Data collection from eLTER sites for the characterization of the water status with the Budyko framework

Knowledge of the water status of eLTER sites is crucial information to guide users in the selection of data for water-related research, the analysis of water-related controls on ecosystem processes, and the analysis of the impact of climate change on ecosystem functioning. The availability of this information will also broaden the scope of users by tapping into the Earth system community, such as climate scientists, hydrologists, land surface modellers, and water resources managers.

We propose to use the Budyko curve (Fig. 1 from Creed et al., 2014) to represent this water status. The Budyko curve **describes the relationship between the resulting evaporation ratio (AET/P) and the aridity index (PET/P) for the measurement period (at least 1 year up to many years)**, which is a measure of the ratio of the energy available (PET, potential evapotranspiration) and water available (P), which mediates that competition. AET refers to the actual evapotranspiration.

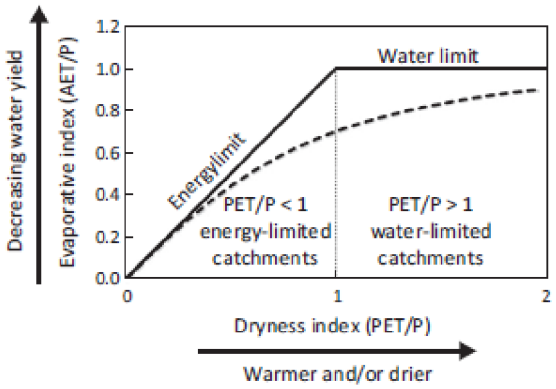

Fig. 1 A Budyko diagram (evaporative vs. dryness index). The solid lines represent energy and water limits to the evaporative index, and the dashed line represents the original theoretical Budyko curve (after Budyko, 1974).

A similar analysis has already been done for networks in the US (e.g., Creed et al.; Global Change Biology (2014) 20, 3191–3208, doi: 10.1111/gcb.12615), and we would now like to repeat this for the European continent by using eLTER data and expanding it to all ecosystems and habitats.

To calculate the representation of a site in the Budyko framework, the following input is required:

Site information: latitude, longitude, elevation (in respect to sea level [m]), land cover

Time series information and metadata:

- begin-end of the time series; XXXX-YYYY
- Has a unit transformation been performed (yes or no)?
- Has a gap filling been performed (yes or no)?

P yearly in mm (accumulated based on gap-free data)

PET yearly in mm (accumulated based on gap-free data) derived from Penman Monteith

AET yearly in mm (accumulated based on gap-free data): measured at the site (e.g., Eddy Covariance, Bowen ratio method or lysimeters)

If PET is not available, the following daily meteorological data are needed:

Tmax = Maximum daily air temperature at 2 m height [°C],
Tmin = Minimum daily air temperature at 2 m height [°C],
Tmean = Minimum daily air temperature at 2 m height [°C],
Pressure = average atmospheric pressure [kPa]
If atmospheric pressure is missing, we will make predictions based on elevation.
alpha = albedo or canopy reflection coefficient [dimensionless],
Rs = The incoming solar radiation [MJ m^{-2} day^{-1}].
If it is missing, we will predict it based on Tmax and Tmin and extraterrestrial radiation (Ra). The latter itself will be predicted based on the solar constant (Gsc = 0.0820), Latitude [rad], day of year, and number of days in the year.
Uz = wind speed [m/s] measured at mH metre height
mH = measurement height of wind speed
RHmax = maximum relative humidity (%)
RHmin = minimum relative humidity (%)
RHmean = Mean relative humidity (%)
If all or part of the humidity data is missing or the quality is poor, we will make predictions based on the temperature data.

If the annual AET and P values are also not calculated due to data gaps, please provide us with the daily data of AET and P so that we can fill in the gaps and then make our own annual calculations.

We prefer data in Excel format if possible. If this is not possible, you can also provide us with the data in another format.