

## ***Interactive comment on “Comparison of six different soft computing methods in modeling evaporation in different climates” by L. Wang et al.***

**L. Wang et al.**

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**## Major comments** There is no mention of local optima problems associated with many soft computing methods. This should at least be acknowledged, any methods for avoiding these problems should be explained in the methods sections for each of the models.

Reply: as suggested, in the methods section, some statements were added for local optima problems of the applied models. We further evaluated the applied models with full weather inputs by changing training and testing period. Please see Table 14 for the results.

The results section is long and repetitive. It would be good to try to summarize the data as much as possible, and draw a bit of a narrative through the results. What is the key

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message you're trying to communicate here? Some specific suggestions are given below in the Tables and Figures sections.

Reply: results section was revised and a discussion section was added.

There is no discussion section. It would be good to have some general discussion of the generalizability of these results, and the implications for others working in the field.

Reply: a discussion section was added as suggested (discussion of the generalizability of these results, and the implications for others working in the field).

## Minor comments l112-5: There is no justification given for the choice of these 8 models. Many more models are mentioned in the introduction. Why choose these 8 specifically?

Reply: the specific reasons for selecting each soft computing model was provided in methods section as suggested.

l226: This sentence mentions a dataset, but this isn't actually described above.

Reply: In this study, MLR models are developed using the same dataset at eight stations in different climates (described in section 2.2) which was used to train and test the above soft computing models.)

l280-303: The important thing is that the sites are diverse. You are not trying to describe the sites, just use them to evaluate models, yet lot of these statistics are just descriptive stats repeated from the table. Better would be to quote ranges (of means, variance, and extremes), and maybe try to relate those to global- or china-wide ranges, to show that the sites are representative.

Reply: we have added "For example, the monthly mean Ep ranged from 2.86 (CQ) to 7.26 mm (MQ) with associated Cv values changing from 0.32 to 0.75 in different climates; the minimum monthly Ep was about 0.15 mm while the maximum monthly Ep

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reached 15.89 mm. Accordingly, the monthly meteorological variables varied greatly for each station in different climates, for example, the monthly mean  $R_g$  at CQ was about 8.8 MJ m<sup>-2</sup>, while the  $R_g$  values increased to 20.41 MJ m<sup>-2</sup> at LSA station; the monthly mean  $T_a$  also changed from 4.17°C to 24.08°C. The diverse climatic characteristics can also be seen from the statistics of  $C_v$ ,  $C_x$ ,  $x_{min}$  and  $x_{max}$  for each parameter at above stations. The monthly variations of  $E_p$  and associated climatic parameters in each station were further illustrated in Fig.5, for example, the monthly  $E_p$ ,  $T_a$ ,  $H_s$  and  $R_g$  are generally higher in summer and lower in winter months and there were also differences for each parameter in different stations, which indicated that above stations are representative for studying  $E_p$  in different climates.)” into the Case Study and Data section

Section 2.3: No rationale is given for the choice of metrics. All three metrics are highly correlated (all  $r \geq 0.9$ ), from what I can see, and therefore two metrics don't provide much more information after the first. Consider using alternate metrics, such as the Nash-Sutcliffe model efficiency coefficient, normalised mean error, correlation, or some of the metrics mentioned in Pachepsky et al. (2016).

Reply: as suggested Nash-Sutcliffe criterion was also included in the revised paper

I314-323: This section should be split up and moved into the relevant Methods subsections.

Reply: It was done as suggested.

I331 (and below): How are these "accuracy ranks" calculated? They are not mentioned in the methods section at all. Perhaps they should be included in the tables?

Reply: this was mentioned in the Results section.

I333-4: It is not clear that  $T_a$  and  $R_g$  are better at modelling  $E_p$  than RH or  $W_s$ , because RH and  $W_s$  are only included as fourth and fifth variables. If the inputs are highly correlated, then RH and  $W_s$  may also perform reasonably by themselves.

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Reply: we have also added two input combinations as iv) RH and v) Ws. Now, the effect of each variable on  $E_p$  can be clearly seen.

I413: the  $R^2$  is not the same thing as Pearson's Correlation Coefficient, except in the simple case of univariate linear regression. Also, some of the correlations between Ws and  $E_p$  (I assume the R column in Table 1) are reasonably high, so it would be reasonable to assume some predictive power.

