Supplemental Material

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Role of Moisture Transport and Recycling in Characterizing Droughts: Perspectives from Two Recent U.S. Droughts and the CFSv2 System

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Supplementary Online Materials for

Role of moisture transport and recycling in characterizing droughts: Perspectives from two recent US droughts and the CFSv2 system

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SUPPLEMENTARY FIGURES

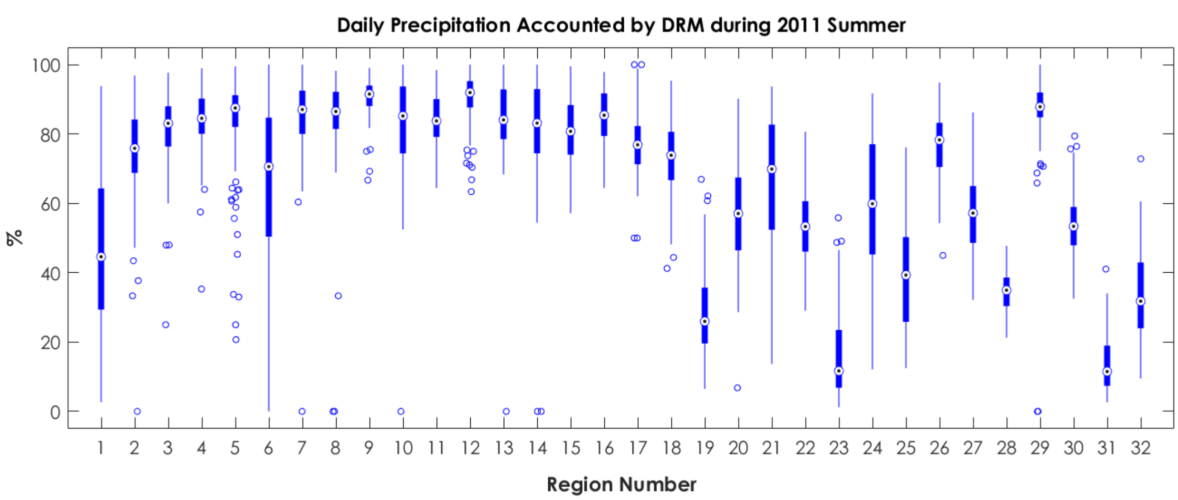

Figure S1: Percentage of daily CFSR precipitation accounted for by the DRM during 2011 summer. DRM loses some moisture across the boundaries of the problem domain, because of which, regions near the boundaries account for less moisture as compared to the ones in the middle (e.g. compare R12 against R31).

