Flash Drought Prediction & Monitoring Tools

Name	Type	URL	Contact info	Source
Climate Engine 	Monitoring, Prediction	https://app.climateengine.org/climateEngine	Dan McEvoy (mcevoyd@dri.edu)	Desert Research Institute
	Climate Engine uses Google Earth Engine for on-demand processing of satellite and climate data on a web browser and features on-demand mapping of environmental monitoring datasets, such as remote sensing and gridded meteorological observations. With fully customizable analyses, the Climate Engine App enables the user to produce maps and time series summaries from these datasets. There are many drought indices, satellite data vegetation metrics, and sub-seasonal forecast products available in Climate Engine that are useful for flash drought monitoring and prediction.			
Climate Smart Farming Water Deficit Calculator 	Monitoring	http://climatesmartfarming.org/tools/csf-water-deficit-calculator/	Art DeGaetano (atd2@cornell.edu)	Northeast Regional Climate Center
	The CSF Water Deficit Calculator estimates soil water content within a crop's effective root zone to inform decision makers about current and forecasted water deficits. This information is used by farmers and irrigation system managers to determine the optimum frequency and duration of watering that is necessary to avoid plant stress. The tool uses historical climatological data; forecasted rainfall and evapotranspiration and user-provided site-specific data to estimate current and forecasted water deficits. With this information, water balance calculations are performed for a soil depth of one foot (the assumed effective root zone of your crop). Water deficit is defined as the amount of water necessary to raise the soil water content to field capacity. Daily forecasted data are also used to forecast water deficits over subsequent days for planning purposes. Water deficit probabilities over the next 30 days are calculated from historical data (2002–present).			
CPC Week-2 Hazards 	Prediction, Communication	https://www.cpc.ncep.noaa.gov/products/predictions/threats/threats.php	Brad Pugh (brad.pugh@noaa.gov)	NOAA Climate Prediction Center
	Beginning in May 2022, rapid onset drought (ROD) risk was added to the Climate Prediction Center's week-2 hazards. Forecasters base this forecast on an internal tool that uses initial conditions, such as antecedent dryness, and skillful temperature and precipitation outlooks during the next two weeks to identify areas at an increased risk of rapid onset drought. The inclusion of the ROD risk to CPC's week-2 hazards will improve communication and supplement the Monthly Drought Outlook.			

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Evaporative Demand Drought Index (EDDI)	Monitoring, Communication	https://psl.noaa.gov/eddi/	Mike Hobbins (mike.hobbins@noaa.gov)	CU Boulder/CIRES and NOAA Physical Sciences Laboratory
	EDDI is a drought monitoring and early warning guidance tool. It examines how anomalous the atmospheric evaporative demand (or the "thirst of the atmosphere") is for a given location and across different timescales. EDDI is generated at 1-week through 12-month timescales. As a multi-scalar index, it captures drying dynamics that operate at different timescales. EDDI can offer early warning of agricultural drought, hydrologic drought, and fire-weather risk by providing near-real-time information on the emergence or persistence of anomalous evaporative demand in a region. A particular strength of EDDI is in capturing the precursor signals of water stress at weekly to monthly timescales, which makes EDDI a strong tool for preparedness for both flash droughts and ongoing droughts. Currently, EDDI is generated daily—though with a 5-day lag-time—by analyzing a near-real-time atmospheric dataset.			
Evaporative Stress Index	Monitoring	https://www.drought.gov/data-maps-tools/evaporative-stress-index-esi	Christopher Hain (christopher.hain@nasa.gov)	NASA Marshall Space Flight Center / SPoRT
	The Evaporative Stress Index (ESI) describes temporal anomalies in evapotranspiration (ET), highlighting areas with anomalously high or low rates of water use across the land surface. Here, ET is retrieved via energy balance using remotely sensed land-surface temperature (LST) time-change signals. LST is a fast-response variable, providing proxy information regarding rapidly evolving surface soil moisture and crop stress conditions at relatively high spatial resolution. The ESI also demonstrates capability for capturing early signals of "flash drought," brought on by extended periods of hot, dry, and windy conditions leading to rapid soil moisture depletion.			
Flash Drought Blends	Monitoring	https://ndmcblends.unl.edu/Home.aspx	Curtis Riganti (criganti2@unl.edu)	National Drought Mitigation Center
	The flash drought blends are one of three gridded drought blends tools being developed at NDMC, alongside short- and long-term blends. The tool is a weighted combination of several short-term drought indicators that are tuned towards detecting flash drought conditions. This tool is still under development; please see https://ndmcblends.unl.edu/Metadata.aspx for further information.			

