Supplement of Hydrol. Earth Syst. Sci., 23, 3843–3863, 2019
https://doi.org/10.5194/hess-23-3843-2019-supplement

Hydrology and Earth System Sciences
Open Access

Supplement of

Using the maximum entropy production approach to integrate energy budget modelling in a hydrological model

Audrey Maheu et al.

Correspondence to: Audrey Maheu (audrey.maheu@uqo.ca)

Contents of this file

Figures S1 to S4

Table S1

Introduction

Figures S1 to S3 supplement the manuscript by providing time series of observed and modelled soil moisture at multiple depths, rather than a single one, as presented in the manuscript. There is one figure per study site (S1: US-Wkg, S2: US-Ton and S3: US-WBW).

Table S1 provides the equation of performance metrics (RMSE, NSE, BE, R^2, PBIAS) using to compare simulated and observed values.

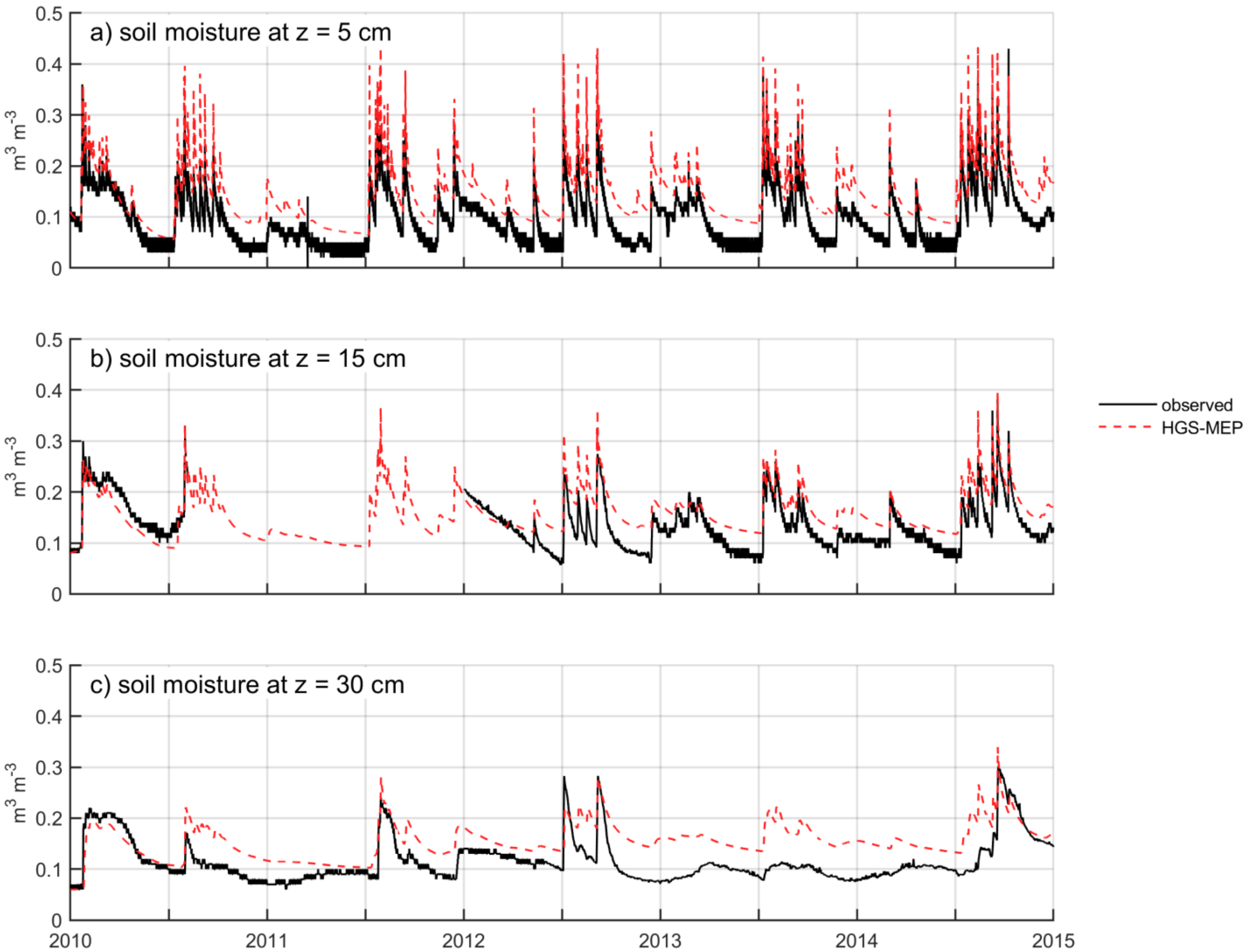

Figure S1. Time series of observed and modelled soil moisture at a depth of a) 5 cm, b) 15 cm and c) 30 cm at US-Wkg (climate: semiarid, vegetation: grassland).