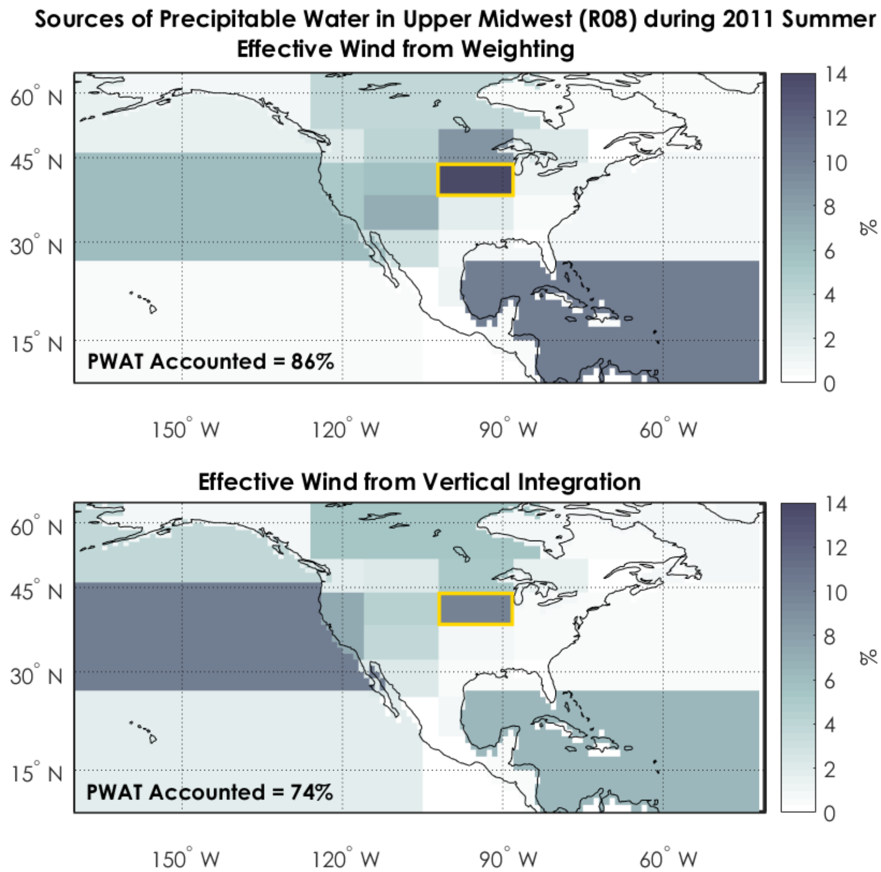

Figure S2: Comparison of the DRM results for two different approaches of effective wind speed calculation, shown for the Upper Midwest (R08) summer in 2011. TOP PLOT: Effective wind speed is calculated based on a weighting scheme (see Section 2.2 in the main paper). BOTTOM PLOT: Effective wind speed is calculated by dividing vertically integrated moisture flux with precipitable water. The weighting scheme resulted in more moisture accounting (86% vs. 74%). Furthermore, the spatial distribution of moisture sources also looks more realistic in the top plot. For example, the Upper Midwest in the top plot has high moisture contributions from the Atlantic Ocean and through local recycling. The bottom plot, on the other hand, shows Pacific Ocean to be a significant moisture contributor, which is quite unlikely, since the Rocky Mountains act as a barrier for moisture transport from the Pacific Ocean to the Upper Midwest.

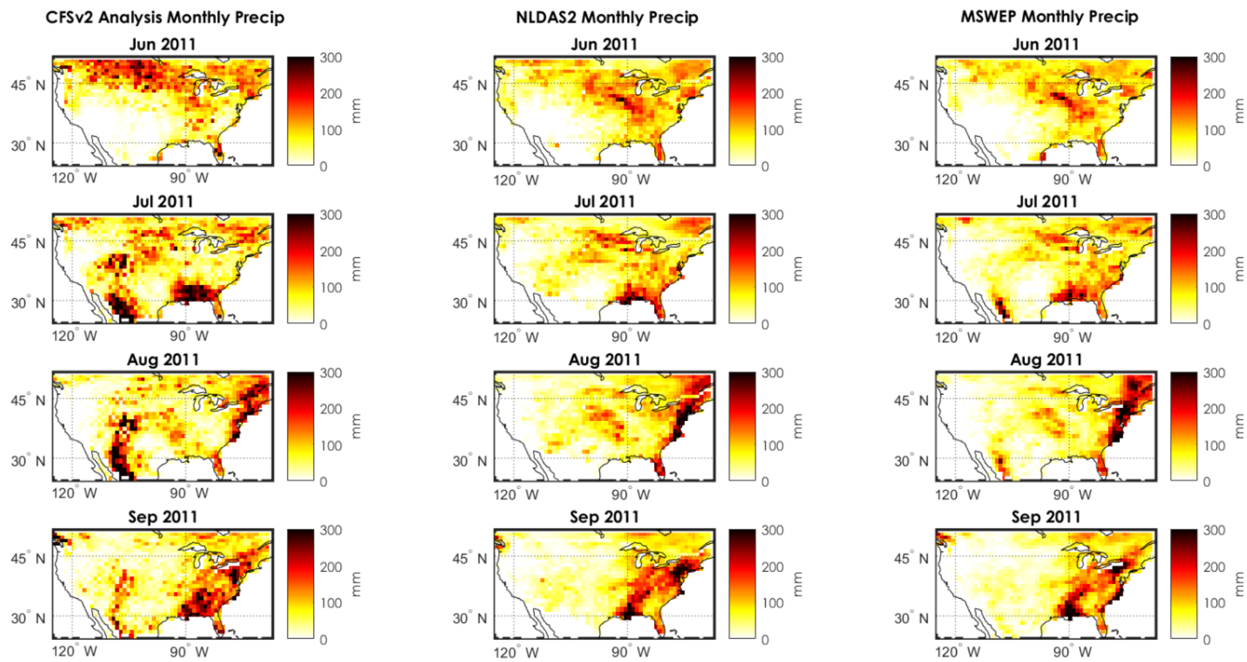

Figure S3: Spatial comparison of monthly precipitation from CFSR, NLDAS2, and MSWEP during the four summer months of 2011 (Texas had drought during this period). Note that NLDAS2 does not have precipitation for Mexico.

