Article

Implication of vegetation response to climate change for mountain grasslands

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Abstract:
1. Evaluate default PET models
2. Evaluate calibrated PET models
3. Sensitivity analysis and model uncertainty of calibrated PET models
4. Implication of elevated CO_2 in PET models
5. Implication of warming in PET models
6. Combined effect of warming and elevated CO_2 in PET models
7. Evaluation, Sensitivity analysis and model uncertainty of calibrated PET models
8. Conclusion

Keywords: keyword 1; keyword 2; keyword 3 (list three to ten pertinent keywords specific to the article, yet reasonably common within the subject discipline.)

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1. Introduction

2. Evaluation of PET models

2.1. Previous research

Sensitivity to erros in potential evapotranspiration input [1] [2] and [3](details of computation) compared 9 PET methods using onsite meteo data (PEnman with empirical wind function applicable to a short grass with rougness coef of 1cm):

$$f(u) = 0.35 + 0.0035 * u_2 \tag{1}$$

2.2. Evaluation of PET models with default coefficients

same Rn same rh same T...

Penman

$$E = \frac{1}{\lambda \rho_w} \frac{\Delta(R_n - G) + K_u \gamma(a_w + b_w u_2)(e_s - e_a)}{\Delta + \gamma} \tag{2}$$

where a_w and b_w are wind function coefficients that are usually receive a local or regional calibration. Parameter K_u =6.43 for ET in mmd^{-1} and K_u =0.268 for ET in mmhour^{-1}. Penman [4] used for clipped grass [5] a_w = 1.0 and b_w = 0.537, respectively,for wind speed in ms $^{-1}$, $es - ea$ in kPa and grass ETo in mmd^{-1}. The equations were intended for use with daily computations. In application of the 1963 Penman, saturation vapor pressure is traditionally based on mean daily air temperature rather than on Tmax and Tmin" [6].

Penman-Monteith [5]

$$E = \frac{1}{\lambda} \frac{\Delta(R_n - G) + \rho_a c_p (e_s - e_a)/r_{ah}}{\left[\Delta + \gamma(1 + \frac{r_s}{r_{ah}})\right]} \tag{3}$$

Priestley-Taylor [5]

$$E = \frac{1.26}{\lambda} \frac{\Delta}{\Delta + \gamma}(R_n - G) \tag{4}$$

Kimberley-Penman [5]

$$E = \frac{1}{\lambda \rho_w} \frac{\Delta(R_n - G) + K_u \gamma(a_w + b_w u_2)(e_s - e_a)}{\Delta + \gamma} \tag{5}$$

where:

$$a_w = 0.4 + 1.4exp - \left[\left(\frac{J - 173}{58}\right)^2\right] \tag{6}$$

$$b_w = 0.605 + 0.345exp - \left[\left(\frac{J - 243}{80}\right)^2\right] \tag{7}$$

Hamon

Turc–

Makink (default) [5]

$$ET_0 = 0.61 \frac{\Delta}{\Delta + \gamma} \frac{R_s}{2.45} - 0.12 \tag{8}$$

Makink to calibrate [5]

$$ET_0 = f * 0.61 \frac{\Delta}{\Delta + \gamma} \frac{R_s}{2.45} - 0.12 \tag{9}$$

Doorenbos and Pruitt [7]

$$ET_0 = c \frac{\Delta}{\Delta + \gamma} \frac{R_s}{2.45} - 0.3 \tag{10}$$

where c is the calibration factor that is a fucntion of rh and ud. allen and pruitt [8]:

$$c = 1.066 - 0.00128 RH_{mean} + 0.045 u_d - 0.0002 RHmean u_d - 0.0000315(RHmean^2) - 0.001103(u_d)^2 \tag{11}$$

u_d has limits $0 < u_d < 10$ ms^{-1}.

Hargreaves [9]

$$ET_0 = 0.0023(T_{max} - T_{min})^{0.5}(T_{mean} + 17.8)\frac{R_a}{\lambda \rho_w} \tag{12}$$

Ra is average daily exoatmospheric radiation(extra terrestrial) Blaney-Criddle [5]

Jensen-Haise [5] - ET$_r$ is alfalfa reference ET

$$ET_r = \frac{1}{\lambda} C_r (T - Tx) R_s \tag{13}$$

C_r and T_x should be constant for a given area... Later Jensen defined:

$$C_r = \frac{1}{C_1 + C_2 C_H} \tag{14}$$

$$C_H = \frac{5}{e_2 + e_1} \tag{15}$$

e2 and e1 are the saturation vapor pressures in kPa at the mean daily maximum and mean daily minimum temperatures, respectively, for the average warmest month of the year in an area, and C1 and C2 are constants (C2 = 13 degress F or 7.3 degrees C).

$$C_1 = 38 - (2Elev/305) \tag{16}$$

$$T_x = -2.5 - 1.4(e_2 - e_1) - Elev/550 \tag{17}$$

2.2.1. Inputs

R_n net longwave radiation

$$R_n l = f_{cd}(a_1 + b_1\sqrt{e_a})\sigma T^4 \tag{18}$$

if 24-hour or longer time steps...T^4 transforms to $(T^4_{max} - T^4_{min})/2$.
σ is for daily values 4.901 x 10^{-9} MJm^{-2}d^{-1}K^{-4} with Rnl in MJm^{-2}d^{-1}
for hourly calculations σ = 2.042 x 10^{-10} MJm2 h^{-1}K^{-4}, Rnl is in MJm^{-2} h^{-1}.

Wright and Jensen [10] developed an expression for f_{cd}:

$$f_{cd} = a\frac{R_S}{R_{SO}} + b \tag{19}$$

a and b are empirical coefficients. General a= 1.3, b=0.3, a_1 = 0.39 and b_1=0.158

2.2.2. Evaluation of calibrated/validated PET models

TEXT

2.2.3. Evaluation of calibrated PET models

TEXT

3. Results

This section may be divided by subheadings. It should provide a concise and precise description of the experimental results, their interpretation as well as the experimental conclusions that can be drawn.

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3.1. Subsection

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Bulleted lists look like this:

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Title 1	**Title 2**	**Title 3**
entry 1	data	data
entry 2	data	data

Text
Text

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This is an example of an equation:

$$a + b = c \tag{20}$$

Please punctuate equations as regular text. Theorem-type environments (including propositions, lemmas, corollaries etc.) can be formatted as follows:

Theorem 1. *Example text of a theorem.*

The text continues here. Proofs must be formatted as follows:

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Interventionary studies involving animals or humans, and other studies require ethical approval must list the authority that provided approval and the corresponding ethical approval code.

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Abbreviations

The following abbreviations are used in this manuscript:

MDPI	Multidisciplinary Digital Publishing Institute
DOAJ	Directory of open access journals
TLA	Three letter acronym
LD	linear dichroism

Appendix A

Appendix A.1

The appendix is an optional section that can contain details and data supplemental to the main text. For example, explanations of experimental details that would disrupt the flow of the main text, but nonetheless remain crucial to understanding and reproducing the research shown; figures of replicates for experiments of which representative data is shown in the main text can be added here if brief, or as Supplementary data. Mathematical proofs of results not central to the paper can be added as an appendix.

Appendix B

All appendix sections must be cited in the main text. In the appendixes, Figures, Tables, etc. should be labeled starting with 'A', e.g., Figure A1, Figure A2, etc.

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