**Table S1.** Goal, usage, arguments, outputs and examples of the five functions of the ‘PowerSDI’ package.

|  |
| --- |
| **Function PlotData.R** |
| **Goal**:  To generate plots of rainfall and accumulated potential evapotranspiration provided by the NASA-POWER.  **Usage**:  PlotData(lon, lat, start.date, end.date)  **Arguments**:  lon: longitude in decimal degrees: (+) Eastern Hemisphere (-) Western Hemisphere.  lat: latitude in decimal degrees: (+) Northern Hemisphere (-) Southern Hemisphere.  start.date: date at which the indices estimates should start ("YYYY-MM-DD").  end.date: date at which the indices estimates should end ("YYYY-MM-DD").  **Outputs**:  Plots of Rainfall and potential evapotranspiration accumulated at the 1-quart.month time scale.  **Example**:  PlotData(lon = -47.3, lat = -22.87, start.date = "2021-12-28", end.date = "2022-12-31") |
| **Function ScientSDI.R** |
| **Goal**:  To help the users to verify if the SPI and SPEI calculated from NASA-POWER data meet the conceptual assumptions expected from standardized drought indices (described in sections 2 and 3).  **Usage**:  ScientSDI(lon, lat, start.date, end.date, distr = "GEV", TS = 4, Good = "Yes", sig.level = 0.95, RainUplim = NULL, RainLowlim = NULL, PEUplim = NULL, PELowlim = NULL)  **Arguments**:  lon: longitude in decimal degrees: (+) Eastern Hemisphere (-) Western Hemisphere.  lat: latitude in decimal degrees: (+) Northern Hemisphere (-) Southern Hemisphere. start.date: date at which the indices estimates should start. Format: YYYY-MM-DD". end.date: date at which the indices estimates should end. Format: YYYY-MM-DD". distr: A character variable ("GEV" or "GLO") defining the distribution to calculate the SPEI. Default is "GEV".  TS: Time scale on the quart.month basis (integer values between 1 and 96). Default is 4. Good: A character variable ("Yes" or "No") to calculate or not the goodness-of-fit and normality tests. Default is "Yes".  sig.level: A numeric variable (between 0.90 and 0.95) defining the significance level for parameter Good. Default is "0.95".  RainUplim: Optional. Upper limit in millimeters from which rainfall values larger than it will be removed. Default is NULL.  RainLowlim: Optional. Lower limit in millimeters from which rainfall values smaller than it will be removed. Default is NULL.  PEUplim: Optional. Upper limit in millimeters from which evapotranspiration values larger than it will be removed. Default is NULL.  PELowlim: Optional. Lower limit in millimeters from which evapotranspiration values smaller than it will be removed. Default is NULL.  **Outputs**:  A list with data calculated at the time scale selected by the user. If Good="Yes", this list includes:  SDI: The NASA-SPI, NASA-SPEI.HS and NASA-SPEI.PM.  DistPar: The parameters of the distributions (gamma and GEV) used to calculate the indices.  GoodFit: The Lilliefors and Anderson-Darling tests goodness-of-fit tests.  Normality: The outcomes of the two normality checking procedures (Wu et al., 2007 and Stagge et., 2015). If Good="No", this list includes SDI and DistPar.  This function also presents other data (in millimiters) calculated from the NASA POWER project: Rainfall amounts (Rain). Potential evapotranspitations values estimated through the Hargreaves and Samani method (PEHS). Potential evapotranspitations values estimated through the FAO-56 Penman-Monteith method (PEPM). The difference between rainfall and potential evapotranspiration.  **Example**:  ScientSDI(lon = -47.3, lat = -22.67, start.date = "1991-01-01", end.date = "2022-12-31") |
| **Function Reference.R** |
