Geophysical Research Letters

Supporting Information for

A Comparison of NOAA Modeled and In Situ Soil Moisture Estimates Across the Continental United States

Peter J. Marinescu[1], Kyle Hilburn[1], Daniel Abdi[2], Isidora Jankov[3]

1: Cooperative Institute for Research in the Atmosphere, Colorado State University, Fort Collins, Colorado
2: Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, Colorado
3: Global Systems Laboratory, NOAA/OAR, Boulder, Colorado

Contents of this file

Introduction

In this supporting information document, we provided extended analyses of comparisons of soil moisture mean and standard deviations between our three datasets as a function of month and season. While this seasonal variability was not a focus of our study, we believe that this information may be useful to the broader scientific community. We further note that because the analyses include ~2.4 years of data, the monthly and seasonal analyses have only 2-3 years of data and therefore, outlier results from one year could possibly skew these results. The analyses of quintiles based on mean soil moisture amounts (Figs. S1-S4) follow the same methods as described in the manuscript. Figures (S5-S8) are similar to Figure 1 in the manuscript and represent maps of temporally averaged integrated soil moisture (ISM) means and standard deviations for the different seasons: winter (December-February), spring (March-May), summer (June-August) and autumn (September-November).

Text S1.

It is important to note that the differences in the data's 1.6 m integrated soil moisture (ISM) and volumetric soil moisture (VSM) means and standard deviations vary throughout the year (e.g., Fig. S1-S8). For most locations, the sign of the differences between the datasets are constant throughout the year, although the magnitudes of these differences can change significantly throughout the year. Also, regionally, there are instances where the sign of the ISM difference changes during different times of the years. For example, in the coastal Pacific Northwest region, the ISM mean difference changes from negative in DJF and MAM (Fig. S5-6) to positive in JJA and SON (Fig. S7-8). Similarly, standard deviation differences vary significantly at different times of the year across the Southeast U.S. (Fig. S5-8). These monthly and seasonal changes are likely associated with the changing precipitation patterns and/or soil moisture processes (i.e., evapotranspiration, snow melt and runoff) that vary regionally and seasonally across CONUS.