Reply: we agree with you that the R indicates that the Ws have reasonable and predictive power. Therefore, we have added "In overall, soft computing models with full weather data (Rg, Ta, Hs, RH and Ws) generally had the best accuracy. This indicates that all these variables are required for better  $E_p$  estimation. It can be seen from the applications that adding RH or Ws inputs into the applied models generally increase their accuracies in predicting  $E_p$  in all stations even though these parameters have the lowest correlation with  $E_p$  (see Table 1)." into the discussion section.

I445: The description of the generalized model should be moved to the methods section and expanded.

Reply: It was done as suggested

I477-480: Performance is not additive, especially when the predictor variables have significant covariance, so it is almost inevitable that RH and Ws will appear to be worse predictors relative to Rg and Ta, when they have only been included in models with multiple other variables.

Reply: we have added two input combinations as iv) RH and v) Ws.

I479: Ws doesn't decrease \*all\* simulation metric results, and again, it is not clear how this variable would perform as a predictor in the absence of other inputs, which are likely correlated.

Reply: we have added two input combinations as iv) RH and v) Ws.

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### Tables Tables 1, 3-10, and 12: There is a \*LOT\* of data in all of the tables. It is very difficult to read information laid out like this. Consider using summary plots (possibly small multiples of parallel coordinate plots) instead and moving the tables to supplemental material, or colouring the table cells to give a clearer indication of performance (normalize colours per column).

Reply: we have showed the best models by bold numbers.

Tables 3-10: There is no explanation given anywhere as to why there are two columns in tables 3-10 for each of the three metrics. Explain in-text, and in the table captions.

Reply: we have explained these as Training and Testing period

### Figures Figure 3: Colour the stars in the same colours as in Figure 4.

Reply: It has been corrected.

Figure 4: Put the legend outside above the graphs, make it larger.

Reply: It has been corrected.

Figures 6-13: - The paper is about comparison between models, not sites. But I have to scroll between 8 pages to compare all of the models. It would be better to have a grid for each site that included all 8 models.

Reply: It has been corrected.

- If you remove the x- and y-axis tags from all but the first row and column, you can save significant space, and probably fit all models on 2x4 grid, allowing more plots per page.

Reply: It has been corrected.

- The bubble effect only adds unnecessary visual detail. Remove the 3d effect, and use smaller circles, so the detail in the scatter plot can be seen properly.

Reply: It has been corrected.

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- I guess that the scatter plots include the seasonal cycle. It may be useful to have corresponding residuals plots, to show under which conditions the modes are performing poorly. - Units should be mm/day, I think.

Reply: It has been corrected.

## Technical notes I48: remove "and air". I49-50: Pan evaporation is a measurement, it doesn't play a role in the ecosystem. Remove clause, or move to previous sentence. I56: "..less \_well\_ understood.." I65: remove "the" I70: Full stop before "For example.." I95: "..in case of without local inputs and outputs" doesn't make sense. Re-word. I97: remove "the" I98: "On the contrary" probably should be "In contrast" I102: "at a few number of stations" makes no sense, re-write sentence, split at "forexample". I128: "\_The\_ MLP is \_a\_ well-known ..." I129-30: "\_hierarchical\_ networks \_consisting of\_ several layers.." I132: The neurons are the nodes. The connections are the synapses. Re-word sentence. I149: "two types of neurons, S-summation and D-summation, which...". I188: "MF" - abbreviation undefined. I190: "RMSE" - abbreviation undefined. I220: "variables are" I225: "analyse" I280: remove "It is clear that" I296: "has lower skewness", I think. I397: "indicate" I475: "..MLP \_performance was\_ superior to.." I476: Full stop after "stations". I479: "\_Decreased\_" (past tense) Table 1: Headers misaligned. R metric needs to be explained in footer. Also, it is probably better to sort by variable first, and then by station, so that stations can be compared. If you do this, add minor grid lines between variables.

Reply: All these have been considered in the revised paper.

Please also note the supplement to this comment:

<http://www.hydrol-earth-syst-sci-discuss.net/hess-2016-247/hess-2016-247-AC1-supplement.pdf>

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2016-247, 2016.