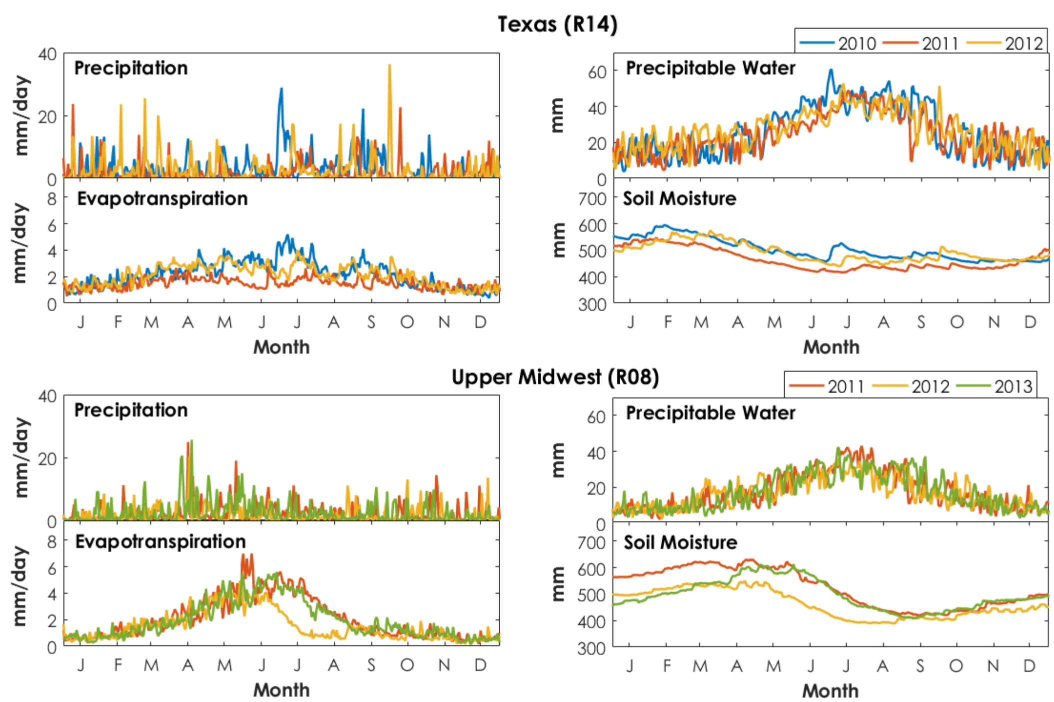

Figure S4: Time series plots of precipitation, precipitable water, evapotranspiration, and soil moisture for Texas (R14) during 2010-2012 and the Upper Midwest (R08) during 2011-2013 from the CFSv2 analysis. This figure is similar to Figure 2 in the main paper, but shows the actual time series instead of the cumulative series.

