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Hidden Water Fluxes In A Mediterranean Ecosystem: New Insights Into Seasonal Dynamics From Lysimeter Data

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Session HS10.3
Live chat on Wednesday, 06 May 2020
14:00-15:45

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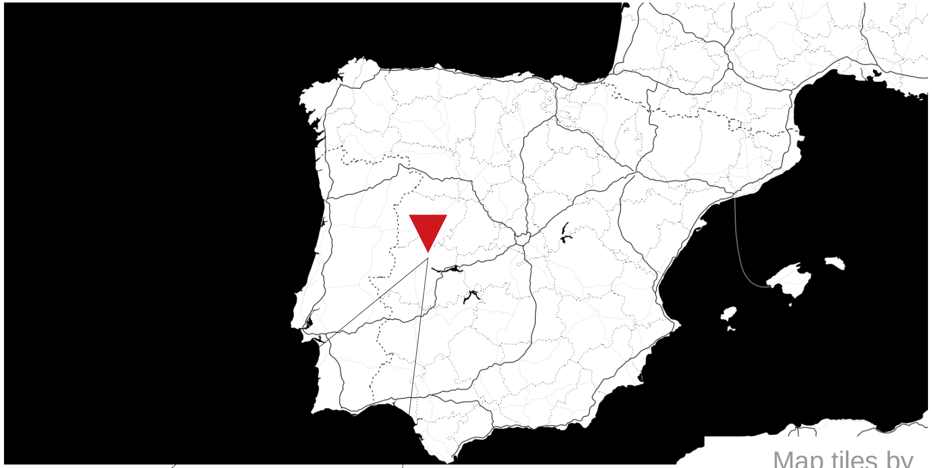
Max Planck Institute
for Biogeochemistry

Research Aim

Quantify monthly fluxes of **precipitation, evapotranspiration and dew** in a **Mediterranean ecosystem** in order to estimate if **dew should be taken into account** in future eco-hydrology related analyses.



Map tiles by Stamen Design

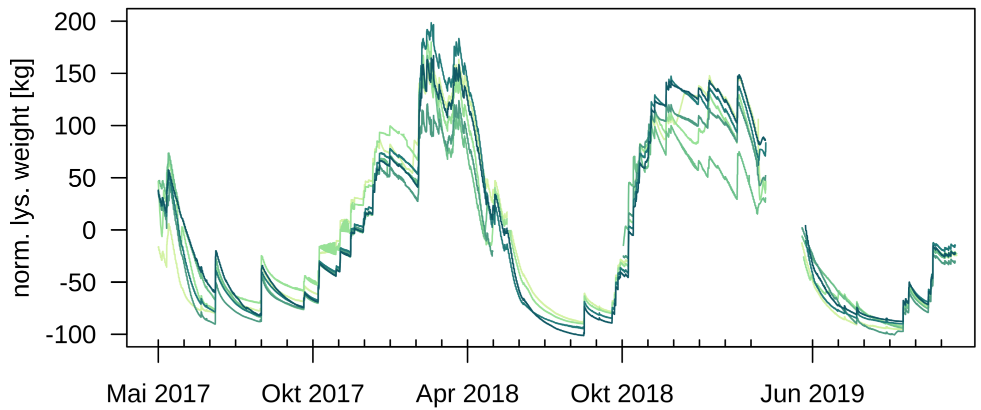
Majadas de Tietar research site (Spain)