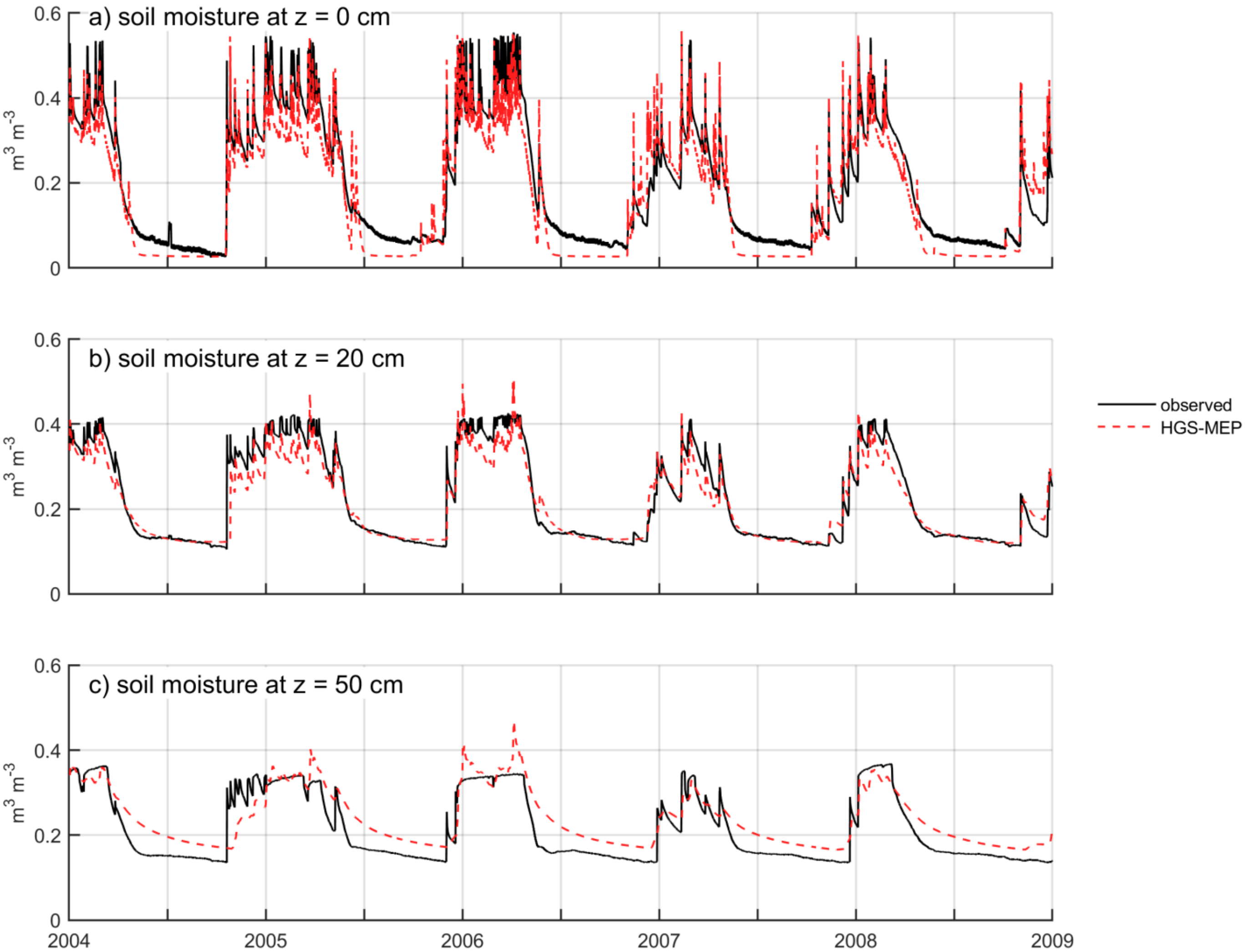

Figure S2. Time series of observed and modelled soil moisture at a depth of a) 0 cm, b) 20 cm and c) 50 cm at US-Ton (climate: Mediterranean, vegetation: woody savanna).

