Layer Type: GRID (either ESRI or ASCII format)

Status: Complete

Geog. Extent: Islands of Hawai‘i, Kaho‘olawe, Kaua‘i, Lāna‘i, Maui, Moloka‘i and O‘ahu

Projection: Geographic Coordinate System

Datum: World Geodetic System 1984 (WGS84)

Resolution: ~250 m resolution (0.00225 x 0.00225 cell size)

Description: Monthly: Each zipped file contains 13 grids: 1 annual and 12 monthly raster grids of the mean. Units will vary depending on the variable.
Monthly-Hourly: Each zipped file contains 288 grids: 24 hours for each month. Units will vary depending on the variable. Shortwave radiation variables only have data for daylight hours (06-20) – 180 grids.
Annual-Hourly: Each zipped file contains 24 grids: the mean of each hour. Units will vary depending on the variable. Shortwave radiation variables only have data for daylight hours (06-20) – 15 grids.

Source: 2014 Climate of Hawai‘i, http://climate.geography.hawaii.edu/

Variables:

Air Temperature: Temperature of the near-surface air. Air temperature is expressed as degrees C (Celsius) or degrees F (Fahrenheit).

Surface Temperature: Temperature of the exposed surface (canopy and/or soil), expressed as degrees C (Celsius) or degrees F (Fahrenheit).

Relative Humidity: The amount of water vapor in the air divided by the maximum possible water vapor content (saturation humidity), expressed as a ratio (0 to 1) or a percent (0 to 100%).

Vapor Pressure Deficit: The amount of water vapor in the air (in terms of vapor pressure) minus the maximum possible water vapor content (saturation vapor pressure), expressed in pressure units (Pascals or millibars).

Wind Speed: The velocity of the wind at a reference height of 2 meter (6 .56 ft) above the vegetation. Wind speed is expressed in meters per second or miles per hour). This variable was derived from maps developed by AWS Truewind (2004).

Cloud Frequency: The proportion of time that clouds are present over a given location. Cloud frequency is expressed as a ratio (0 to 1) or a percent (0 to 100%).

Albedo: The proportion of incident solar radiation reflected by the surface. Albedo is expressed as a ratio (0 to 1) or a percent (0 to 100%).

Available Soil Moisture: Soil moisture available for evapotranspiration divided by the available soil moisture capacity, expressed as a ratio (0 to 1).

Canopy Wetness Fraction: Fraction of time that vegetation is wet from rain, fog or dew.

Vegetation Cover Fraction: Fraction of ground area covered by vegetation.

Leaf Area Index: Leaf area (one-sided) divided by ground area.

Land Cover: Type of land cover. Categories are based on dominant vegetation species, climate, topography, and degree of urban development. This map was derived from a higher resolution map available at LANDFIRE.gov.

Air Layer Heat Storage: Increase or decrease in sensible and latent heat stored in the air layer, expressed in Watts per square meter.

Biomass Heat Storage: Sensible heat conducting into or out of the biomass, expressed in Watts per square meter.

Soil Heat Flux: Sensible heat conducting into or out of the soil, expressed in Watts per square meter.

Vegetation Height: Vegetation height in meters.

Normalized Difference Vegetation Index (NDVI): A gridded vegetation index made available by MODIS (NASA). See http://modis.gsfc.nasa.gov/data/dataprod/

Enhanced Vegetation Index (EVI): A gridded vegetation index made available by MODIS (NASA). See http://modis.gsfc.nasa.gov/data/dataprod/

Canopy Conductance: A parameter that describes the control exerted on gas exchanges by the stomata of plant leaves. This parameter incorporates the stomatal conductance, based on species-specific maximum stomatal conductance modulated by light level, temperature, humidity, and available soil moisture. Canopy conductance is expressed in meters per second.

Roughness Length: A parameter that describes the influence of surface (vegetation) roughness on the flow of air and the generation of turbulent eddies, expressed in meters.

Terrain Shading: For each pixel, this variable indicates whether it is shaded or not shaded by surrounding terrain for the given month and time of day.

Clear Sky Radiation with Terrain Shading: Clear sky radiation (see above) with the effects of terrain shading included. If the pixel is shaded, direct radiation is set to zero. Diffuse radiation is assumed to be unchanged. Clear sky radiation with terrain shading is expressed in Watts per square meter.