Mediterranean tree-grass ecosystem

39°56 24.68” N
5°45 50.27” W

Mean annual temp 16°C
Mean annual precip 700 mm

(A.) Data processing and flux partitioning from 6 large weighting lysimeters

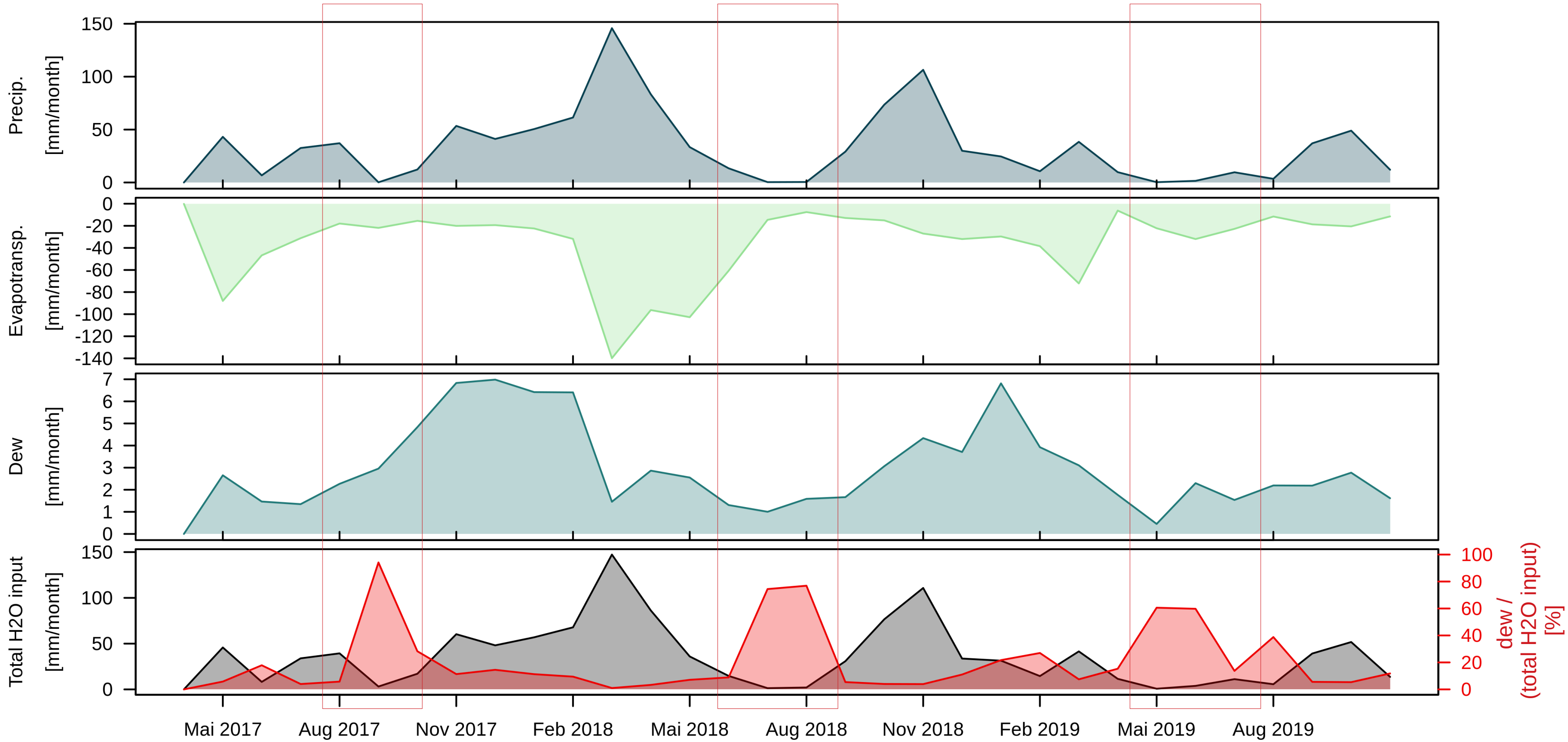


(B.) Modelling potential dewfall with the Penman-Monteith equation, using timeseries of independent climate variables

$$\lambda_v\, E = \frac{s}{s+\gamma} \times (Q^* - G) + \frac{\gamma}{s+\gamma}\,\frac{\rho_a\,\gamma\,\delta q}{r_{av}}$$

(please see slide number 6 for lysimeter processing information and modelling parameter explanation)

Results I: Dew occurrs throughout the whole year



1) the amount of dewfall can exceed monthly precipitation sums, especially during summer

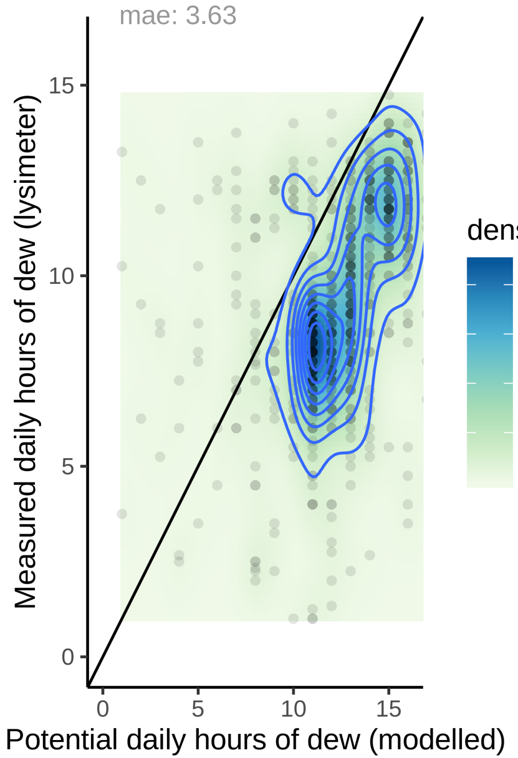
2) yearly dew sums are approximately 6 % of the total ecosystems water input