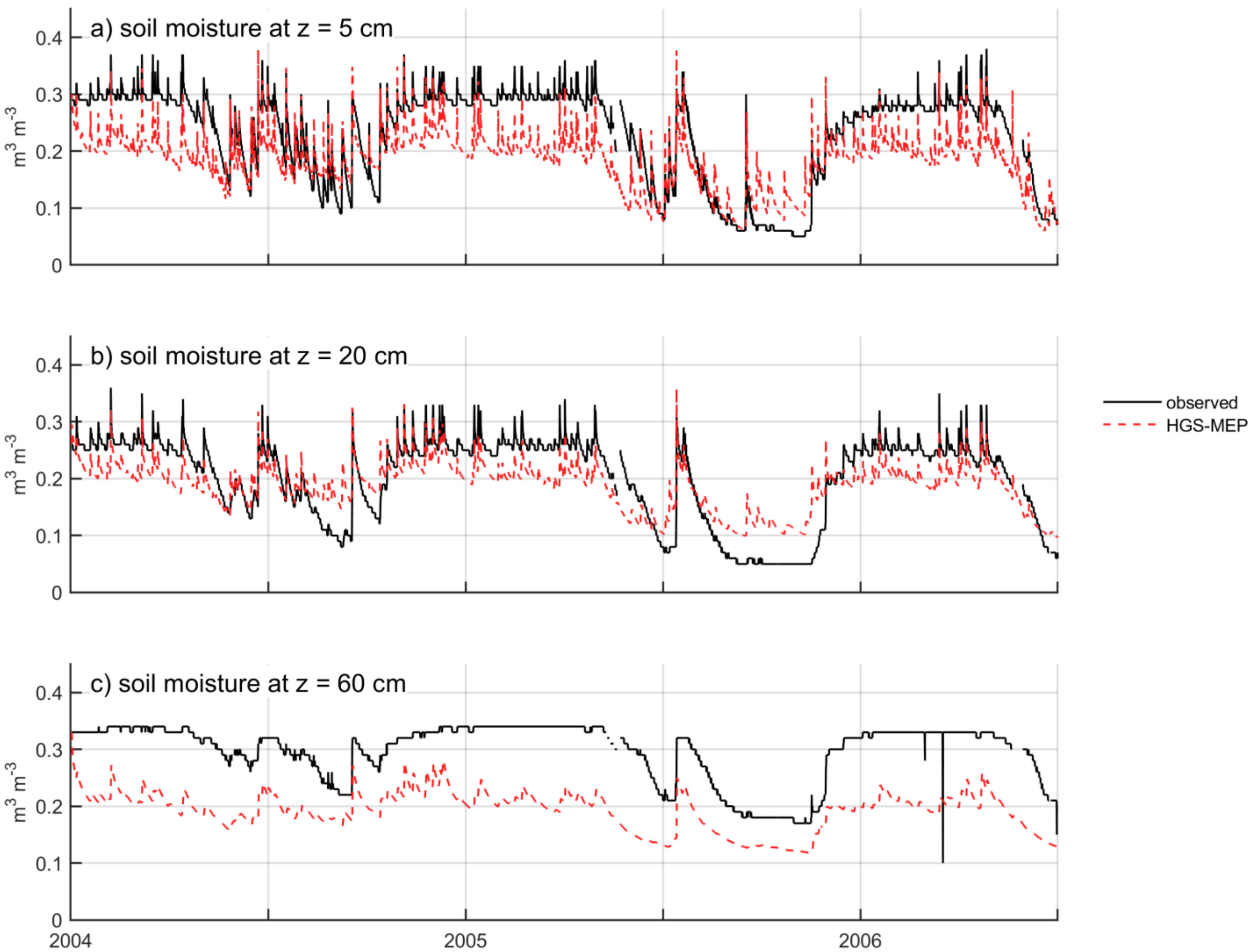

Figure S3. Time series of observed and modelled soil moisture at a depth of a) 5 cm, b) 20 cm and c) 60 cm at US-WBW (climate: temperate, vegetation: deciduous broadleaf forest).