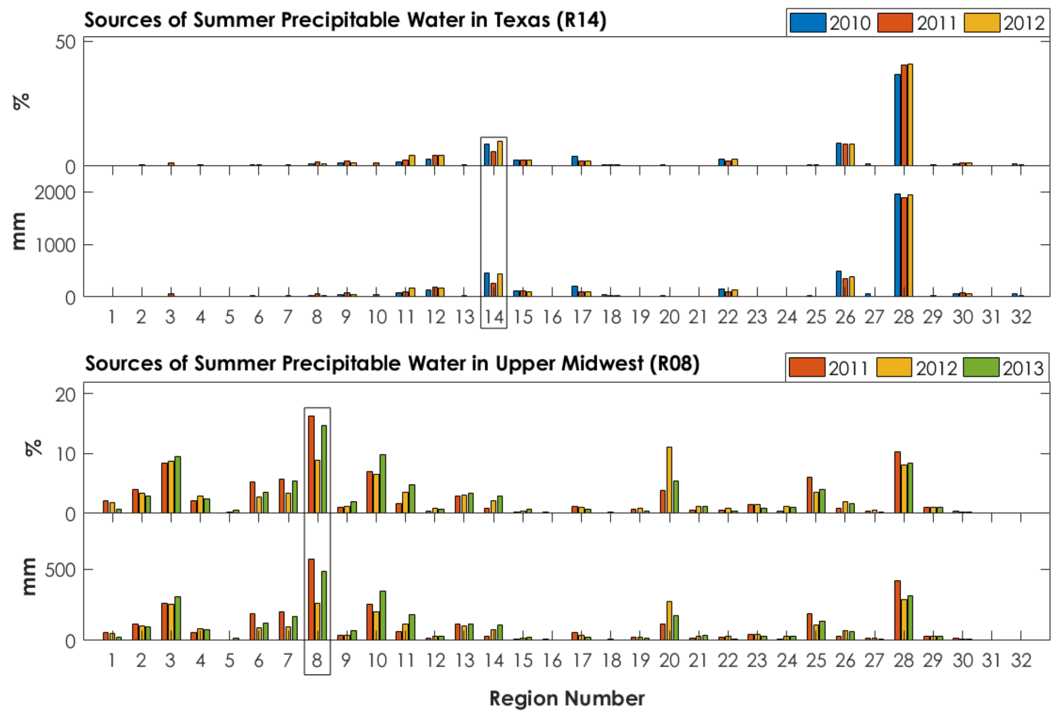

Figure S5: Recycling ratio (%) and recycled precipitable water (mm) from different sources to Texas (R14) and the Upper Midwest (R08). This figure is similar to Figure 3 in the main paper, but shows precipitable water instead of precipitation.

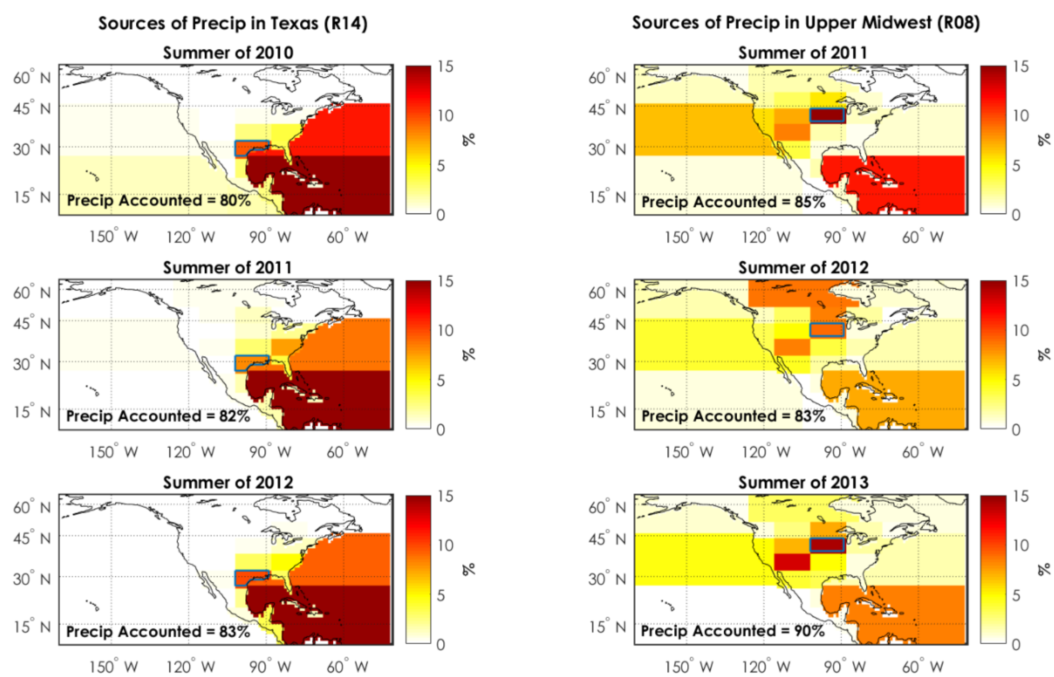

Figure S6: Sources of precipitation in Texas (R14) during the summer of 2010-2012 and in the Upper Midwest (R08) during the summer of 2011-2013. This figure is similar to Figure 4 in the main paper, but shows the contributions in terms of percentages.