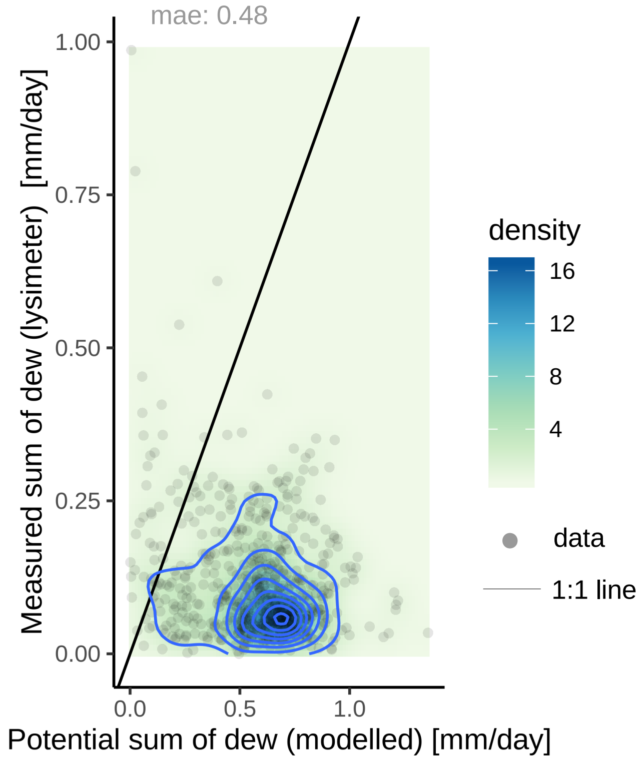
Results II: Modelling results support lysimeter findings

Modelling confirms meteorological conditions to be favorable for dewfall

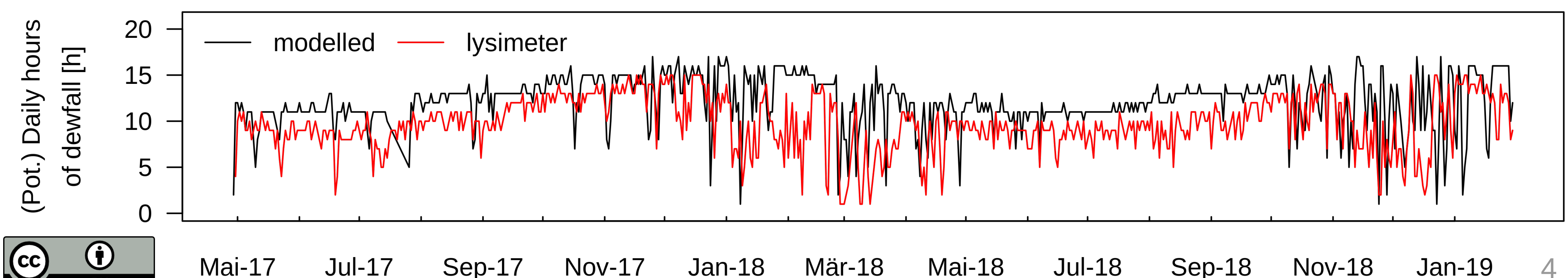
Modelled potential dew duration is mostly higher than lysimeter weight changes classified as dew

Modelled daily dew sums exceed measured values





Modelled and measured duration of dewfall is more consistent during summer, than during winter and spring.



The occurrence of dewfall throughout the dry season could be of importance for plants and microbes.

Differences between modelled and measured values will be explored in future analysis to better understand meteorological drivers of dew fluxes.