| **Goal**:  To calculate both SPI and SPEI from daily data obtained from a ground weather station or any other reference source.  **Usage**:  Reference(ref, distr = "GEV", PEMethod = "HS", TS = 4)  **Arguments**:  ref: A data frame with the variables required for calculating the SDIs. See file “PowerSDI\_1.0.0.pdf” at <https://github.com/gabrielblain/PowerSDI> for further information.  distr: A character variable ("GEV" or "GLO") defining which distribution is used to calculate the SPEI. Default is "GEV".  PEMethod: A character variable ("HS" or "PM") defining the potential evapotranspiration method. Default is "HS".  TS: Time scale on the quart.month" basis (integer values between 1 and 96). Default is 4.  **Outputs**:  A data frame with: Rain, potential evapotranspiration, difference between rainfall and potential evapotranspiration, SPI and SPEI calculated at the time scale selected by the user.  **Example**:  data("refHS"); Reference(ref = refHS, distr = "GEV, PEMethod = "HS", TS = 4) |
| **Function Accuracy.R** |
| **Goal**:  To verify how well NASA-POWER data actually represent real-world/observed data.  **Usage**:  Accuracy(obs\_est, conf.int = "Yes", sig.level = 0.95)  **Arguments**:  obs\_est: A 2-column matrix. The reference or observed and the estimated or predicted data. See file “PowerSDI\_1.0.0.pdf” at <https://github.com/gabrielblain/PowerSDI> for further information.  conf.int: A character variable ("Yes" or "No") defining if the function must calculate confidence intervals. Default is "Yes".  sig.level: A numeric variable (between 0.90 and 0.95) defining the significance level for parameter the confidence intervals. Default is 0.95.  **Outputs**:  Absolute mean error (AME), Square root of the mean squared error (RMSE), Willmott's indices of agreement: original (dorig), Modified (dmod) and refined (dref), Pearson determination coefficient (R2). If conf.int="Yes", confidence intervals are calculated.  **Example**:  data("ObsEst"); Accuracy(obs\_est = ObsEst, conf.int = "Yes", sig.level = 0.95). |
| **print.PowerSDI.Accuracy** |
| **Goal:**  Custom print() method for PowerSDI.Accuracy objects.  **Usage:**  ## S3 method for class 'PowerSDI.Accuracy'  print(x, digits = max(3L, getOption("digits") - 3L), ...)  **Arguments:**  x: a PowerSDI.Accuracy object  **digits:** The number of digits to be used after the decimal when displaying accuracy values.  **…:** ignored |
| **plot.PowerSDI.Accuracy** |
| **Goal:**  Custom plot() method for PowerSDI.Accuracy objects.  **Usage:**  ## S3 method for class 'PowerSDI.Accuracy'  plot(x, ...)  **Arguments:**  x: a PowerSDI.Accuracy object  **...:** Other parameters as passed to plot()  **Outputs:**  Nothing. Side-effect: plots graphs. |
| **Function OperatSDI.R** |
| **Goal**:  To generate routine operational NASA-SPI and NASA-SPEI estimates.  **Usage:**  OperatSDI(lon, lat, start.date, end.date, PEMethod = "HS", distr = "GEV", parms, TS = 4)  **Arguments**:  lon: longitude in decimal degrees.  lat: latitude in decimal degrees.  start.date: Date at each the calculation must start (“YYYY-MM-DD").  end.date: Date at each the calculation must end (“YYYY-MM-DD").  PEMethod: A character variable ("HS" or "PM") defining the potential evapotranspiration method. Default is "HS".  distr: A character variable ("GEV" or "GLO") defining which distribution is used to calculate the SPEI. Default is "GEV".  parms: Parameters required for calculating the SPI and SPEI. It is provided by the ScientSDI function (DistPar).  TS: Time scale on the "quart.month" basis (integer values between 1 and 96).  **Outputs:**  A data frame with Rainfall, potential evapotranspiration (PE), difference between rainfall and PE (in millimiters), the NASA-SPI and NASA-SPEI, and the SDI categories corresponding to each indices estimates.  **Example:**  data("DistPar"); OperatSDI(lon = -47.3, lat = -22.67, start.date = "2023-01-31", end.date = "2023-07-07", parms = DistPar). |