

How are CFS seasonal forecasts affected by poor snow initialization?

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Due to poor snow initialization, whereby SWE is initialized to be too low, the National Center for Environmental Research's Climate Forecast System (CFS) predicts less SWE on a particular date in later forecasts than in earlier forecasts: forecasts made earlier in the winter tend to have more SWE than forecasts made later in the winter, and later forecasts tend to predict earlier melt than earlier forecasts. In this research, we examine the impact that this has on other forecast quantities at the spring-summer transition (from April-June). We find that the snow cover affects some model quantities such as net shortwave radiation, turbulent heat fluxes, soil moisture, and near-surface air temperature much more than do sea surface temperatures, demonstrating the fundamental importance of snow for seasonal and sub-seasonal forecasting during the spring-summer transition. Furthermore, we find that in the CFS, later predictions of SWE (e.g. those made on April 1st) are actually worse than earlier SWE predictions (e.g. those made on January 1st), yet later predictions of air temperature show much less bias than earlier predictions of air temperature. This suggests CFS deficiencies in the atmospheric processes (e.g., radiative transfer) that provide compensating errors for the initialized shallow snowpacks.