Evapotranspiration reconstruction based on land surface models and observed water budget components while considering irrigation

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**Introduction**

This supporting information provides Figures S1 to S9. Figure S1 shows the comparison and root mean square difference (RMSD) of the precipitation values between the CMA-0.5° and MSWEP datasets during 1998–2015 over the Yellow River basin. Figure S2 shows the comparison of water balance ET estimates based on the observation-based precipitation and precipitation computed using 57 gauge stations across the Yellow River basin. Figure S3 is the same as Figure 2 but based on the irrigation scheme using crop-specific monthly growing areas with wheat, maize, soybeans, and rice being taken
into account. Figure S4 shows evaluations of runoff in the GLDAS 1.0, 2.0, and 2.1 versions using collected naturalized runoff over the Yellow River basin. Figure S5 shows temperature and snowfall of GLDAS 1.0 over the Yellow River basin from 1979 to 2015. Figure S6 shows evaluations of monthly precipitation in the GLDAS 1.0, 2.0, and 2.1 using observation-based result. Figure S7 is the same as Figure 7 but based on the GLDAS 2.1 soil moisture, which shows comparisons of monthly evapotranspiration ($ET$) among average reconstructed $ET$ from four land surface models in GLDAS 1.0, three collected synthesis products, and water balance estimate. Figure S8 (S9) is the same as Figure 10 (11) but based on the GLDAS 2.1 soil moisture.
Figure S1. Comparison and RMSD of monthly precipitation (mm/month) between the CMA-0.5° and MSWEP datasets over the Yellow River basin from 1998 to 2015.
**Figure S2.** Comparison of water balance $ET$ estimates based on the observation-based precipitation and precipitation computed using 57 gauge stations across the Yellow River basin.
Figure S3. The same as Figure 2 but based on the irrigation scheme using crop-specific monthly growing areas with wheat, maize, soybeans, and rice being taken into account.
Figure S4. Evaluations of runoff (mm/year) in the GLDAS 1.0, 2.0, and 2.1 against naturalized runoff data over the Yellow River basin provided by the Yellow River Conservancy Commission.
Figure S5. GLDAS 1.0 temperature (a, °C) and snowfall (b, mm/year) over the Yellow River basin from 1979 to 2015.
Figure S6. Evaluations of precipitation (mm/month) in the GLDAS 1.0, 2.0, and 2.1 using observation-based result over the Yellow River basin.
Figure S7. The same as Figure 7 but based on the GLDAS 2.1 soil moisture.
Figure S8. The same as Figure 10 but based on the GLDAS 2.1 soil moisture.
Figure S9. The same as Figure 11 but based on the GLDAS 2.1 soil moisture.
Derivation of equation (8):

\[
\text{TWSC} = P - ET - R
\]

\[
\frac{\text{TWSC}}{P} = 1 - \frac{ET}{P} - \frac{R}{P}
\]

\[
\frac{\text{TWSC}}{P} = 1 - \beta - \alpha
\]

\[
\frac{\text{TWSC}}{P} \div \frac{ET}{P} = \frac{1 - \beta - \alpha}{\beta}
\]

\[
\frac{\text{TWSC}}{ET} = \frac{1 - \beta - \alpha}{\beta}
\]

\[
\Delta ET = \Delta R \times \frac{ET}{|\text{TWSC}| + ET}
\]

\[
\Delta ET = \Delta R \times \frac{1}{|\text{TWSC}/ET| + 1}
\]

\[
\Delta ET = \Delta R \times \frac{1}{|(1 - \beta - \alpha)/\beta| + 1}
\]