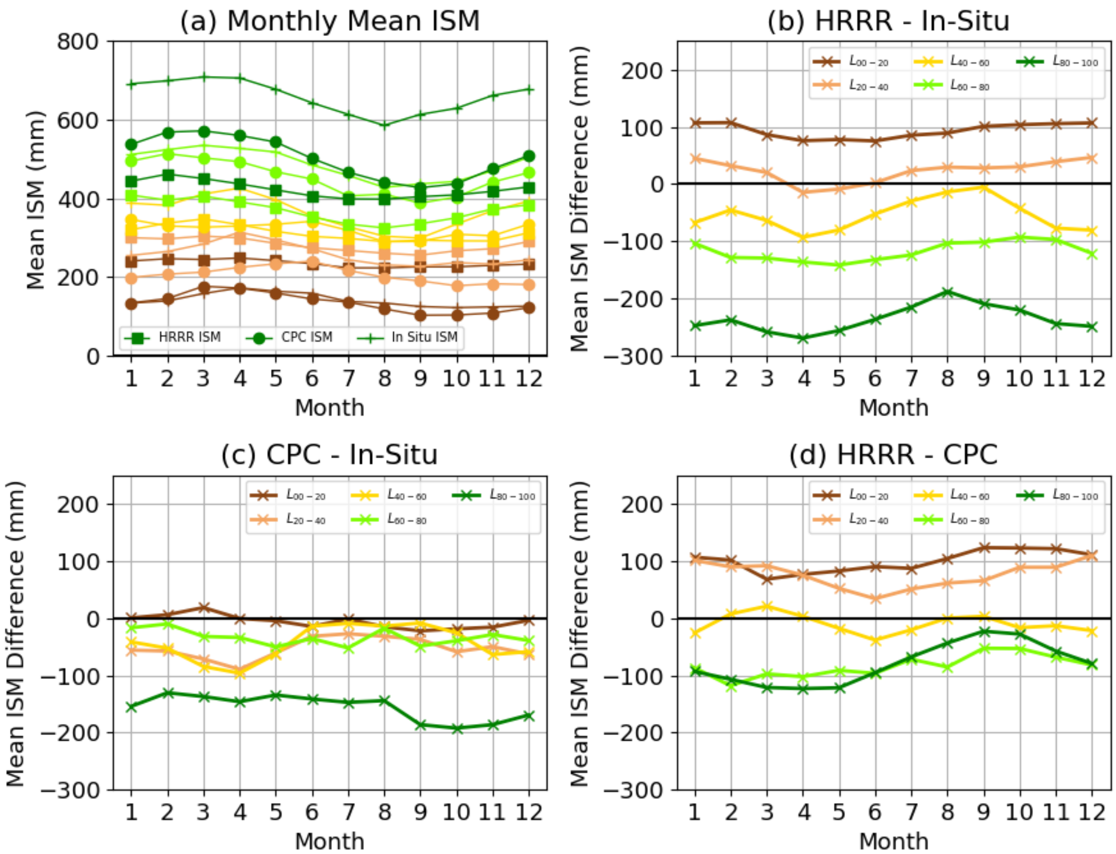

Figure S1. (a) Monthly 1.6 m deep ISM means for HRRR, CPC and in situ data. Data shown is the mean for the five quintiles based on ISM amounts from the driest 20% (brown) to the wettest 20% (dark green). (b-d) shows the mean of the ISM mean differences between all three datasets. Locations are placed into quintiles based on the average ISM for all three datasets.

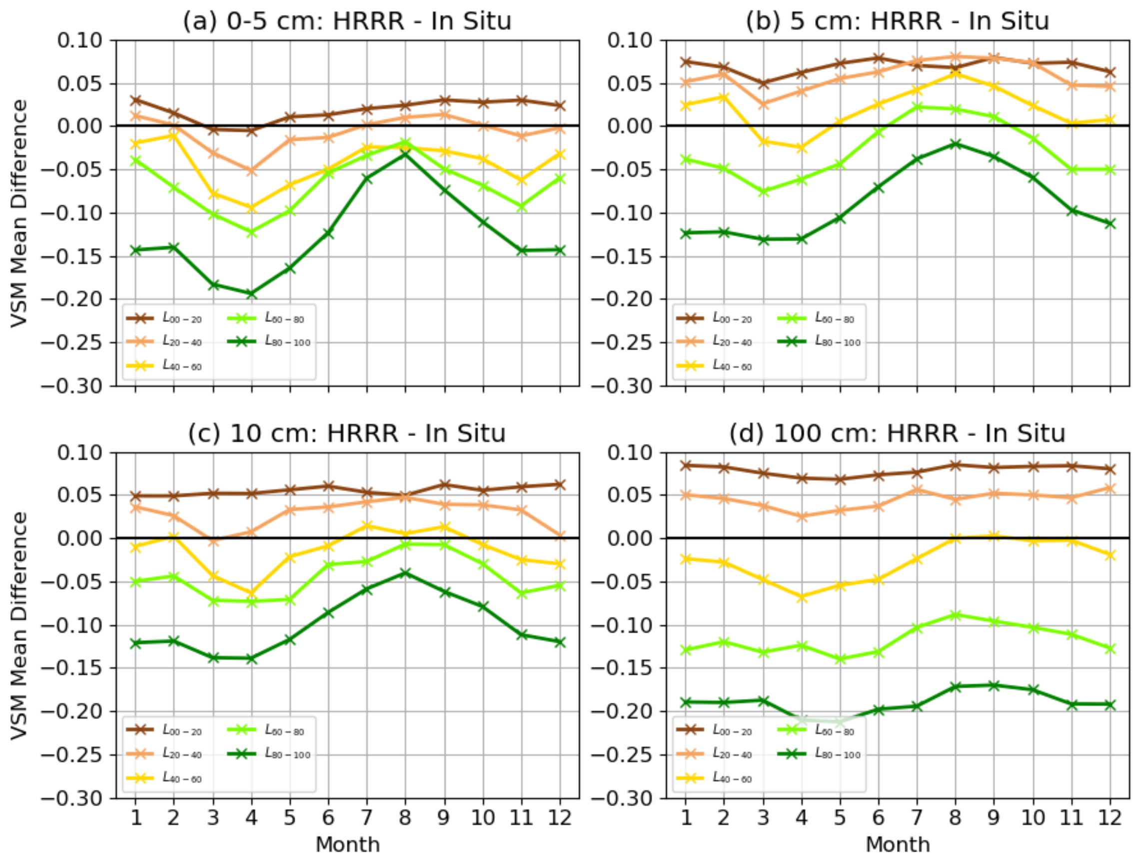

Figure S2. Monthly differences of HRRR and in situ VSM means at four different soil depths: (a) 0 cm in HRRR and 5 cm in the in situ observations; (b) 5 cm, (c) 10 cm, and (d) 100 cm. Data shown is the mean difference for the data separated into five quintiles based on VSM amounts from the driest 20% (brown) to the wettest 20% (dark green). Locations are placed into quintiles based on the average VSM for both HRRR and in situ data and are calculated separately for each soil depth.

