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A deep learning hybrid predictive modeling (HPM) approach for estimating evapotranspiration and ecosystem respiration

Jiancong Chen et al.

Correspondence to: Jiancong Chen (nigel_chen1993@berkeley.edu)

Supplementary Materials

1. Deep Learning Model Configuration

Table S.1 Configuration of Deep-Learning Module

Layer	Output Shape	Parameters #	Note
LSTM	[50, 1]	11600	
LSTM	[25]	7600	
Dropout	[25]	0	Rate = 0.1
Dense	[8]	208	L2 regularizers, 0.01
Dropout	[8]	0	Rate = 0.1
Dense	[1]	9	Output Layer

2. CLM performance at US-NR1

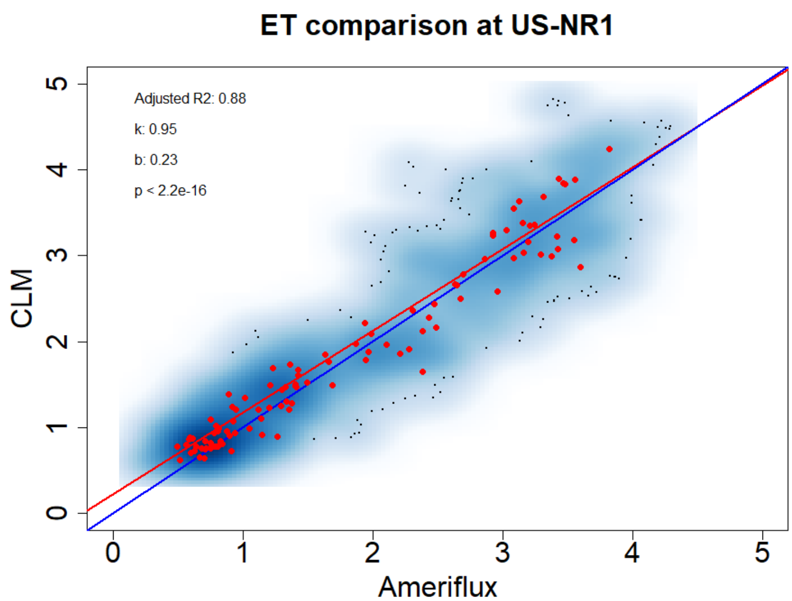

Figure S1. Comparison of ET estimation from CLM and flux tower measurements at US-NR1. Consistency between CLM estimation and direct measurement from flux tower is observed.

3. Comparison of HPM estimations at the East River Watershed to other studies

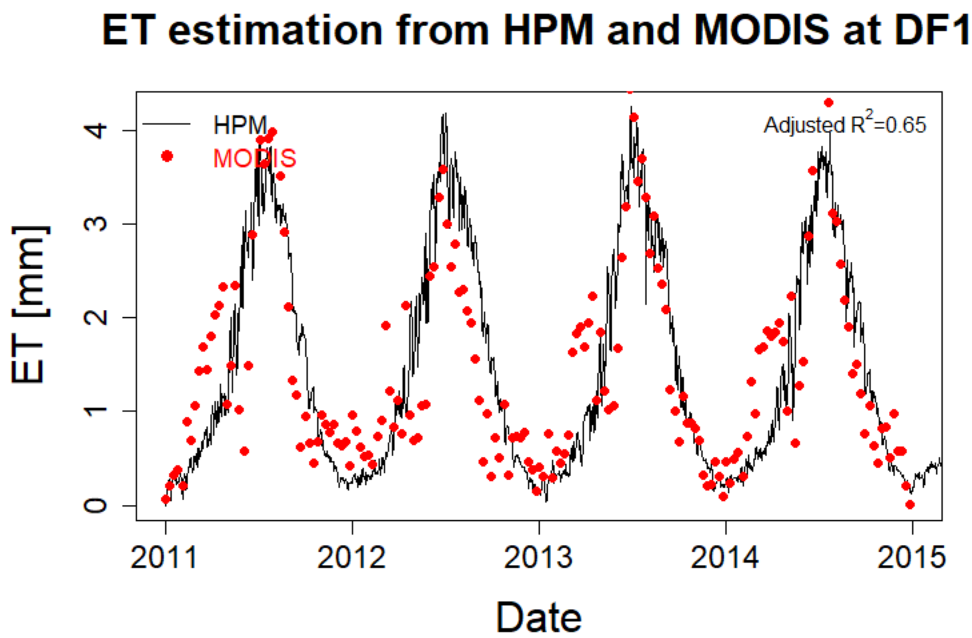

Figure S2. Comparison of 8-day averaged ET estimation from HPM and Mu et al. (2013) at deciduous forests site in East River Watershed.