Air Density: The density of air, estimated as a function of air pressure, temperature, and humidity. Air density is expressed in kilograms per cubic meter.

Available Energy: Available energy is equal to net radiation (see above) minus energy stored in the biomass, air layer, and soil. Available energy is expressed in Watts per square meter.

Solar Radiation: Incident solar radiation on a horizontal surface. Solar radiation is expressed in Watts per square meter or kilowatt-hours per square meter per day.

Clear Sky Radiation: Incident solar radiation on a horizontal surface calculated for a condition of no clouds. This variable is estimated based on the sun angle as a function of time of day, time of year, latitude and longitude, and on the optical properties of a cloud-free atmosphere in Hawai'i. Clear sky radiation is expressed in Watts per square meter or kilowatt-hours per square meter per day.

Diffuse Radiation: Solar radiation that reaches the surface after reflection by atmospheric gases, aerosols, clouds, or surrounding terrain. Radiation is expressed in Watts per square meter.

Downward Longwave Radiation: Longwave radiation from atmosphere and clouds reaching the surface. Longwave radiation is expressed in Watts per square meter.

Upward Longwave Radiation: Longwave radiation that is emitted by the surface. Longwave radiation is expressed in Watts per square meter.

Net Radiation: The incoming shortwave (solar) and longwave (infrared) radiation minus the outgoing reflected shortwave and emitted longwave radiation. Net radiation is the main source of energy for evapotranspiration. Net radiation is expressed in Watts per square meter or kilowatt-hours per square meter per day.

Evapotranspiration: The rate of transfer of water from the surface to the atmosphere through evaporation of water from wet leaves, branches, and stems of plants, transpiration (see below), and evaporation from soil. Evapotranspiration (ET) is expressed as a depth of water (mm or inches).

Latent Heat Flux: Evapotranspiration expressed in energy units. When water changes phase, latent heat is either absorbed or released. In the case, of evapotranspiration, latent heat is absorbed. ET can be expressed either in water depth units or energy units (Watts per square meter), and it is a simply matter to convert from depth to energy units or vice versa.

Transpiration: Evaporation of water from inside leaf pores known as stomata. Plant roots extract water from the soil. The pressure gradient inside the plant moves water from the roots, through the stem and branches, to the leaves. There, plants control the rate of transpiration by opening and closing their stomata. This stomatal regulation also affects the uptake of carbon dioxide from the air, thus affecting photosynthesis. Transpiration is expressed as a depth of water (mm or inches).

Wet-Canopy Evaporation: Direct evaporation of water from wet leaves, branches, and stems of plants. During and after rain and fog events, or following dew deposition, water can evaporate directly from the outsides of leaves, steams, and branches. Wet-canopy evaporation is expressed as a depth of water (mm or inches).

Soil Evaporation: Evaporation of water from soil. Soil evaporation is expressed as a depth of water (mm or inches).

Grass Reference Surface Potential ET: The rate of evapotranspiration that would occur under the given atmospheric conditions if soil moisture were not limiting and if the surface were completely covered with short grass. This variable was calculated using the Penman-Monteith approach (see below), but with the surface characteristics held constant for a reference surface of grass. Grass Reference Surface Potential ET is expressed as a depth of water (mm or inches).

Penman-Monteith Potential ET: The rate of evapotranspiration that would occur under the given atmospheric conditions if soil moisture were not limiting, calculated using the Penman-Monteith approach. The actual vegetation characteristics are used. The Penman-Monteith method incorporates net radiation (see below), air temperature, humidity, wind speed, and vegetation characteristics. Penman-Monteith Potential ET is expressed as a depth of water (mm or inches).

Priestley-Taylor Potential ET: The rate of evapotranspiration that would occur under the given atmospheric conditions if soil moisture were not limiting, calculated using the Priestley-Taylor Potential ET approach. The Priestley-Taylor Priestley-Taylor method incorporates net radiation (see below) and air temperature. Potential ET is expressed as a depth of water (mm or inches).

For complete methodology, please see the final report on the Downloads page, or a condensed description at http://climate.geography.hawaii.edu/methods.html

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