CFS gridMET

Variables (italicized denotes derived variable):

Maximum temperature
Minimum temperature
Specific humidity
Downward shortwave radiation flux at the surface
Total precipitation
Mean wind speed
Reference evapotranspiration
Vapor pressure deficit
100-hour dead fuel moisture
1000-hour dead fuel moisture
Energy Release Component
Burning Index
*EDDI**

Resolution:

1/24th degree (~4-km)
Daily

Time period:

Next 28-days
48-member forecast

Description

This product uses 6-hourly forecasts from the Climate Forecast System (CFSv2) that include 4 ensemble members 4 times daily (0Z, 6Z, 12Z, 18Z). These forecasts are global, span the next 6-months, and are at a horizontal resolution of 0.5 degrees. For each forecast, we tabulate daily summaries (e.g., maximum temperature, total precipitation, average wind speed) over the local calendar day (12Z-6Z). For example, daily maximum temperature is computed as the maximum of the four 6-hour periods in the forecast day. These forecasts are used to compute anomalies for the calendar date using the 1982-2010 CFSv2 calibration climatologies.

To procure forecasts compatible with gridMET, we bilinearly interpolate daily CFSv2 anomalies to the gridMET domain and superpose these to gridMET climatologies. Anomalies are additive for temperature and radiation, and multiplicative for precipitation, specific humidity, and wind speeds. To avoid any highly unrealistic precipitation forecasts, we clamp precipitation anomalies at 30 (e.g., a location can not have more than 30-times the daily average amount). This

procedure preserves the spatial structure of anomalies from CFSv2 forecasts but makes the outputs compatible with gridMET products.

In addition to producing 16 forecasts per day that are provided as netcdf outputs, we produce additional summarized forecasts for the next 28 days. First, forecasts from the previous 2 days are used to produce a 48-ensemble member forecast. These have a format of XXYZ. Secondly, we produce a 48-ensemble member median forecast that has the median forecasts. These have a format of FYZGSA.

Derived products

Reference evapotranspiration forecasts are calculated using the ASCE Penman-Monteith method for each ensemble member. These forecasts are provided as both ensemble forecasts and the 48-member median. Using these forecasts we additionally calculate EDDI for weekly (week 1, 1-7 day; week 2, 8-14 days; week 3, 15-21 days; week 4, 22-28 days), as well as 2-week (1-14 days), 3-week (1-21 days), and 4-week (1-28 days) time scales. EDDI is calculated using non-parametric probability-based methods where plotting positions are transformed to indices assuming an inverse-normal distribution. All data are standardized over a common time period of 1979-2018.

Forecasts of daily vapor pressure deficit (VPD) are calculated using standard approaches from daily forecasts of maximum temperature, minimum temperature, and specific humidity.

Forecast for fire danger indices from the National Fire Danger Rating System (NFDRS) are calculated by using initial states of fuel moistures updated daily by running observations and calculating independent trajectories of NFDRS for each forecast member. We are currently using a semi-updated version of NFDRS that includes some, but not all of the recent updates to NFDRS 2016. We additionally only run calculations for ERC/BI for fuel model G which is widely used across much of the western US.

Filename structure

The CFS-gridmet data is currently publicly available here.
There are three kinds of files currently available:

- i.e. cfsv2_metdata_forecast_vs_daily_18_4_2.nc: these files denote an ensemble member of the CFS forecast each for the next 30 days specified from the date in the metadata. Specifically this file name is structured *_daily_{hour}_{ensemble}_{day} where
    - hour = 00,06,12,18 represents the hour of the day of the forecast
    - day = 0,1,2 represents either the current day (0) or yesterday (1) or 2 days ago (2)
    - ensemble= 0,1,2,3 representing the ensemble run

- I.e. cfsv2_metdata_forecast_vpd_daily.nc: these files denote the ensemble median CFS forecast over all 48 ensemble members
- I.e. cfsv2_metdata_forecast_48ENS_fm100_daily_4d.nc: these files have all 48 ensemble members inside them as a 4-d array and are the forecasts for the next 28 days from the initial date specified in the metadata (oops this date needs to be added!)

References

Saha, Suranjana, and Coauthors, 2010: The NCEP Climate Forecast System Reanalysis. Bull. Amer. Meteor. Soc., 91, 1015.1057. doi: 10.1175/2010BAMS3001.1

Abatzoglou J. T., 2011: Development of gridded surface meteorological data for ecological applications and modelling. International Journal of Climatology. doi: 10.1002/joc.3413

Hobbins, M., A. Wood, D.J. McEvoy, J. Huntington, and C. Morton, James Verdin, Martha Anderson, and Christopher Hain, 2016: The Evaporative Demand Drought Index: Part I – Linking Drought Evolution to Variations in Evaporative Demand. Journal of Hydrometeorology. 17, 1745-1761, doi: 10.1175/JHM-D-15-0121.1

Cohen, Jack D.; Deeming, John E. 1985. The national fire-danger rating system: basic equations. Gen. Tech. Rep. PSW-GTR-82. Berkeley, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Forest and Range Experiment Station. 16 p. https://www.fs.fed.us/psw/publications/documents/psw_gtr082/psw_gtr082.pdf