HPM-based ET estimation at East River Watershed is comparable to Mu et al. (2013), where ET is computed based upon the logic of the Penman-Monteith equation and MODIS remote sensing data (Fig. S2), and the HPM-based R_{ECO} estimation is comparable to what Berryman et al. (2018) discovered, with growing season R_{ECO} ranging between 555 to 607 gCm^{-2} and mean growing season R_{ECO} ranging between 3.01 to 3.30 gCm^{-2}. Annual ET between deciduous forests and evergreen forests are not statistically different, which is similar to Mu et al. (2013). Annual R_{ECO} differences between evergreen forests and deciduous forests are around 50 gCm^{-2}, which is comparable to Berryman et al. 2018.

3. Distribution of NDVI at the East River Watershed between 2012 and 2015

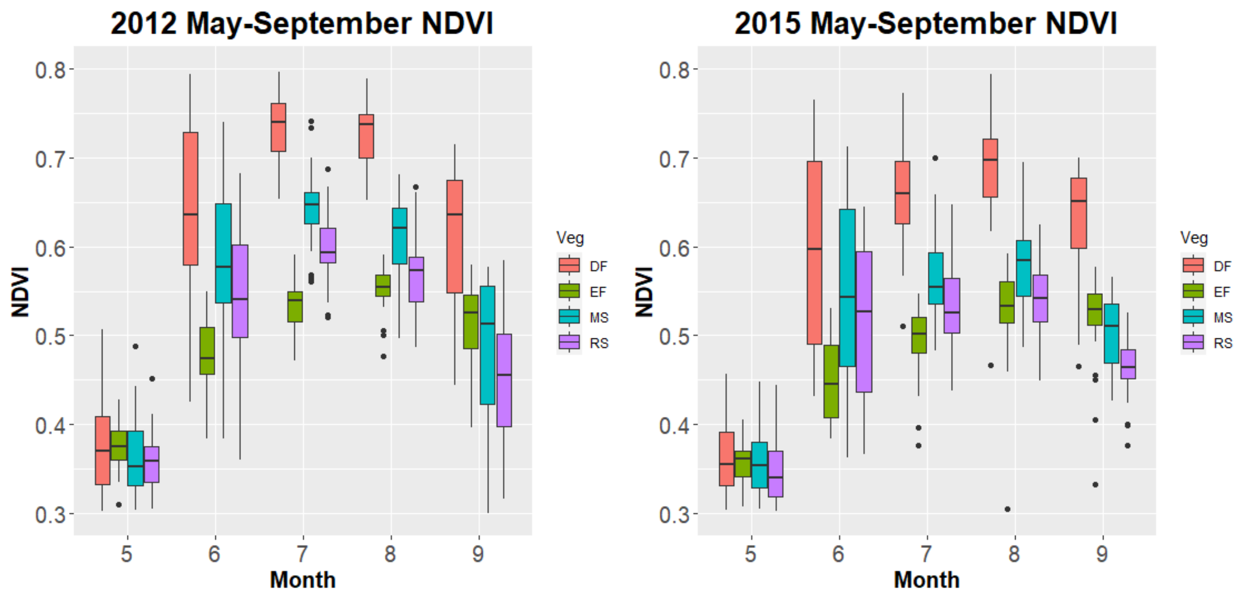

