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10. MONITORING GLOBAL DROUGHT USING THE SELF-CALIBRATING PALMER DROUGHT SEVERITY INDEX

–J. Barichivich, T. J. Osborn, I. Harris, G. van der Schrier, and P. D. Jones

The self-calibrating Palmer Drought Severity Index (scPDSI) over the period 1950–2022 shows that the ongoing increase in global drought since mid-2019 (Barichivich et al. 2020, 2021) reached a new historical peak in October 2022 (Fig. 2.39), surpassing the peak in August 2021 (Barichivich et al. 2022). A historical maximum of 6.2% of the global land area experienced extreme drought conditions ($\text{scPDSI} \leq -4$) in August 2022, slightly greater than the previous maximum in October 1984 (6.1%). The extent of severe plus extreme drought conditions ($\text{scPDSI} \leq -3$) in 2022 exceeded 15% of the global land area between July and November, reaching a historical maximum of 15.8% in August. Similarly, moderate or worse drought conditions ($\text{scPDSI} \leq -2$) peaked in October at a historical maximum of 29% of the global land area.

The global pattern of regional droughts in 2021 largely persisted through 2022 (Plate 2.1q). Drought severity through western

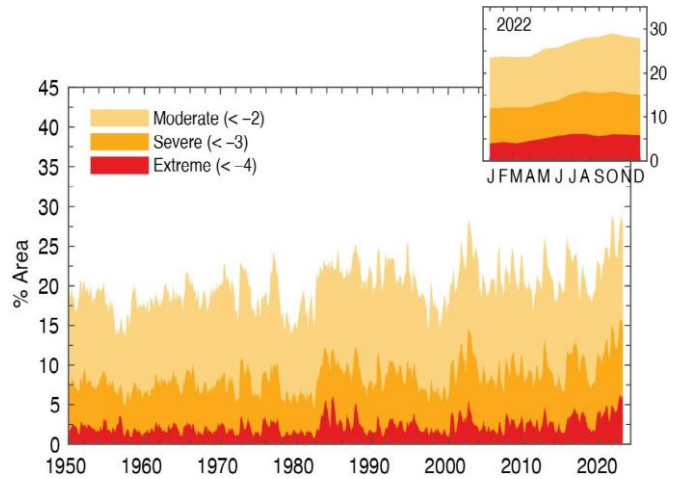


Fig. 2.39. Percentage of global land area (excluding ice sheets and deserts) with the self-calibrating Palmer Drought Severity Index (scPDSI) indicating moderate (<-2), severe (<-3), and extreme (<-4) drought for each month during 1950-2022. Inset: each month of 2022.

North America remained mostly unchanged from 2021 to 2022, but worsened in Europe, parts of South America, and the midlatitudes of Asia (Fig. 2.40). Despite persistent drought conditions in western North America, California experienced a milder fire season than in 2021 (section 2h3) but the west–east moisture contrast observed across the United States since 2017 persisted (Plate 2.1q). In South America, earlier drought hot spots through most of Chile and around the El Gran Chaco region in northern Argentina intensified (Barichivich et al. 2022). The record-breaking megadrought of central Chile reached its 13th consecutive year in 2022, and 80-year record-low river levels in northern Argentina and Paraguay (e.g., Bermejo and Paraná) disrupted fluvial transport.

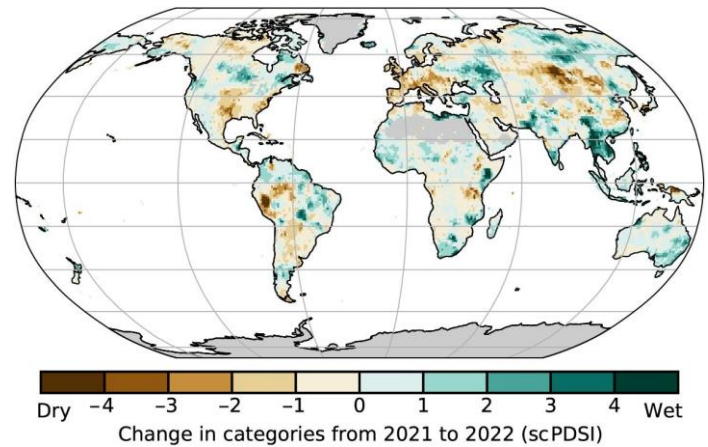


Fig. 2.40. Change in drought (self-calibrating Palmer Drought Severity Index [scPDSI]) from 2021 to 2022 (mean scPDSI for 2022 minus mean scPDSI for 2021). Increases in drought severity are indicated by negative values (brown), decreases by positive values (green). No calculation is made where a drought index is not physically meaningful (gray areas: ice sheets or deserts with approximately zero mean precipitation).

A persistent lack of precipitation in large areas of Europe from winter to summer, together with warmer-than-usual conditions and a sequence of heatwaves (sections 2b4, 7f) triggered a severe-to-extreme drought (Plate 2.1q). At its peak, the drought affected more than two-thirds of Europe, becoming one

of the worst historical droughts in France, Spain, Germany, and Italy. In northern Italy, the Po River and canals in Venice reached record-low levels. The drought did not extend into northern Europe, where wet conditions across Fennoscandia continued through 2022. In northern Africa, previous moderate drought intensified to extreme drought along the Mediterranean coast from Morocco to Tunisia (Plate 2.1q). Most of the Middle East from eastern Turkey to Pakistan also saw an intensification of drought to severe or extreme conditions.

Although changes in moisture anomalies through tropical Africa are uncertain due to the sparse coverage of meteorological station data, this region largely saw a continuation of the wet conditions that began in 2019 (Plate 2.1q). In southern Africa, drought conditions seen since 2018 continued through 2022 but eased slightly compared to 2021 (Fig. 2.40). In Australia, previous drought eased in the east but most of the country continued under moderate drought during 2022 (Plate 2.1q). In contrast, India and Southeast Asia experienced predominantly wet conditions. The Yangtze River basin in central-eastern China saw severe drought as a result of precipitation deficit combined with an extreme heatwave, though most of northern China saw wet conditions (see section 7g and Sidebar 7.2 for details). Previous moderate-to-severe drought in parts of northeastern Siberia and the Russian Far East continued in 2022 (Plate 2.1q).

The update of the scPDSI (Wells et al. 2004; van der Schrier et al. 2013) for this year uses global precipitation and Penman-Monteith Potential Evapotranspiration (ET) from an early update of the Climatic Research Unit gridded Time Series (CRU TS) 4.07 dataset (Harris et al. 2020). It incorporates new estimates of some variables in CRU TS4.07 compared with CRU TS4.06 used last year, affecting potential ET via an improved baseline climatology for cloud cover. These revisions modify the scPDSI drought index values throughout, notably a small reduction in the global areas of moderate and severe drought that is consistent throughout the time series.