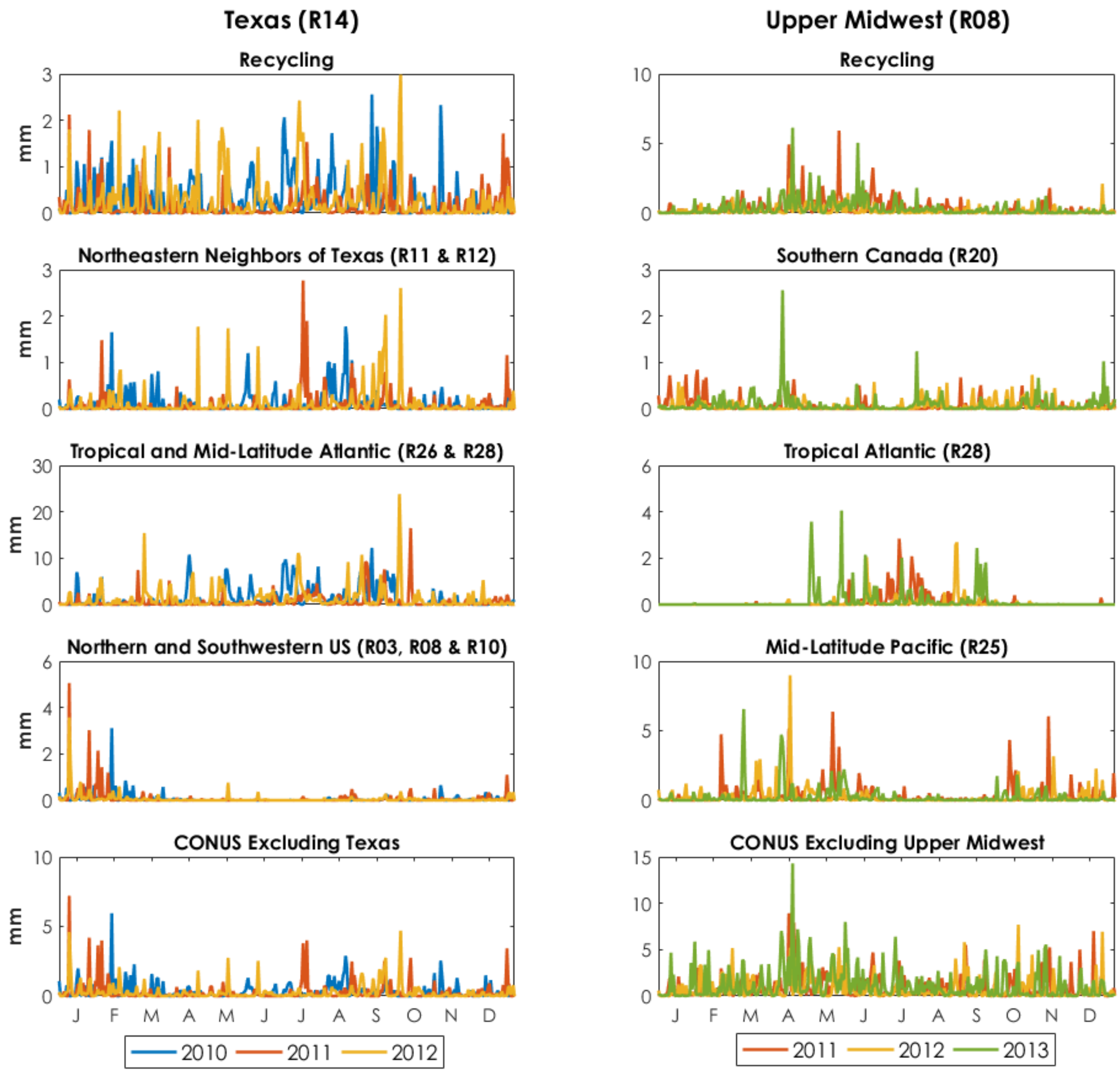

Figure S7: Temporal patterns of recycled and advected precipitation for Texas (R08) and the Upper Midwest (R08). This figure is similar to Figure 5 in the main paper, but shows the actual time series instead of the cumulative series.