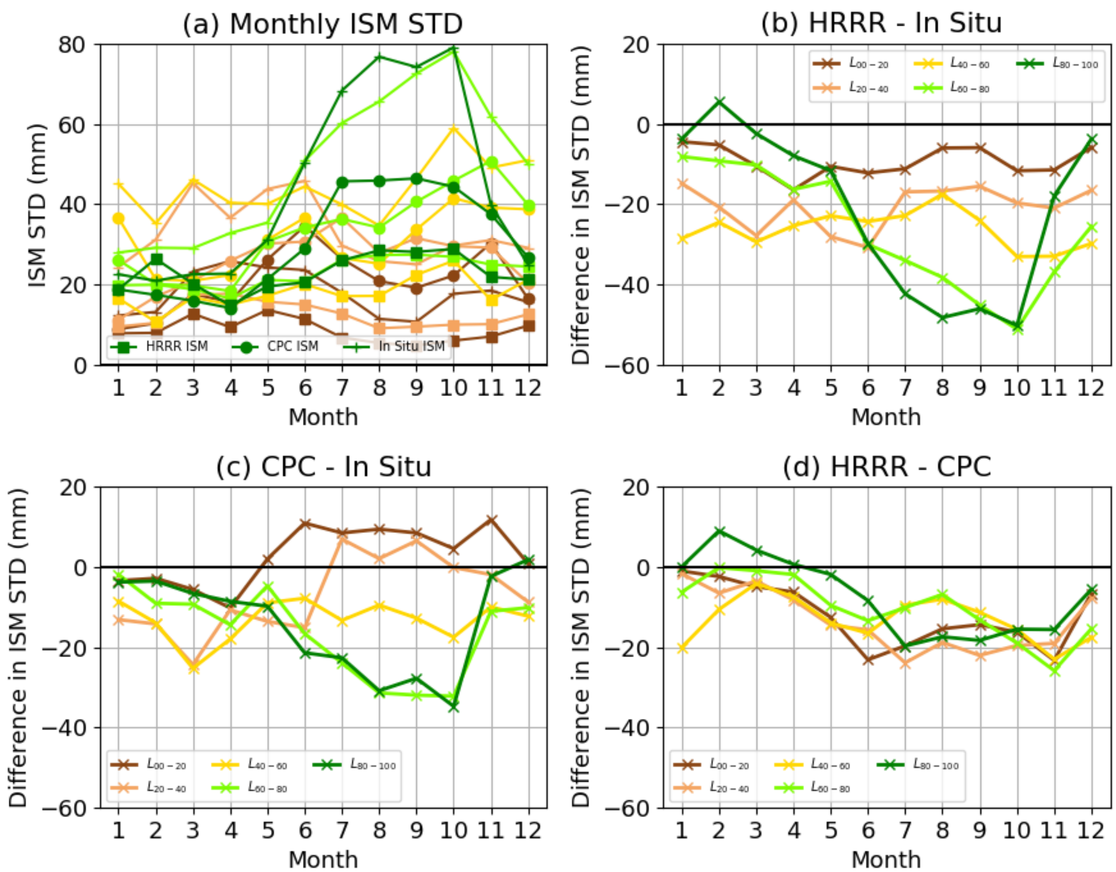

Figure S3. (a) Monthly 1.6 m deep ISM standard deviation for HRRR, CPC, and in situ data. Data shown as the mean of the quintiles from the driest 20% (brown) to the wettest 20% (dark green). (b-d) shows the mean differences of the ISM standard deviation comparisons between all three datasets.

