**WaPOR Reference Evapotranspiration Validation Exercise**

In this exercise, you will validate WaPOR RET data using your own data from a climatic station. You will practice converting reference data (i.e., hourly or daily net radiation, temperature, relative humidity and windspeed) to reference ET using FAO56 method and compare this to WaPOR RET layer.

**Preparing the data:**

### Calculate daily net radiation, temperature, relative humidity and windspeed

*This step can be skipped if daily data is provided*

* Add four columns to the spreadsheet where you will be calculating the 24hr values of the climatological data: Solar24, T24, RH24, u24.
* For net radiation, relative humidity and windspeed the 24hr value is the average over the preceding 24 hrs.
* For Temperature the value is the average of the minimum and maximum temperature observed in the 24hr (FAO56)

$$T\_{air,24}=\frac{T\_{max}+T\_{min}}{2}$$

* Calculate these values for each 24 hrs

### Calculate solar radiation from sunshine hours

*RN* (the net radiation) is calculated as the incoming short wave radiation at the earth's surface (or global radiation) *RS* minus the fraction *r* that is reflected and minus the net outgoing long wave radiation *RnL*

***RN = (1 - r)*** ***RS - RnL***

where

*r* reflection coefficient (FAO uses *r = 0.23* for grass)

*RS* = *(0.20 + 0.60 n/N) RA*

*RnL* = *5.6745\*10-8 (273 + Ta)4 (0.34 - 0.139 √ed) (0.1 + 0.9 n/N)*

*n/N* fraction of sunshine hours per day

Values for radiation received at the outer limits of the atmosphere *RA* are read for a given date and latitude from table 1.

**Task 1: Use the calculated daily values in the FAO56 equation**

* Obtain the FAO56 excel file from the OCW platform
* Copy or create lookup for the daily values for Solar24, T24, RH24 and u24 into the excel file and calculate reference ET.
* The excel file uses the FAO56 method for estimating ETref ([Allen et al., 1998](https://www.fao.org/3/X0490E/x0490e00.htm#Contents)):



**Task 2: compare RET data from station and WaPOR**

* Download WaPOR RET data for the location of your climatic station
* Compare the two time series (using the excel spreadsheet file “validation” from OCW)

The excel file helps you calculate different metrics for the validation (see validation document for the explanation of the different metrics).

**Table 1 Short wave radiation RA received at the outer limits of the atmosphere expressed in W.m-2**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Lat | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
| NORTHERN HEMISPHERE |
|  | 60 | 40 | 103 | 200 | 317 | 417 | 469 | 446 | 360 | 243 | 134 | 57 | 26 |
|  | 52 | 91 | 157 | 252 | 357 | 440 | 475 | 457 | 389 | 292 | 192 | 111 | 74 |
|  | 50 | 106 | 172 | 263 | 363 | 443 | 475 | 460 | 392 | 297 | 203 | 126 | 89 |
|  | 40 | 177 | 240 | 317 | 395 | 455 | 477 | 466 | 420 | 346 | 266 | 194 | 160 |
|  | 30 | 232 | 300 | 366 | 420 | 460 | 472 | 463 | 435 | 386 | 320 | 260 | 226 |
|  | 20 | 309 | 354 | 400 | 435 | 449 | 452 | 452 | 440 | 412 | 369 | 323 | 297 |
|  | 10 | 366 | 397 | 423 | 435 | 429 | 423 | 426 | 429 | 423 | 406 | 375 | 357 |
| Equator | 0 | 415 | 429 | 435 | 420 | 397 | 383 | 389 | 409 | 426 | 429 | 417 | 409 |
|  | 10 | 455 | 449 | 432 | 397 | 357 | 334 | 343 | 375 | 412 | 440 | 449 | 452 |
|  | 20 | 489 | 457 | 415 | 357 | 306 | 277 | 289 | 332 | 389 | 437 | 469 | 483 |
|  | 30 | 492 | 452 | 386 | 312 | 246 | 214 | 226 | 277 | 352 | 423 | 477 | 500 |
|  | 40 | 495 | 432 | 349 | 254 | 183 | 149 | 160 | 217 | 306 | 395 | 472 | 509 |
|  | 50 | 483 | 403 | 297 | 192 | 117 | 83 | 97 | 154 | 249 | 357 | 457 | 503 |
|  | 60 | 472 | 360 | 237 | 123 | 51 | 26 | 37 | 89 | 186 | 309 | 432 | 500 |
|  | SOUTHERN HEMISPHERE |