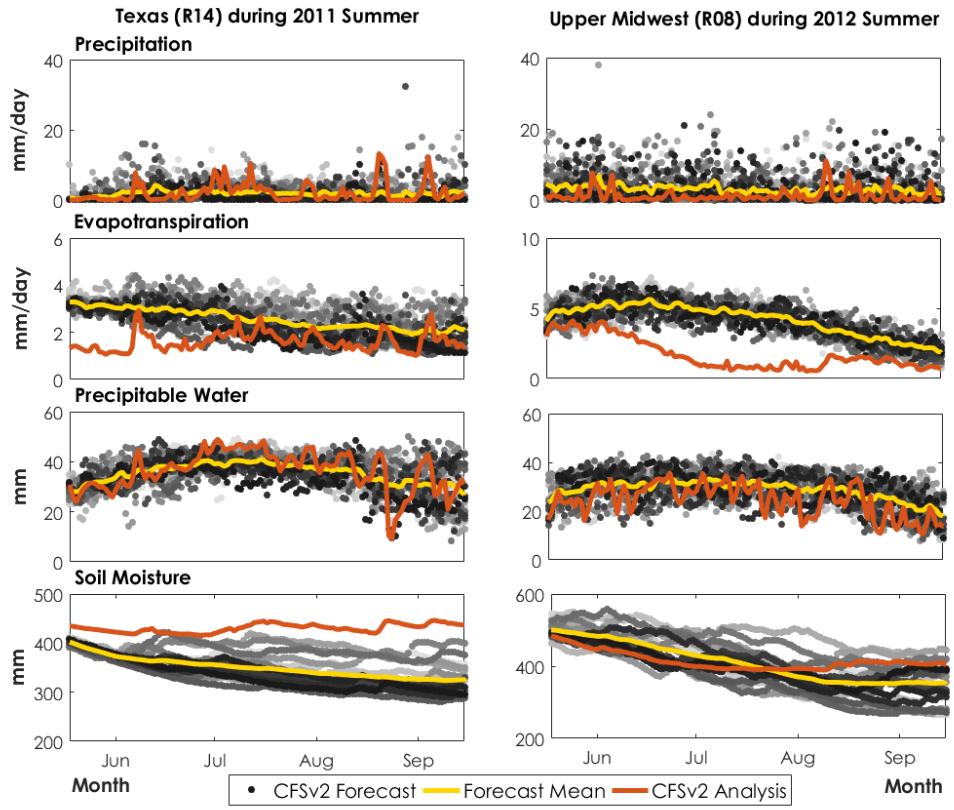

Figure S8: Comparison of precipitation, evapotranspiration, precipitable water, and soil moisture from CFSv2 analysis and forecasts. This figure is similar to Figure 6 in the main paper, but shows the actual time series instead of the cumulative series.