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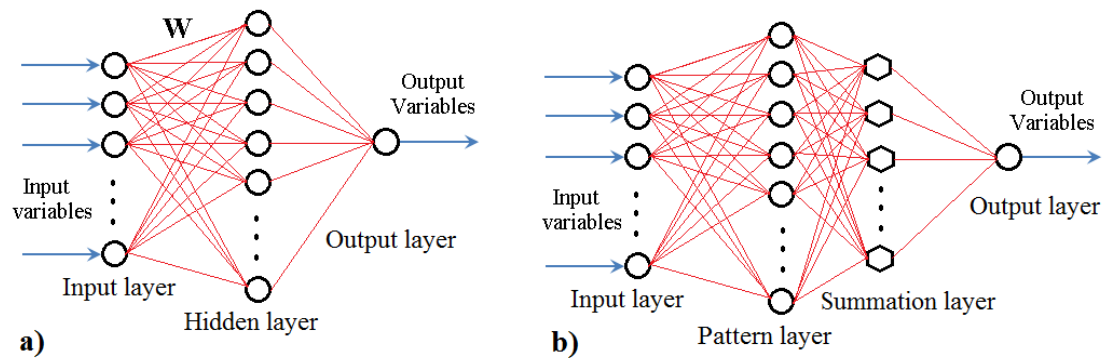
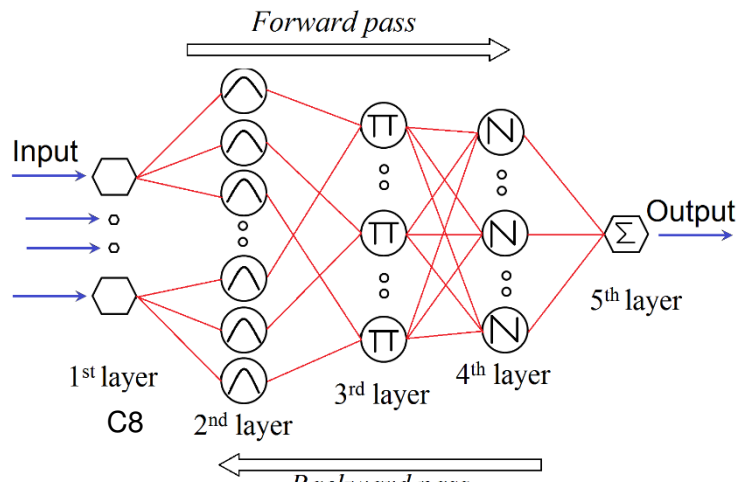


Fig. 1. Schematic architecture of: a) MLP neural network; b) GRNN.



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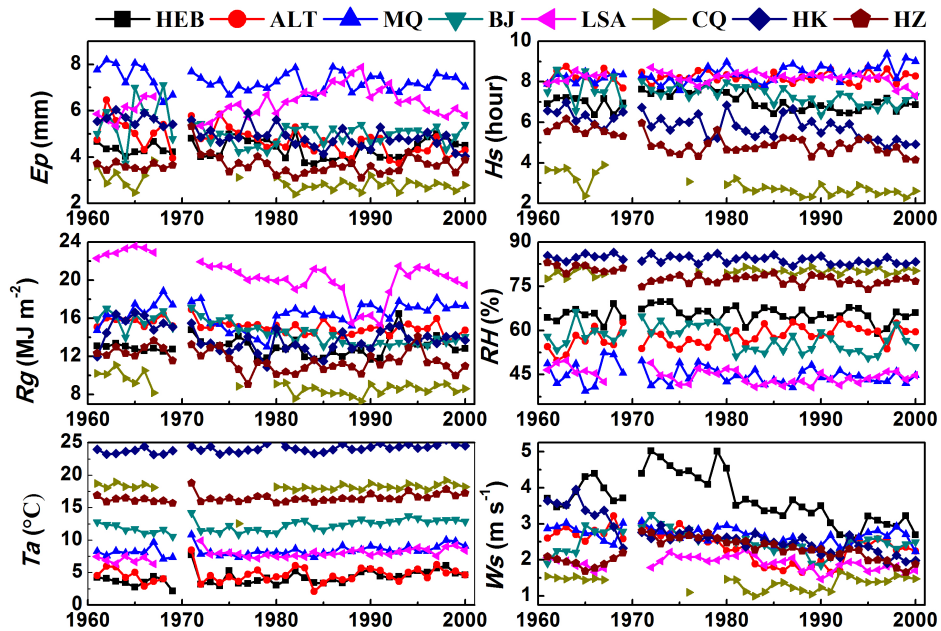


Fig. 3.