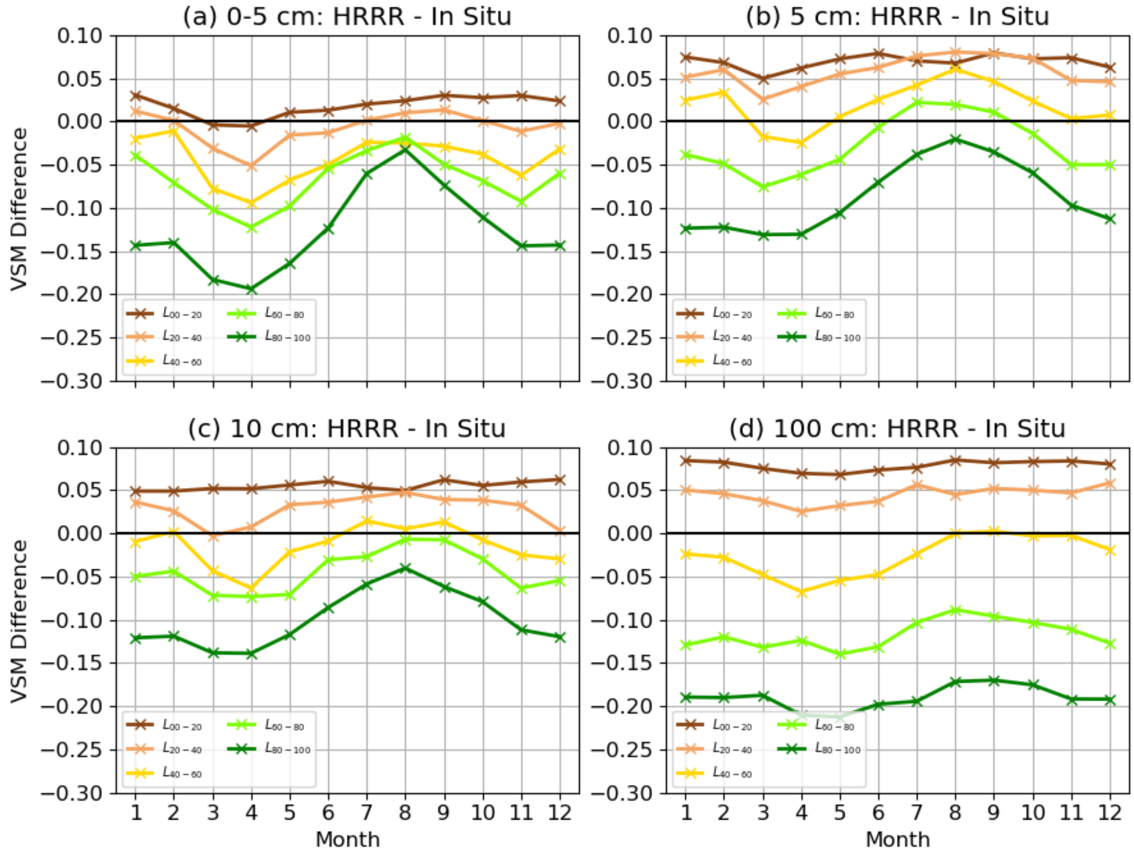

Figure S4. Monthly differences of HRRR and in situ VSM standard deviations at four different soil depths: (a) 0 cm in HRRR and 5 cm in the in situ observations; (b) 5 cm, (c) 10 cm, and (d) 100 cm. Data shown as the mean of the five quintiles of data from the driest 20% (brown) to the wettest 20% (dark green). Quintiles are based on the average VSM for both HRRR and in situ data and are calculated separately for each soil depth.

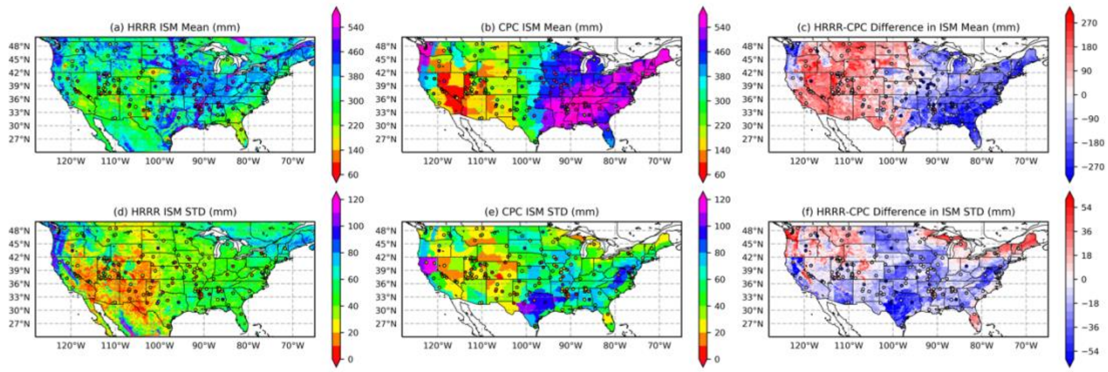

Figure S5. 1.6 m deep ISM values and standard deviations temporally averaged over the study period for the winter months of December, January and February. (a) represents the HRRR model, (b) represents the CPC model, and (c) represents their difference. (d-f) are the same as (a-c), except for the ISM standard deviations. Filled circles represent locations of the 172 in situ observations from the USCRN and SCAN networks that pass quality control checks, as described in the text. In (c) and (f), the filled circles represent the difference HRRR minus in situ observation, while the filled circles represent the in situ station ISM mean and standard deviations, respectively, for the other panels.