Figure S3. 2012 and 2015 distribution of NDVI at the East River Watershed

4. Meteorological forcings heterogeneity within East River Watershed and across SNOTEL stations

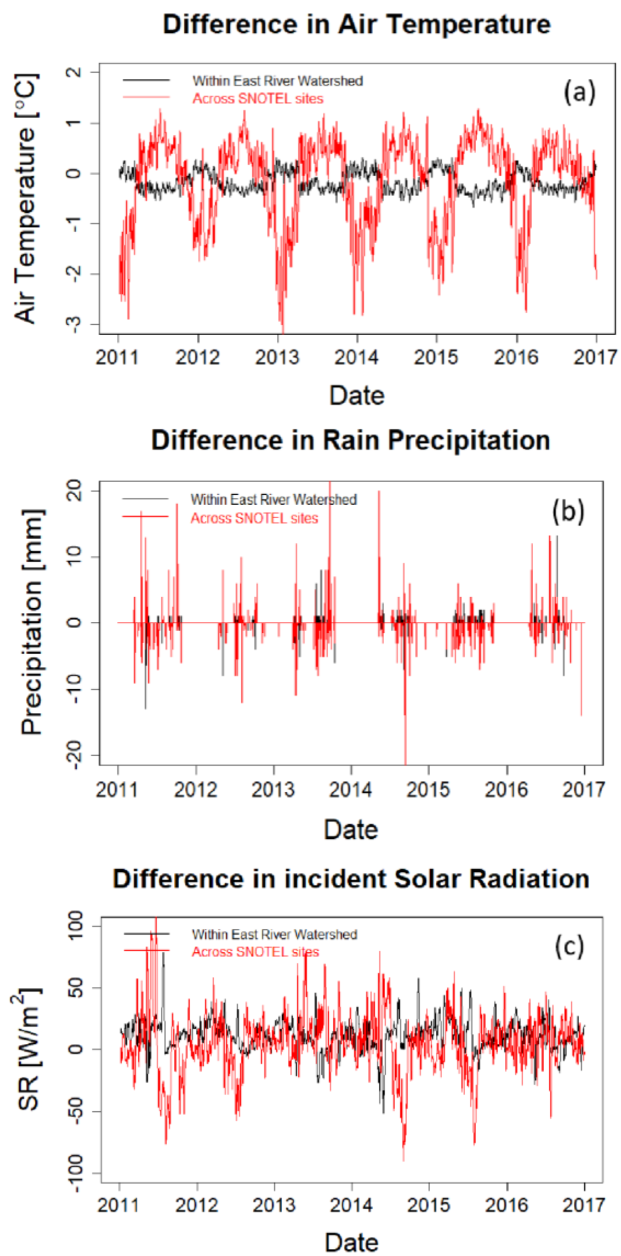

Figure S4. Meteorological forcings heterogeneity within East River Watersheds (DF1 and EF1, black lines) with DAYMET data and across SNOTEL stations (ER-BT and ER-PK, red lines) with SNOTEL data.

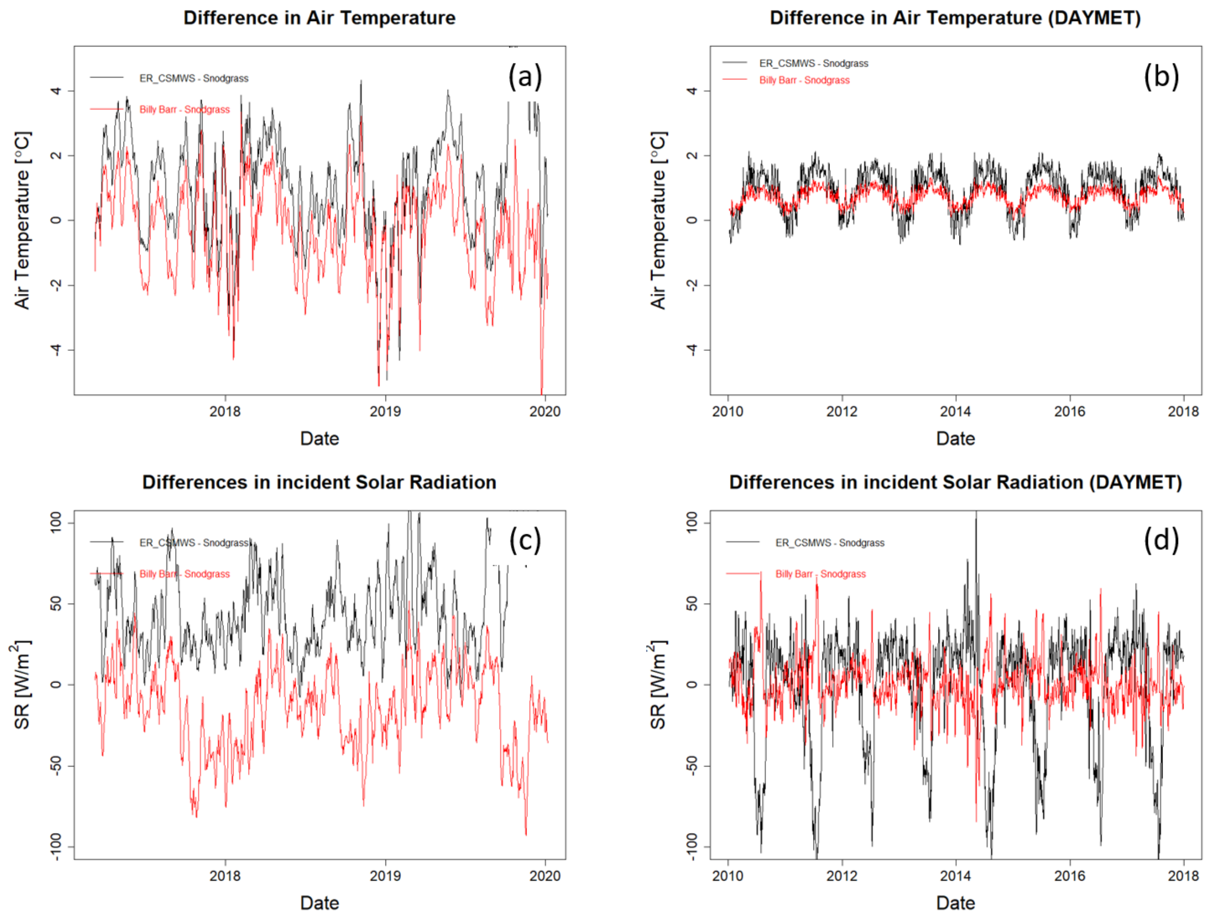

Figure S5. Differences in air temperature and incident solar radiation among three weather stations (ER_CSMWS, Snodgrass and Billy Barr) locations within the East River Watershed. Panel (a) and (c) present data from weather stations obtained from https://wfsfa-data.lbl.gov/. Panel (b) and (d) present data obtained from DAYMET.