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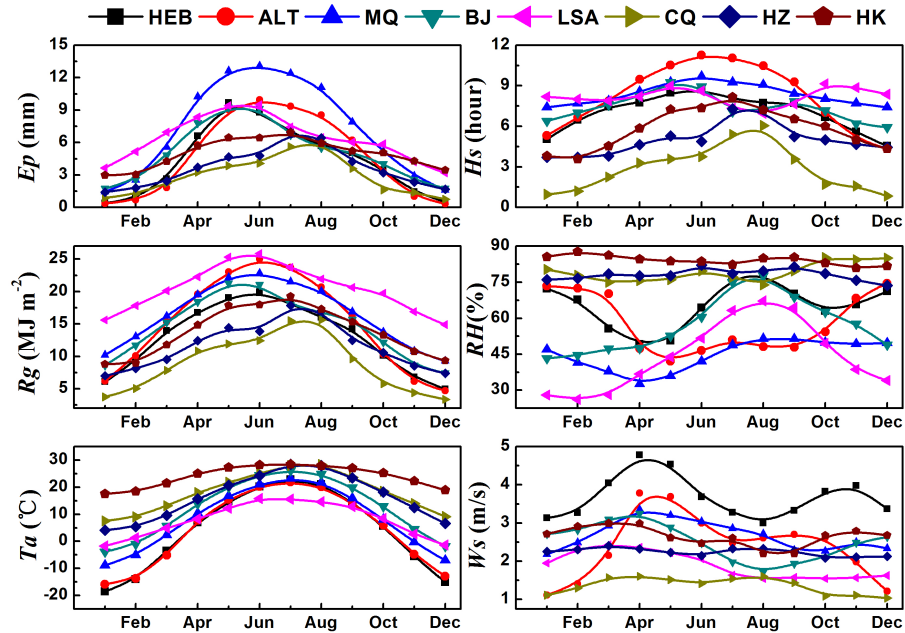


Fig. 4.

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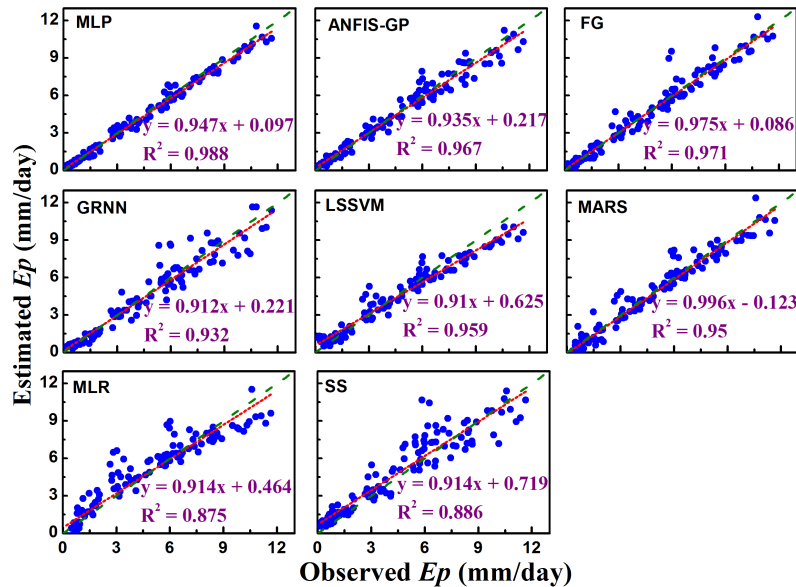


Fig. 5.