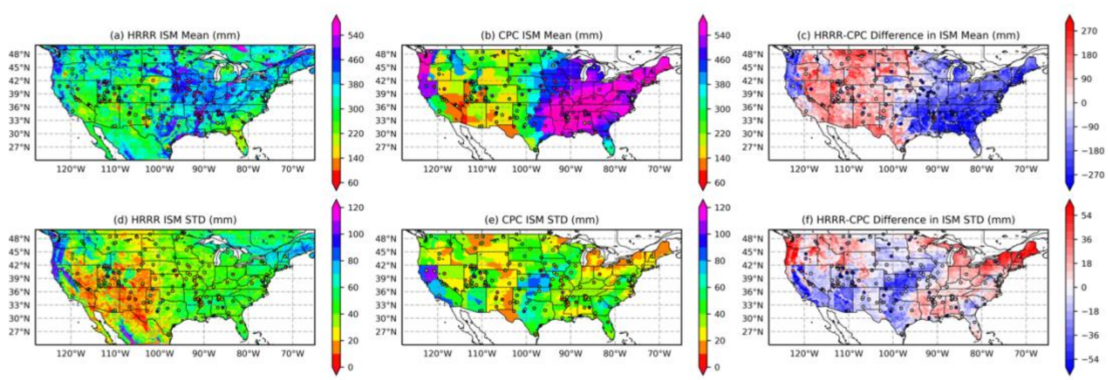

Figure S6. Same as Figure S5, but for the spring months of March, April and May.

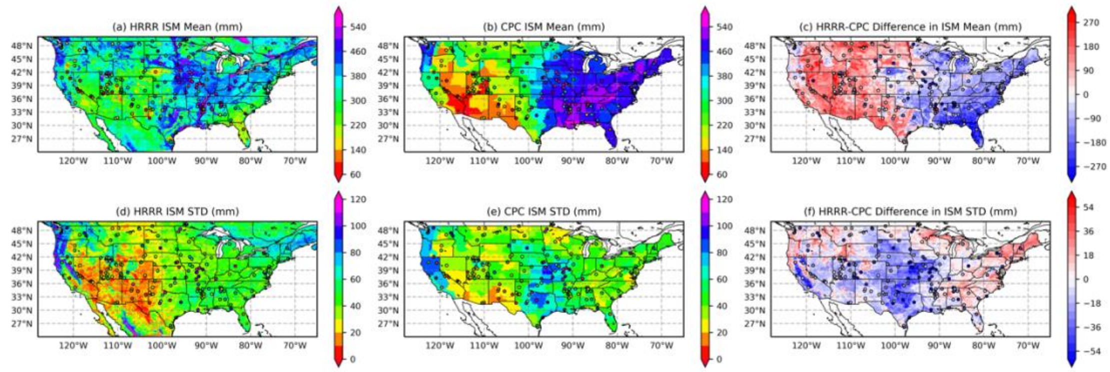

Figure S7. Same as Figure S5, but for the summer months of June, July and August.

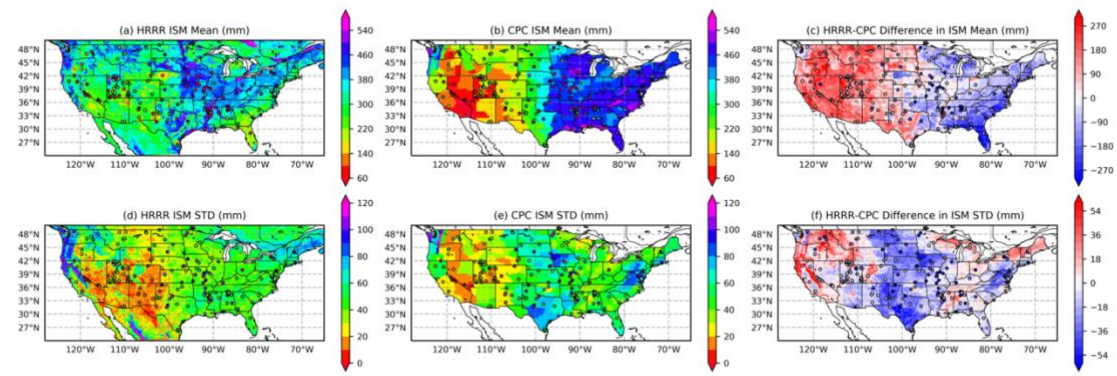

Figure S8. Same as Figure S5, but for the autumn months of September, October and November.