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FLASH: FLash drought Assessment using SMAP Hydrology	Monitoring	http://vadosezone.tamu.edu/flash/	Vinit Sehgal (vinit@tamu.edu)	Texas A&M University
	FLASH (FLash drought Assessment using SMAP Hydrology) is an open-source tool for near-real-time global flash drought monitoring using NASA's SMAP soil moisture, operating at low latency (2 days) and 1-day temporal resolution. Two complementary indices are defined based on SMAP soil moisture for measuring the severity and the rate of intensification of drought, namely, Soil Moisture Stress (SMS) and Relative Rate of Drydown (RRD), respectively. SMS and RRD are non-linearly combined to provide FDSI (Flash Drought Stress Index) ─ a composite indicator used for global flash drought monitoring. FLASH relies on the footprint-scale (36-km) thresholds of soil hydrologic regimes (energy-limited wet phase, moisture limited transitional, and dry phase) and land-atmospheric coupling strength to estimate flash drought severity. Several advantages of FDSI include non-reliance on long-term soil moisture records, sensitivity to changing land-surface heterogeneity, land-atmospheric interactions, and evolving meteorological anomalies. FDSI is extensively validated globally across multiple timescales (daily, weekly, and monthly) using a suite of vegetation and meteorological drought indices. Since its operationalization in 2021, FLASH has captured major drought events across the globe and provides freely available public data access to various stakeholders for effective drought mitigation.			
QuickDRI	Monitoring	quickdri.unl.edu	Curtis Riganti (criganti2@unl.edu)	National Drought Mitigation Center
	QuickDRI is a geospatial tool that characterizes the intensification of short-term drought condition patterns on a weekly basis across the continental United States (CONUS) at a 1-km gridded spatial resolution. The primary goal of QuickDRI is to serve as an "alarm" indicator of rapidly emerging events such as "flash drought" that manifest rapidly on the order of a few days to weeks, are often difficult to detect using traditional drought indicators, and can having devastating negative impacts on agriculture and natural resources.			
Rapid Drought Intensification Risk Tool	Prediction	https://mrcc.purdue.edu/MWDEWS/flashdroughttool.html	Jonathan Weaver (weaverjc@purdue.edu)	Midwestern Regional Climate Center
	Flash droughts can be devastating to communities and ecosystems. The Rapid Drought Intensification Risk Tool, developed by the Midwestern Regional Climate Center, represents a significant advance in predicting these events. By utilizing advanced artificial intelligence techniques to analyze millions of atmospheric data points, the tool can forecast the likelihood of rapid drought intensification over the next two weeks. Its intuitive and interactive interface allows users to assess the risk of such intensification for any location in the central and eastern United States from April 1–October 31. The tool provides decision-support information without requiring personal knowledge of weather conditions or whether such conditions would lead to rapid drought intensification, making it accessible to a wide range of users. By utilizing this tool, individuals and organizations can make informed decisions, prepare for potential flash droughts, and minimize the harm caused by these disruptive events.			
Standardized Evaporative Stress Ratio (SESR)	Monitoring	N/A (still in development)	Jordan Christian (jchristian@ou.edu)	University of Oklahoma
	The Standardized Evaporative Stress Ratio (SESR) is a metric used to capture flash drought development by quantifying the overall evaporative stress on the environment. SESR is the ratio of evapotranspiration (used as a general indicator of the available moisture at the land surface) and potential evapotranspiration (the demand for land-surface moisture given the atmospheric conditions). Near real-time monitoring of flash drought is provided by computing SESR from NLDAS-2 at pentad (5-day) resolution. Areas are identified with flash drought development after a minimum set of criteria are satisfied: 1) change in SESR between pentads at the 25th percentile or lower for at least four consecutive weeks (i.e., a rapid and persistent decline in SESR values) and 2) a SESR value at the 20th percentile or lower (i.e., drought conditions are reached).			

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U.S. Drought Portal (Drought.gov)	Monitoring, Prediction, Planning, Communication	https://www.drought.gov	Kelsey Satalino & Steve Ansari (kelsey.satalino@noaa.gov; steve.ansari@noaa.gov)	NOAA/NIDIS, NOAA/NCEI
	The U.S. Drought Portal (drought.gov) is an interagency federal website that provides a one-stop shop for drought data, maps, and resources from across the federal government, academia, and the private sector—including tools for flash drought monitoring, prediction, and communication. On Drought.gov, users can explore up-to-date interactive maps showing current, future, and historical conditions from the national to the city/county level. This includes measures of evaporative demand (EDDI), soil moisture, temperature, precipitation, and vegetative stress. These maps are customizable, allowing users to zoom in on a region of interest, adjust the map appearance, display state/tribal/county boundary lines, and download high-quality images to use in communications, research, or reports. The website also contains educational resources on flash drought, summaries of relevant research, and targeted resources developed from the previous National Flash Drought Workshop. Finally, users can browse the Drought.gov Data Catalog to search for an even wider range of tools and resources, filtering by indicator type, file format, period of record, and more.			
U.S. Drought Portal - Soil Moisture Product Dashboard	Monitoring	https://www.drought.gov/testing/soil-moisture-indicators	Marina Skumanich (marina.skumanich@noaa.gov)	NOAA/NIDIS
	The Soil Moisture Product Dashboard provides easy, side-by-side access to several root-zone soil moisture mapping products, including NASA's SPoRT-LIS, GRACE, NationalSoilMoisture.com, and NLDAS NOAH. These maps are customizable, allowing users to zoom in on a region of interest, adjust the map appearance, display state/tribal/county boundary lines, and download high-quality images to use in communications, research, or reports. The aim is to facilitate the review and intercomparison of different soil moisture estimates to support convergence of evidence assessment of drought conditions.			
Water Deficit Trends	Monitoring	https://hprcc.unl.edu/wdt/#	Gannon Rush (grush2@unl.edu)	High Plains Regional Climate Center
	The Water Deficit Trends tool allows for quick overviews of how SPI/SPEI has trended between weeks on a nationwide map, and overlays of the latest Drought Monitor, USGS stream gages, and other data layers. Clicking any station on the map opens the Trend Analysis Panel, which shows a week-by-week overview of precipitation and drought indices at the station. A short, printable report is also available, which includes information about the closest 5 USGS stream gages over the weeks analyzed.			