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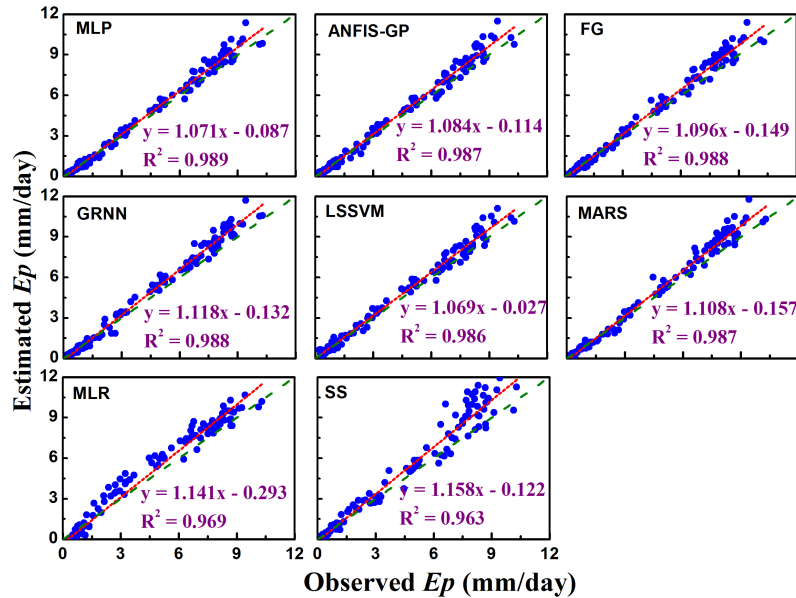


Fig. 6.

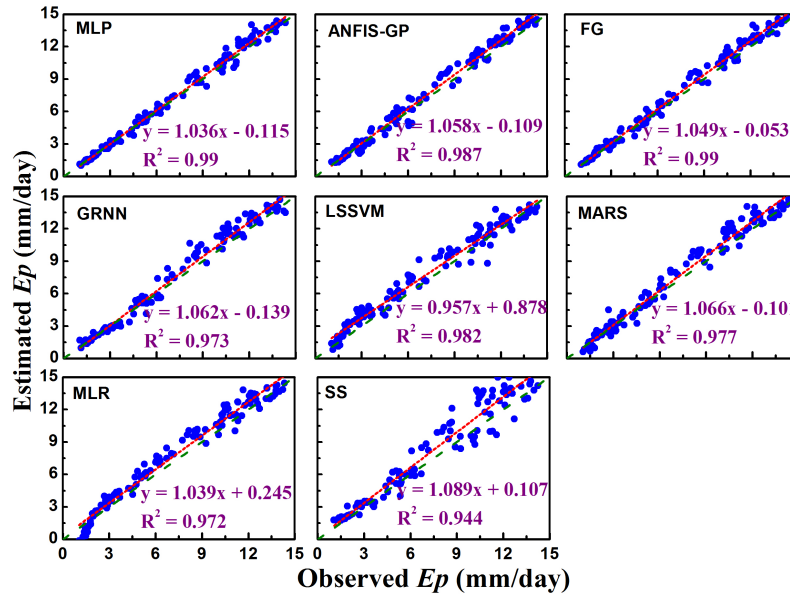


Fig. 7.

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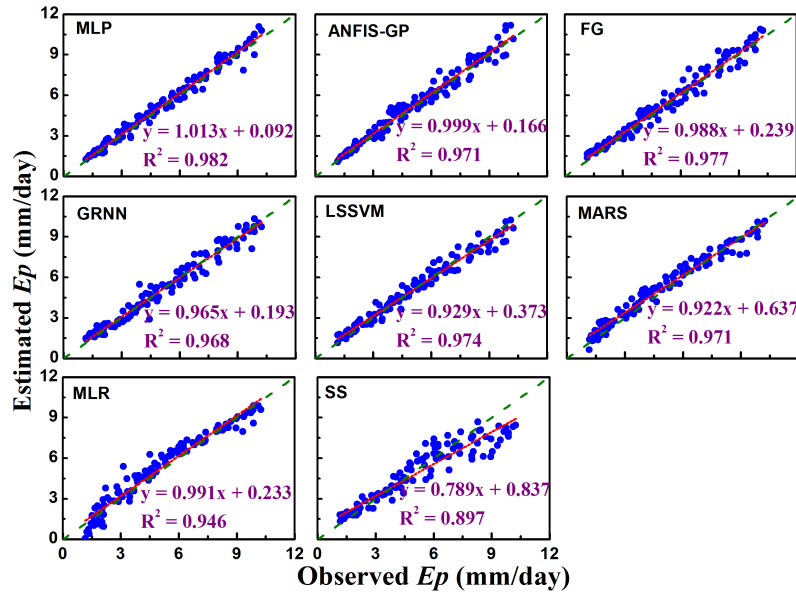


Fig. 8.

