



*Supplement of*

## **Implementation of a multi-layer snow scheme in the GloSea6 seasonal forecast system: impacts on land–atmosphere interactions and climatological biases**

**Eunkyo Seo et al.**

*Correspondence to:* Eunkyo Seo (eseo@pknu.ac.kr)

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Supplementary materials

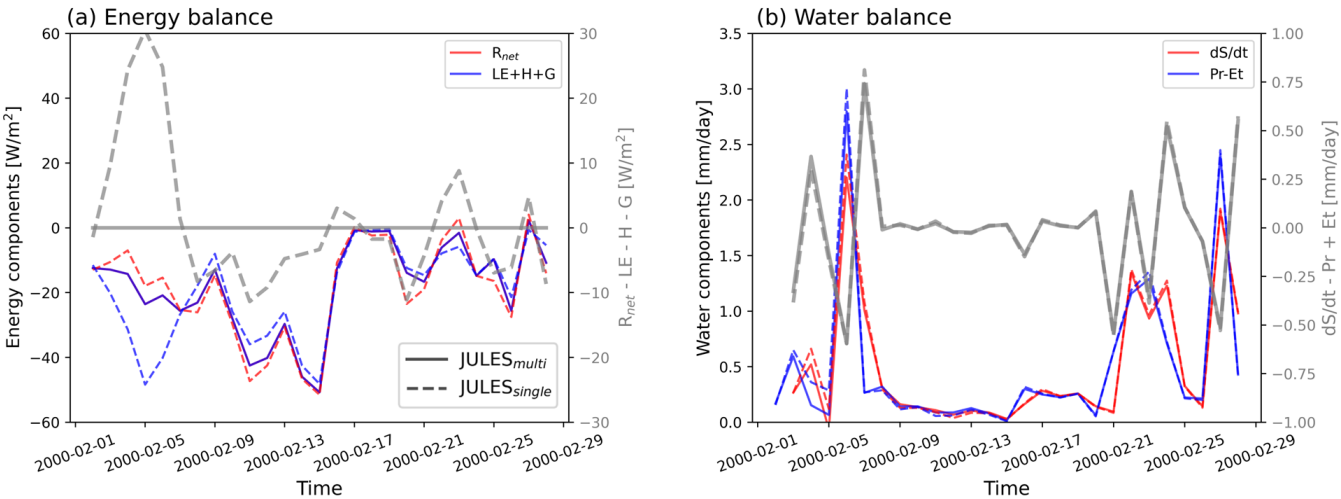
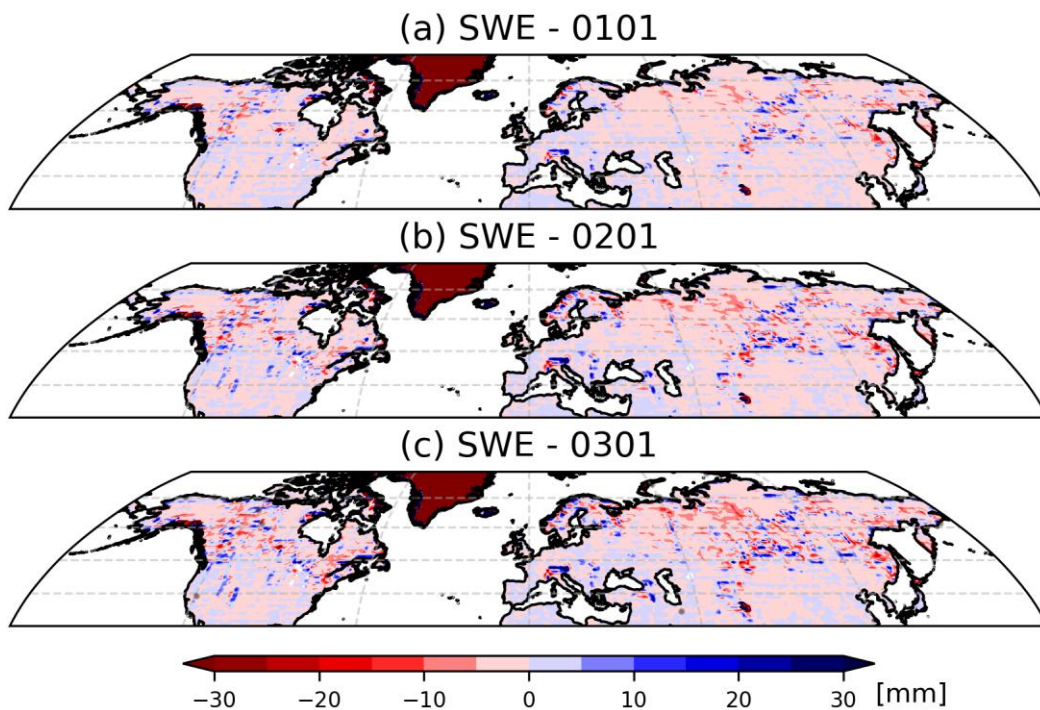


Figure S1: Daily time series of the components of (a) energy and (b) water budgets at a point in Eurasian continent (83.75E, 65.83N) for February of 2000 from JULES LSM offline simulations ( $JULES_{single}$ : dashed line and  $JULES_{multi}$ : solid line). The budget closure imbalance is shown in grey in each panel. Some terms necessary to close the water budget are missing from the model diagnostics, but the approximated balance is nearly unchanged between the two schemes.