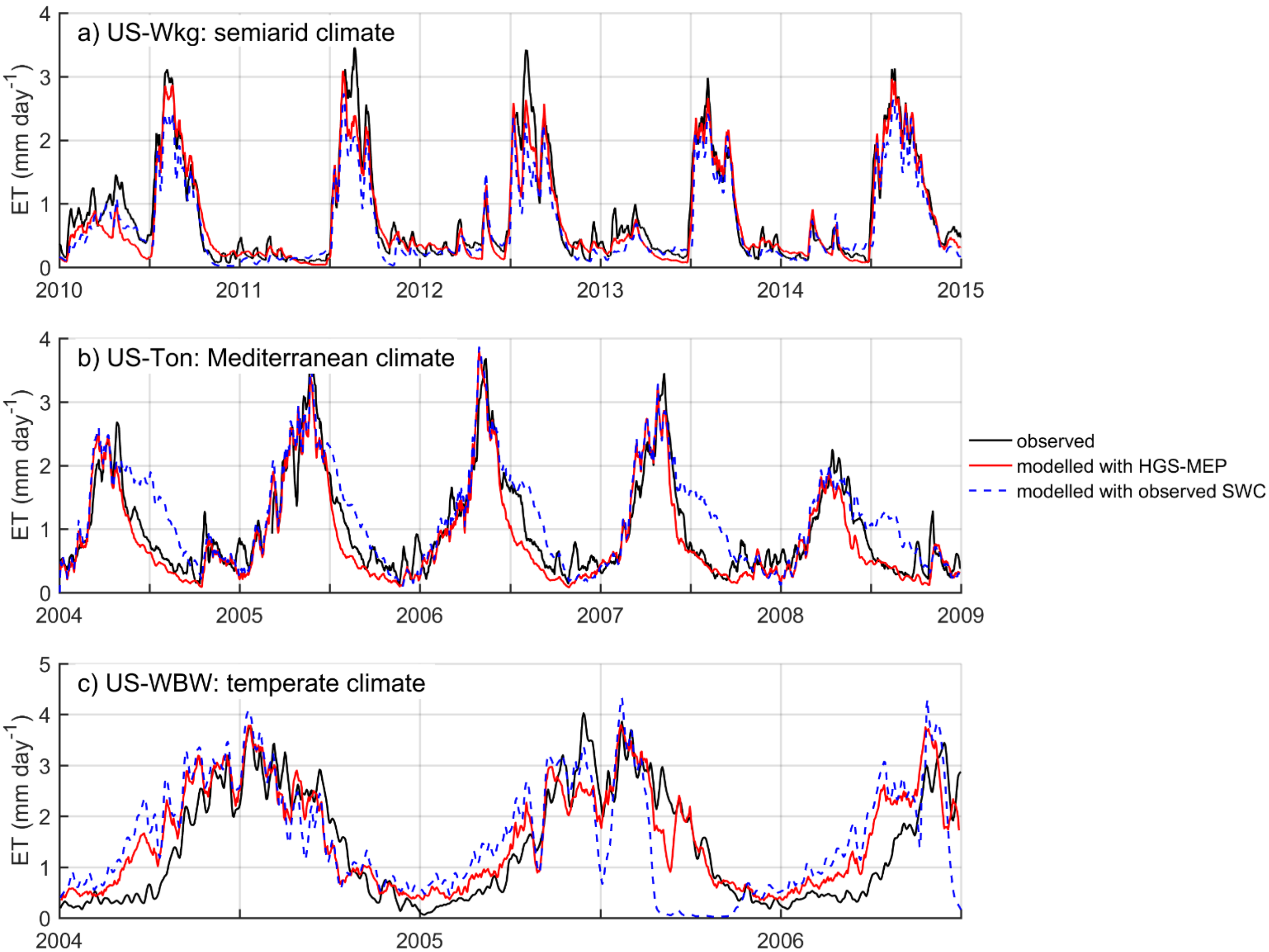

Figure S4. Comparison of observed evapotranspiration, evapotranspiration simulated by the HGS-MEP model and evapotranspiration simulated with the MEP-ET model using soil water content (SWC) observations at a) US-Wkg, b) US-Ton and c) US-WBW. Soil water content observations nearest to the surface were used as input to the MEP-Ev model (z = 5 cm at US-Wkg, z = 0 cm at US-Ton and z = 5 cm at US-WBW) and observations in the middle soil layer were used as input to the MEP-Tr model (z = 15 cm at US-Wkg, z = 20 cm at US-Ton and z = 20 cm at US-WBW).

Table S1. Equation of performance metrics to compare observed and simulated values.

metric	equation
root mean square error	$\mathrm{RMSE} = \sqrt{\frac{1}{N}\sum_{t=1}^{N}[x_{sim}(t) - x_{obs}(t)]^2}$
Nash-Sutcliffe efficiency (NSE)	$\mathrm{NSE} = 1 - \left[\frac{\sum_{t=1}^{N}[x_{sim}(t) - x_{obs}(t)]^2}{\sum_{t=1}^{N}[x_{obs}(t) - \bar{x}_{obs}]^2}\right]$