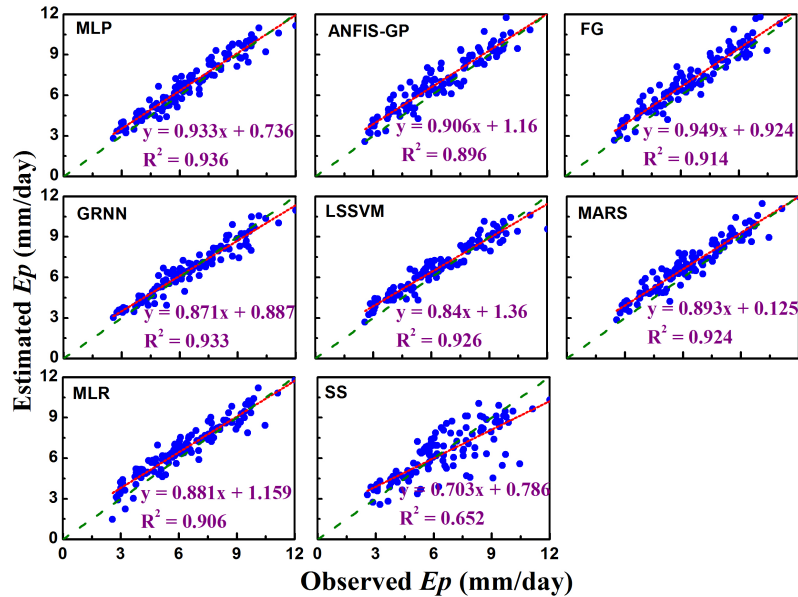


Fig. 9.

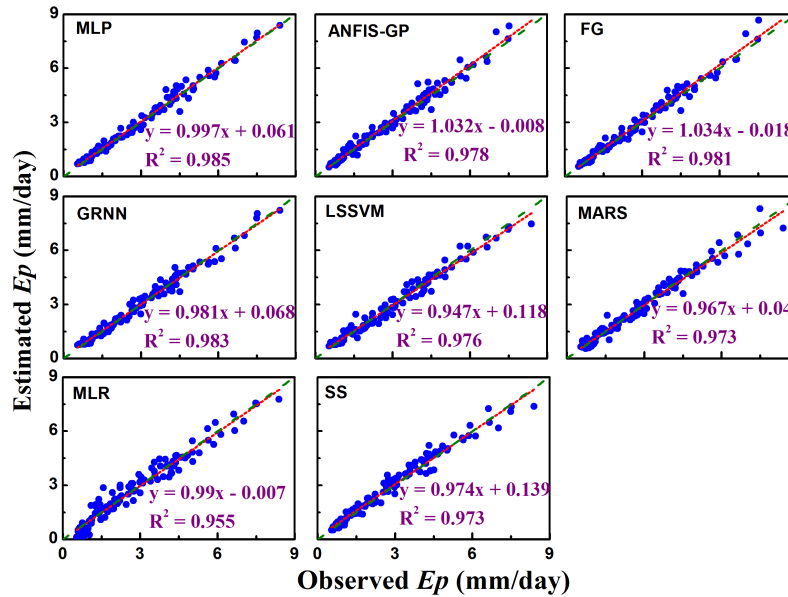


Fig. 10.

