Online appendix C: shorter-range precipitation forecasts.

a supplement to

Performance of Operational Model Precipitation Forecast Guidance During the 2013 Colorado Front-Range Floods

by

Thomas M. Hamill

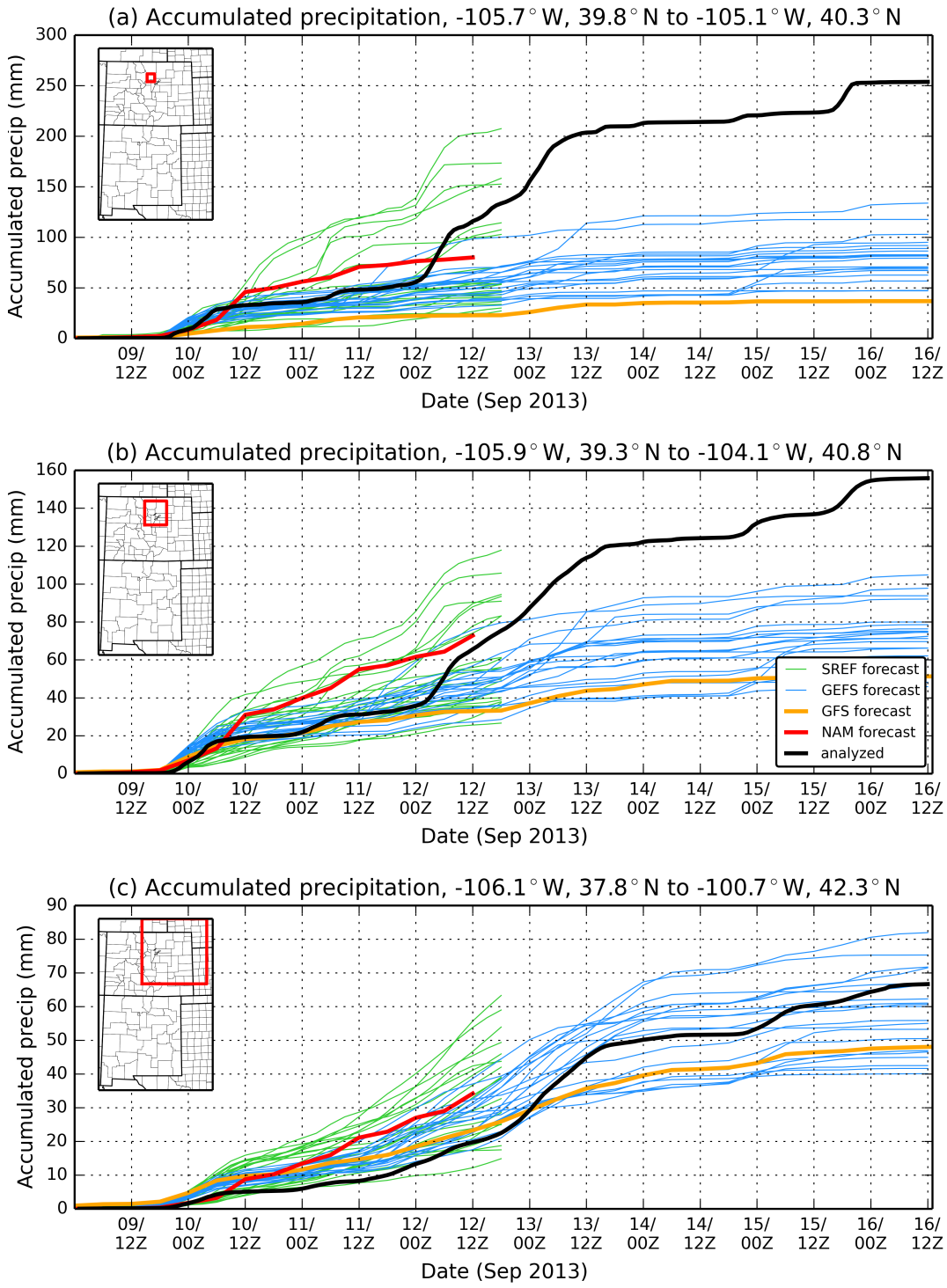

Figure C1: "Plume" diagrams of accumulated precipitation forecasts and the analysis for shorter-range deterministic and ensemble forecast systems provided by the NWS, initialized 12 UTC 09 Sep 2013. The three panels provide the forecast and analyzed accumulated precipitation averaged over three increasingly large areas, denoted by the red box in each figure. Only the first 20 members of each ensemble prediction system are displayed. SREF forecasts are initialized 3 h later, at 15 UTC.