10 **Figure S2: Spatial distribution of the climatological difference (GloSea6-GloSea5) of snow water equivalent from the average of 1-day forecasts from the runs initiated at 1<sup>st</sup> day of (a) January, (b) February, and (c) March for 24 years. The dotted area indicates the difference is statistically significant at a 95% confidence level after FDR control across the grid.**

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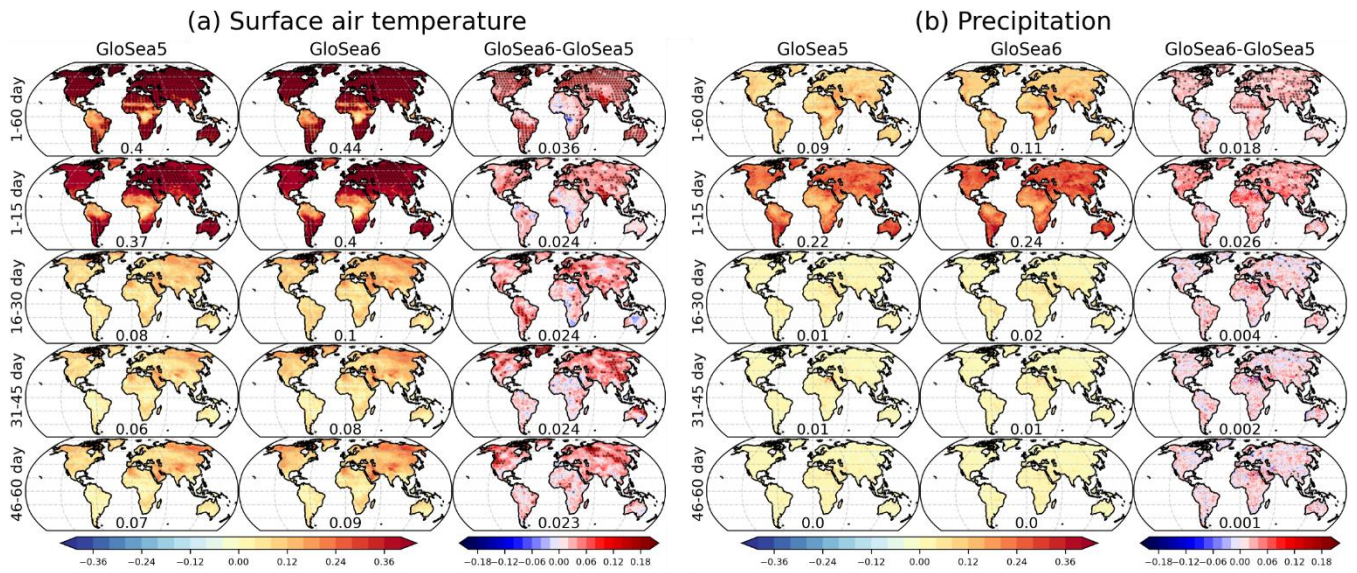


Figure S3: Spatial distribution of forecast skill, measured as the temporal correlation coefficient, for (a) surface air temperature and (b) precipitation in GloSea5 and GloSea6 across lead forecast days initiated in May–August of 1993–2016, where all available ensemble members are used. Dotted areas indicate statistical significance at a 95% confidence level.

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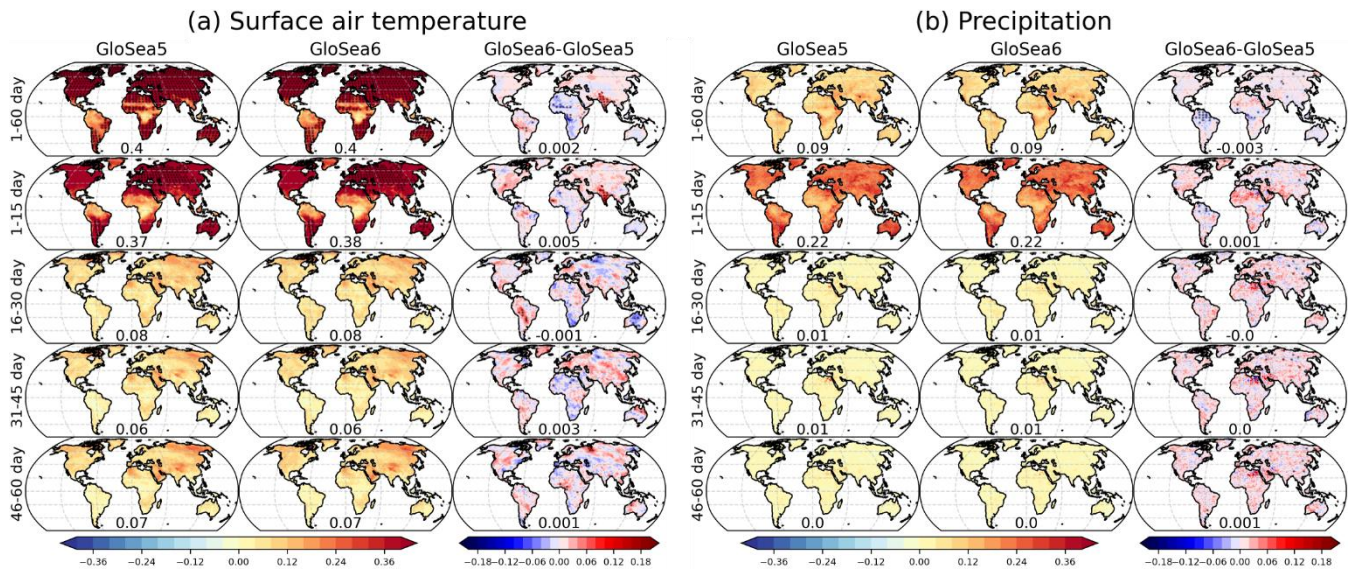


Figure S4: Same as Fig. S3, but when only three ensemble members are used for the assessment in GloSea5 and GloSea6.