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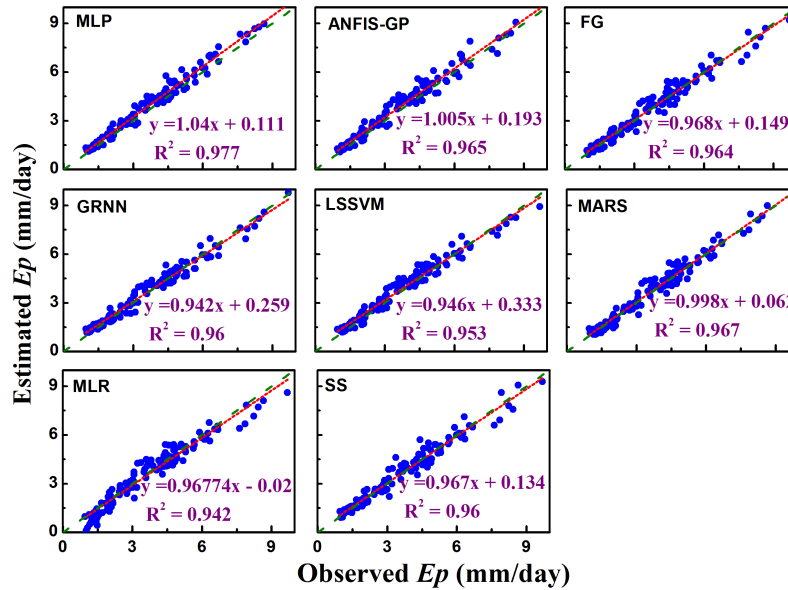


Fig. 11.

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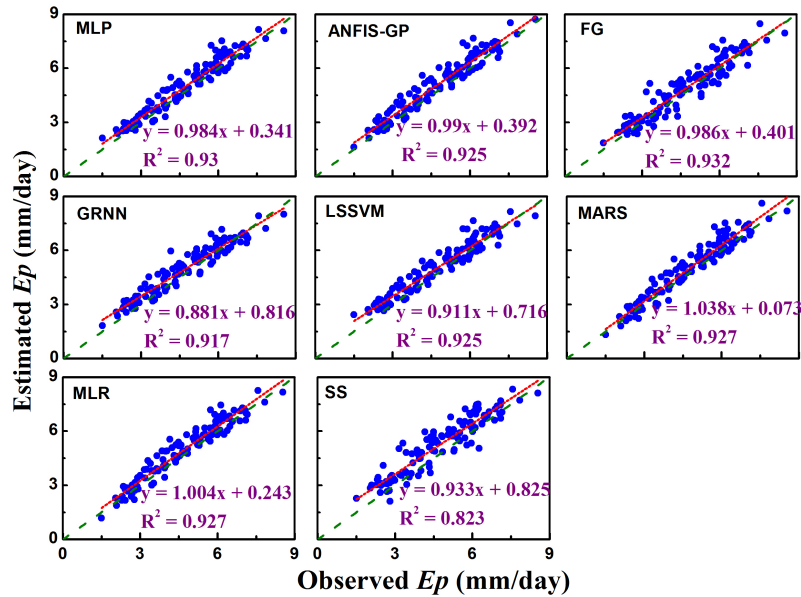


Fig. 12.

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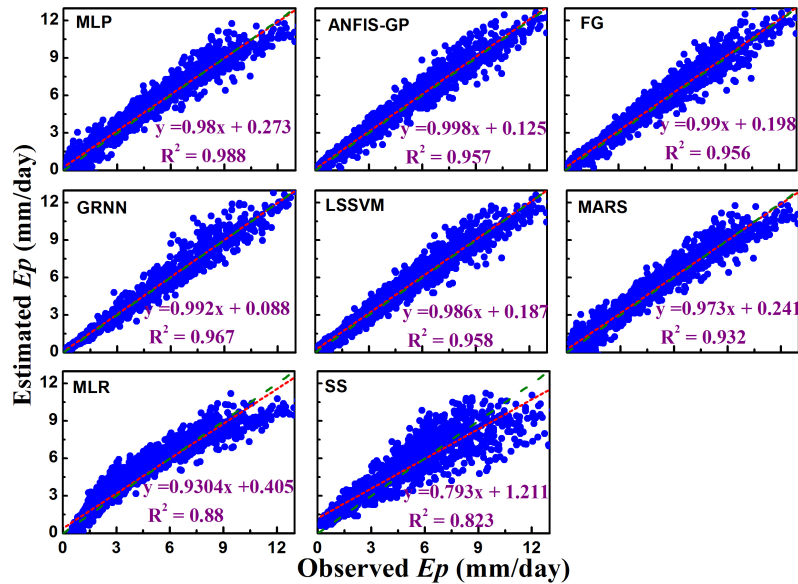


Fig. 13.

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