How unique are fluxes from different FLUXNET sites?

Extended Budyko Analysis

The following 2 plots show predictability metrics for Potential and Actual evapotranspiration.
Predictability metrics for Potential Evapotranspiration (PET).
Predictability metrics for Actual Evapotranspiration.
Extended BioClim plots

The following figures use the WorldClim BioClim variables.

- Figure 1 shows the remaining predictability metrics for diurnal temperature range,
- Figure 2 shows isothermality,
- Figure 3 shows temperature seasonality,
- Figure 4 temperature annual range,
- Figure 5 precipitation seasonality,
- Figure 6 precipitation of wettest quarter, and
- Figure 7 precipitation of the driest quarter.

There is a hint of a trend towards higher uniqueness in sites that are driest in their wettest quarter, which is perhaps simply a reflection of the same effect seen in Figure 3 in the paper. Other determinants do not have a clear pattern in RMSE uniqueness.

There are some other patterns visible in some of the other predictability metrics, for example there appears to be a trend towards a better overlap metric at sites with a higher BioClim_t_annual_range, as well as sites with a higher BioClim_t_seasonality.
Figure 1: Predictability metrics for temperature diurnal range. Note: The first row is already included in the paper.
Figure 2: Predictability metrics for temperature isothermality.
Figure 3: Predictability metrics for temperature seasonality.
Figure 4: Predictability metrics for temperature annual range.
Figure 5: Predictability metrics for rainfall seasonality.
Figure 6: Predictability metrics for precipitation of the wettest quarter.
Figure 7: Predictability metrics for precipitation of the driest quarter.
Extended Vegetation type analysis

This figure shows the other predictability metrics for grouped vegetation type which were omitted from the paper.
Figure 8: Predictability metrics for vegetation type (grouped, see Methods).
Extended Geographic analysis

This section includes maps of RMSE uniqueness mean for Qh and Qle, mapped as per Figure 11 in the paper, as well as the remaining remoteness metrics, as per Figure 12. Distribution of uniqueness appears to be different for Qh (more high-uniqueness sites), but over-all, both variables have a similar, but less distinct pattern of uniqueness as seen in NEE in Figure 11.

Figure 9: Map of Qh predictability - RMSE uniqueness, averaged across models, as per Figure 11 in the paper.
Predictability ensemble: Qle - rmse uniqueness mean

Figure 10: Map of Qle predictability - RMSE uniqueness, averaged across models, as per Figure 11 in the paper.
Predictability metrics by RMSE uniqueness
Energy Gap Closure analysis

The energy closure problem in FLUXNET is investigated in Figure 11, where we show the actual gap (in $W/m^2$), and in Figure 12 where we show the absolute energy gap normalised by $R_{net}$. In the first figure, there is no trend in any flux. In the second figure, there is a trend toward higher uncertainty in sites with large energy gaps relative to their total $R_{net}$, however this trend is quite uncertain, due to the low number of sites involved.
Figure 11: Predictability metrics for energy gap (W/m²). Sites with positive energy gaps have too much Rnet relative to the over heat fluxes.
Figure 12: Predictability metrics for energy gap normalised by Rnet.
Extended dataset length analysis

The following plot shows the predictability metrics by data set length that were omitted from Figure 13.
Predictability metrics for number of years in dataset.
## Fluxnet Citations

Sites, vegetation types, locations and studied periods of flux sites used in this analysis. All data originally from www.fluxdata.org, via https://github.com/trevorkeenan/FLUXNET_citations. Vegetation types: deciduous broadleaf forest (DBF); evergreen broadleaf forest (EBF); evergreen needleleaf forest (ENF); grassland (GRA); mixed deciduous and evergreen needleleaf forest (MF); savanna ecosystem (SAV); shrub ecosystem (SHR); wetland (WET).

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