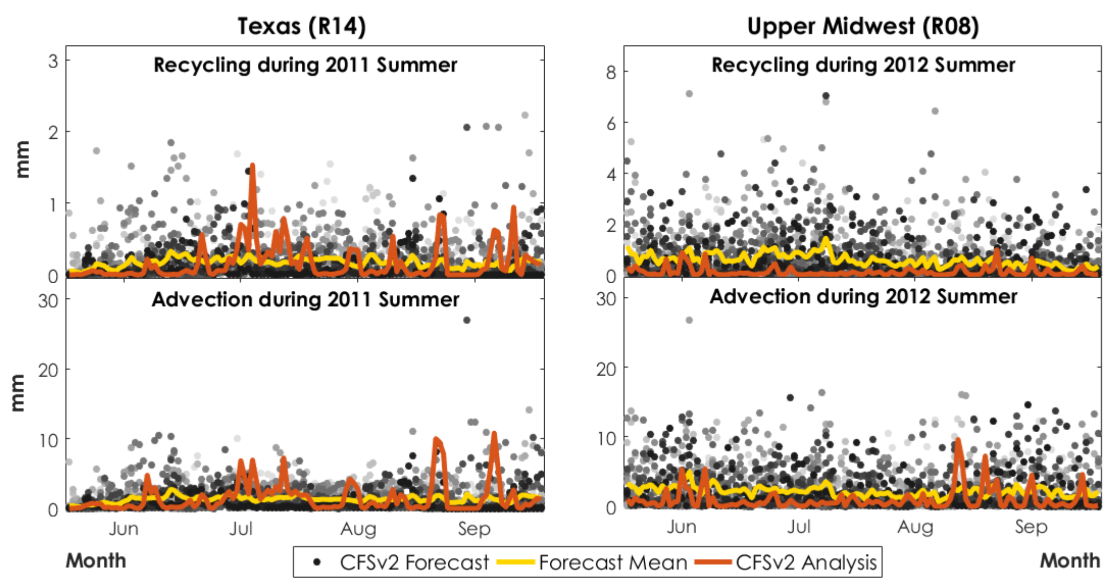

Figure S9: Comparison of advected and recycled precipitation from the CFSv2 analysis and forecasts. This figure is similar to Figure 7 in the main paper, but shows the actual time series instead of the cumulative series.

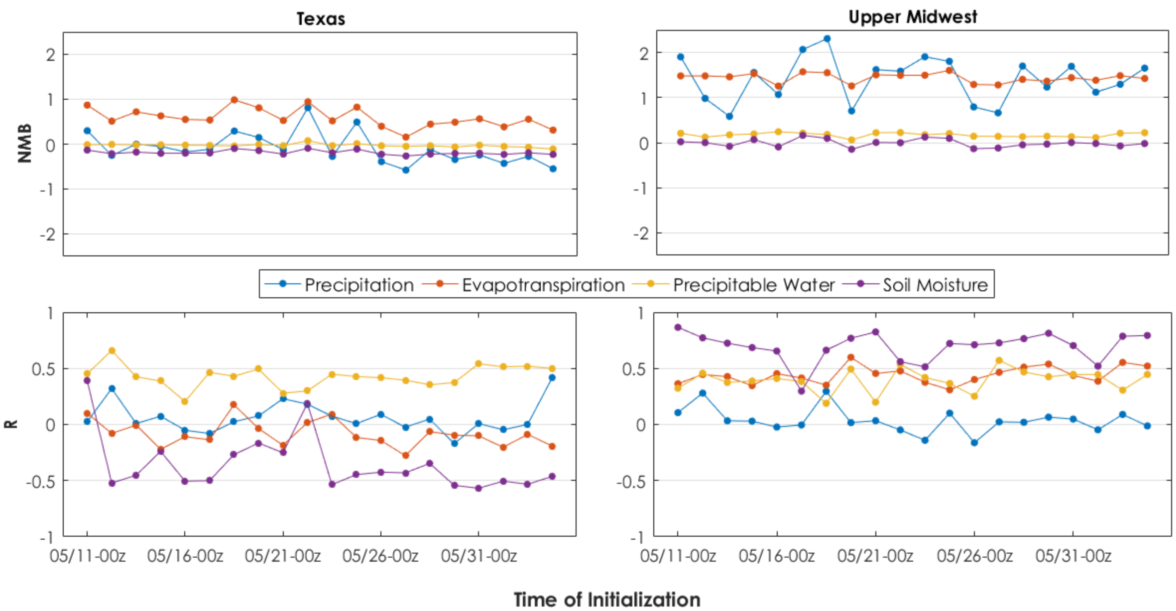

Figure S10: Normalized Mean Bias (NMB) and Pearson's Linear Correlation Coefficient (R) calculated for the CFSv2 forecasts with different initialization times using CFSv2 analysis as the reference. This figure shows results for the entire summer (JJAS).

SUPPLEMENTARY TABLES

Table S1: Data files used in this study for any given day.

Time (UTC)	UGRD, VGRD, SPFH, PWAT	LHTFL, PRATE
00	cdas1.t00z.pgrbhanl.grib2	cdas1.t00z.sfluxgrbf00.grib2
06	cdas1.t06z.pgrbhanl.grib2	cdas1.t06z.sfluxgrbf00.grib2
12	cdas1.t12z.pgrbhanl.grib2	cdas1.t12z.sfluxgrbf00.grib2
18	cdas1.t18z.pgrbhanl.grib2	cdas1.t18z.sfluxgrbf00.grib2