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If you have further questions please don't hesitate to contact me: spaulus@bgc-jena.mpg.de

Thank you for your attention

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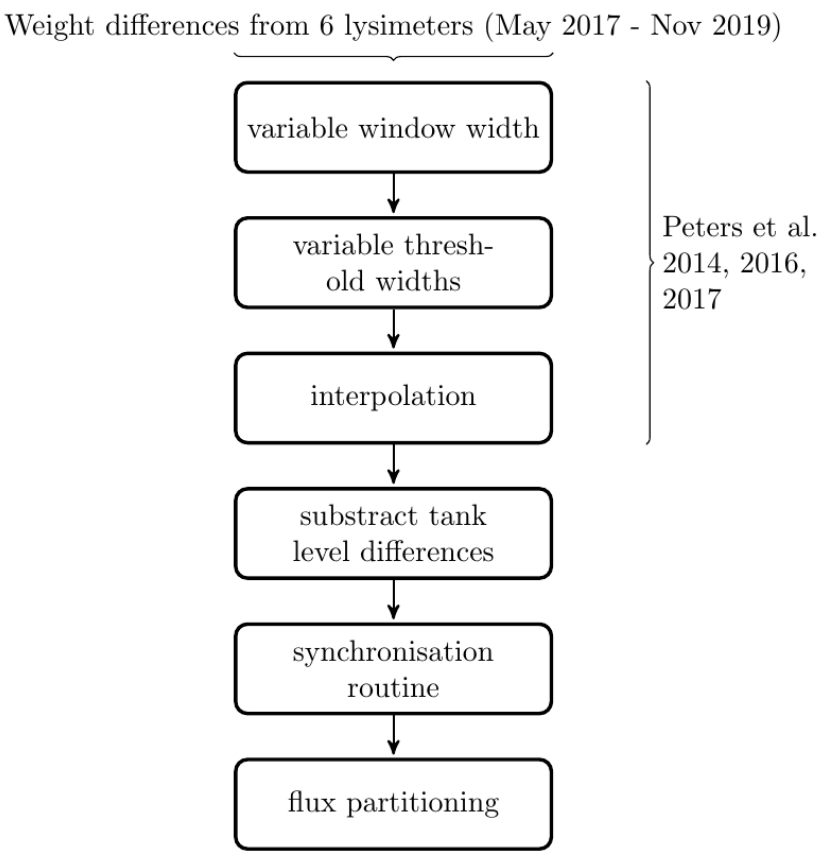

(B.) Modelling potential dewfall with the Penman-Monteith equation, using timeseries of independent climate variables

$$\lambda_v\, E = \frac{s}{s+\gamma} \times (Q^* - G) + \frac{\gamma}{s+\gamma}\,\frac{\rho_a\, \gamma\, \delta q}{r_{av}}$$

Sign	Description	Unit
G	Soil heat flux	$\mathrm{W\,m^{-2}}$
Q^*	Net radiation	$\mathrm{W\,m^{-2}}$
γ	Psychrometric constant	$\mathrm{K^{-1}}$
λ_v	Latent heat of vaporization	J kg−1
s	Slope of the saturation specific humidity curve	kPa K−1
E	Evaporation rate	J kg−1
δq	deficit in specific humidity at reference level	kPa
r_{av}	Aerodynamic resistance to vapor transport between the surface and air	$\mathrm{W\,m^{-2}}$

Most important information on the use of this formula in order to obtain dewfall hours and quantity can be found in Jacobs et al. 2008 and Ritter et al. 2019

References

Slide 2	Map tiles by Stamen Design, under CC BY 3.0. Data by OpenStreetMap, under OdbL.: http://maps.stamen.com/#toner
Slide 6	Peters, A, T Nehls, H Schonsky, and G Wessolek. 2014. “Separating Precipitation and Evapotranspiration from Noise–a New Filter Routine for High-Resolution Lysimeter Data.” Hydrology and Earth System Sciences 18 (3). Copernicus GmbH: 1189–98.
	Peters, Andre, Thomas Nehls, and Gerd Wessolek. 2016. “Improving the Awat Filter with Interpolation Schemes for Advanced Processing of High Resolution Data.” Hydrology and Earth System Sciences 20 (6). Copernicus GmbH: 2309–15.
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	Jacobs, A. F., Heusinkveld, B. G., Wichink Kruit, R. J., & Berkowicz, S. M. (2006). Contribution of dew to the water budget of a grassland area in the Netherlands. Water Resources Research, 42(3).
	Ritter, F., Berkelhammer, M., & Beysens, D. (2019). Dew frequency across the US from a network of in situ radiometers. Hydrology and Earth System Sciences, 23(2), 1179-1197.