Documentation: Script for calculating Sunrise/Sunset

Overview

This Python script calculates the sunrise and sunset times for a specific location (latitude and longitude) on a specific date. It uses astronomical formulas to determine the sun positions and returns the results in UTC time.

Features

- Converts decimal times into the format HH:MM.
- Determines the order of a day in the year for a specific date.
- Calculates the times for sunrise and sunset for given GPS-Coordinates and a specific date.

Key Functions

`convert_decimaltime(decimal_time)`

Converts decimal time into HH:MM format.

- **Arguments:**
  - decimal_time (float): Time in decimal format.
- **Returns:**
  - time (str): Time in HH:MM format.

`day_of_year(year, month, day)`

Computes the day of the year for a given date (e.g. 1 = January 1).

- **Arguments:**
  - year (int): Year.
  - month (int): Month.
  - day (int): Day.
- **Returns:**
  - day_number (int): The day number of the year.

`calculate_hour_angle(is_rise_time, cosH)`

Computes the hour angle based on whether it is sunrise or sunset.

- **Arguments:**
  - is_rise_time (bool): True for sunrise, and False for sunset.

- cosH (float): Cosine of the hour angle.

- **Returns:**
  - hour_angle (float): Hour angle in hours.

`calculate_sun_time(latitude, longitude, date, zenith, is_rise_time)`

Determines the UTC time for sunrise or sunset.

- **Arguments:**
  - latitude (float): Geographic latitude.
  - longitude (float): Geographic longitude.
  - date (int, int, int): Date in format (Year, Month, Day).
  - zenith (float): Solar zenith angle.
  - is_rise_time (bool): True for sunrise, False for sunset.
- **Returns:**
  - sun_time (float): UTC time for the solar event.

`calculate_sunrise_sunset(latitude, longitude, date)`

Computes both sunrise and sunset times in UTC.

- **Arguments**:
  - latitude (float): Geographic latitude.
  - longitude (float): Geographic longitude.
  - date (int, int, int): Date in format (Year, Month, Day).
- **Returns**:
  - sunrise_utc, sunset_utc (float, float): Both sunrise and sunset in UTC time.

Usage Example

from file_name import calculate_sunrise_sunset

sunrise, sunset = calculate_sunrise_sunset(latitude, longitude, date)

Accuracy

The calculated sunrise and sunset times each have an error of approximately ±1 minute. This discrepancy can be due to:

- **Algorithm approximations:** The calculation assumes a spherical Earth and does not include minor variations in Earth's orbit.
- **Rounding errors:** The conversion from decimal hours to HH:MM format introduces minor differences.

Despite these minor variations, the script provides a reliable estimation of sunrise and sunset times in UTC.