normalized benchmark efficiency (BE)	$\mathrm{BE} = 1 - \left[\frac{\sum_{t=1}^{N}[x_{sim}(t) - x_{obs}(t)]^2}{\sum_{t=1}^{N}[x_{obs}(t) - x_{bench}(t)]^2}\right]$
coefficient of determination (R^2)	$R^2 = \frac{\frac{1}{N}\sum_{t=1}^{N}[(x_{obs}(t) - \bar{x}_{obs})(x_{sim}(t) - \bar{x}_{obs})]}{\sqrt{\frac{N\sum_{t=1}^{N}x_{obs}^2 - [\sum_{t=1}^{N}x_{obs}(t)]^2}{N(N-1)}}\sqrt{\frac{N\sum_{t=1}^{N}x_{sim}^2 - [\sum_{t=1}^{N}x_{sim}(t)]^2}{N(N-1)}}}$
percent bias (PBIAS)	$\mathrm{PBIAS} = \frac{\sum_{t=1}^{N}[x_{sim}(t) - x_{obs}(t)]}{\sum_{t=1}^{N}[x_{obs}(t)]} * 100$

where $x_{obs}(t)$ is the observed value at time step t, $x_{obs}(t)$ is the simulated value, $\bar{x}_{obs}$ is the mean observed value over the simulation period of length N, x_{bench} is the benchmark model, in this case the interannual mean of observed values for each calendar day.