correlation decay length, so it is shorter for precipitation than for temperature. Including additional data in regions that previously had sparse coverage reduces the number of grid cells that were relaxed towards normal conditions. Incomplete data coverage tends, therefore, to give a low bias for the estimated areas experiencing anomalous conditions such as droughts (but also anomalously wet regions). This explains the difference between the results shown here, with the inclusion of additional precipitation data reducing the low bias in the estimated area experiencing drought by an increasing amount from the mid-1990s onwards. The difference is quite notable for 2014, as highlighted in the main text. In addition, the scPDSI algorithm includes both a “backtracking” component (that can end dry or wet spells slightly earlier if an opposite anomaly follows) and a calibration stage: both of these features can slightly affect the results when a longer period (such as an extra year) is used.
Fig. S2.19. scPDSI patterns for (a) 1985 and (b) 1987, with maximum area (~30%) of moderate drought (see Fig. 2.28 of the main text). There are some common features in the drought patterns for these years with extensive drought, such as widespread drought in Africa, the Middle East, Australia, and western U.S. In other regions and especially in the Northern Hemisphere extratropics, patterns of dry and wet conditions are quite different between these dry years.
Fig. S2.20. HadCRUT4 temperature anomalies for Europe during JJA 2015 (base period: 1981–2010).
Fig. S2.21. ENSEMBLES version 12 rainfall anomalies for Europe in (a) Jul and (b) Aug 2015. (base period: 1981–2010).
Fig. S2.22. Surface wind anomalies over ocean from RSS (relative to 1988–2010) for Jul–Dec (a) 1997 and (b) 2015.

REFERENCES