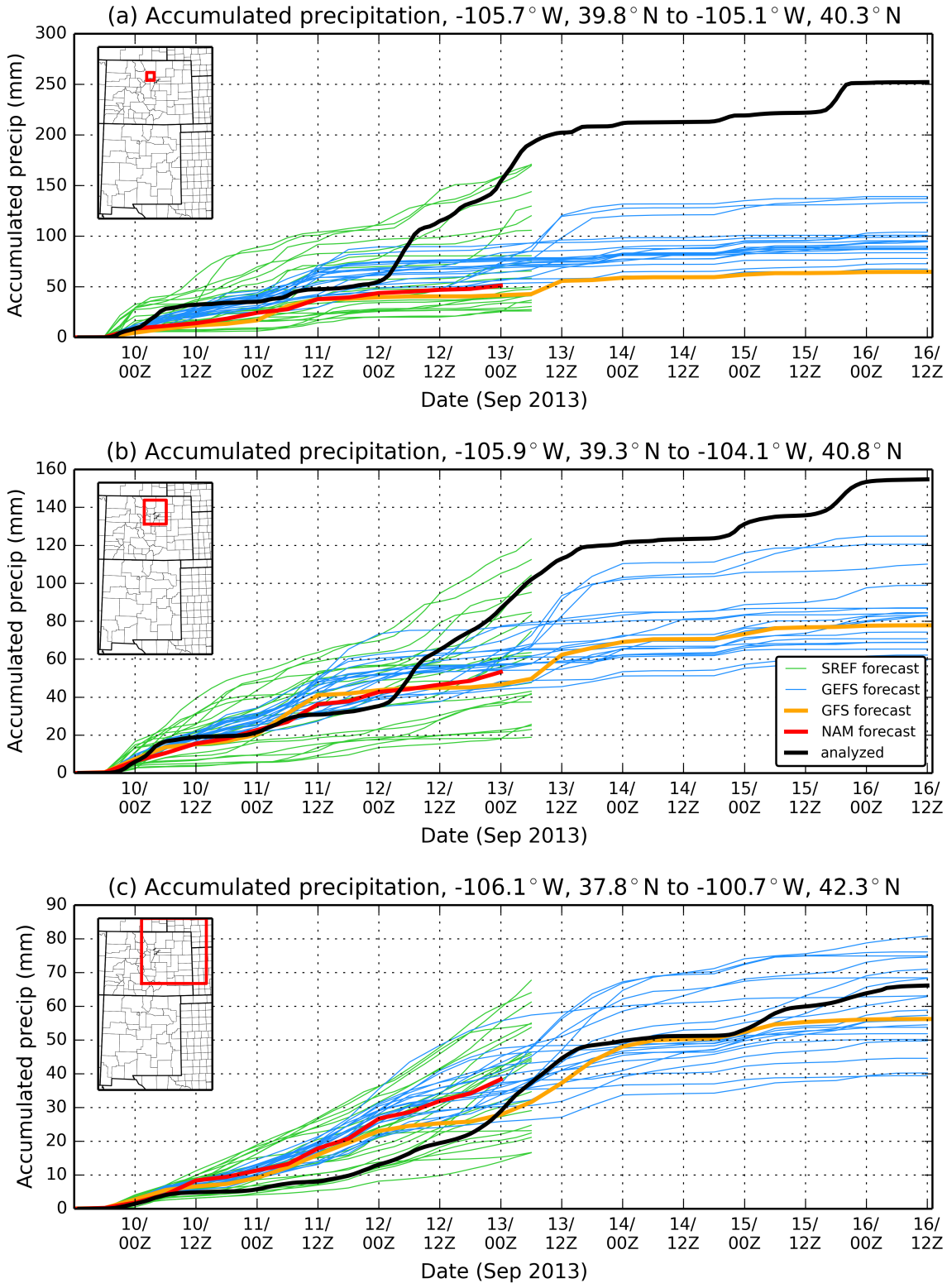

Figure C2: As in Fig. C1, but for forecasts initialized on 12 UTC 09 Sep 2013.

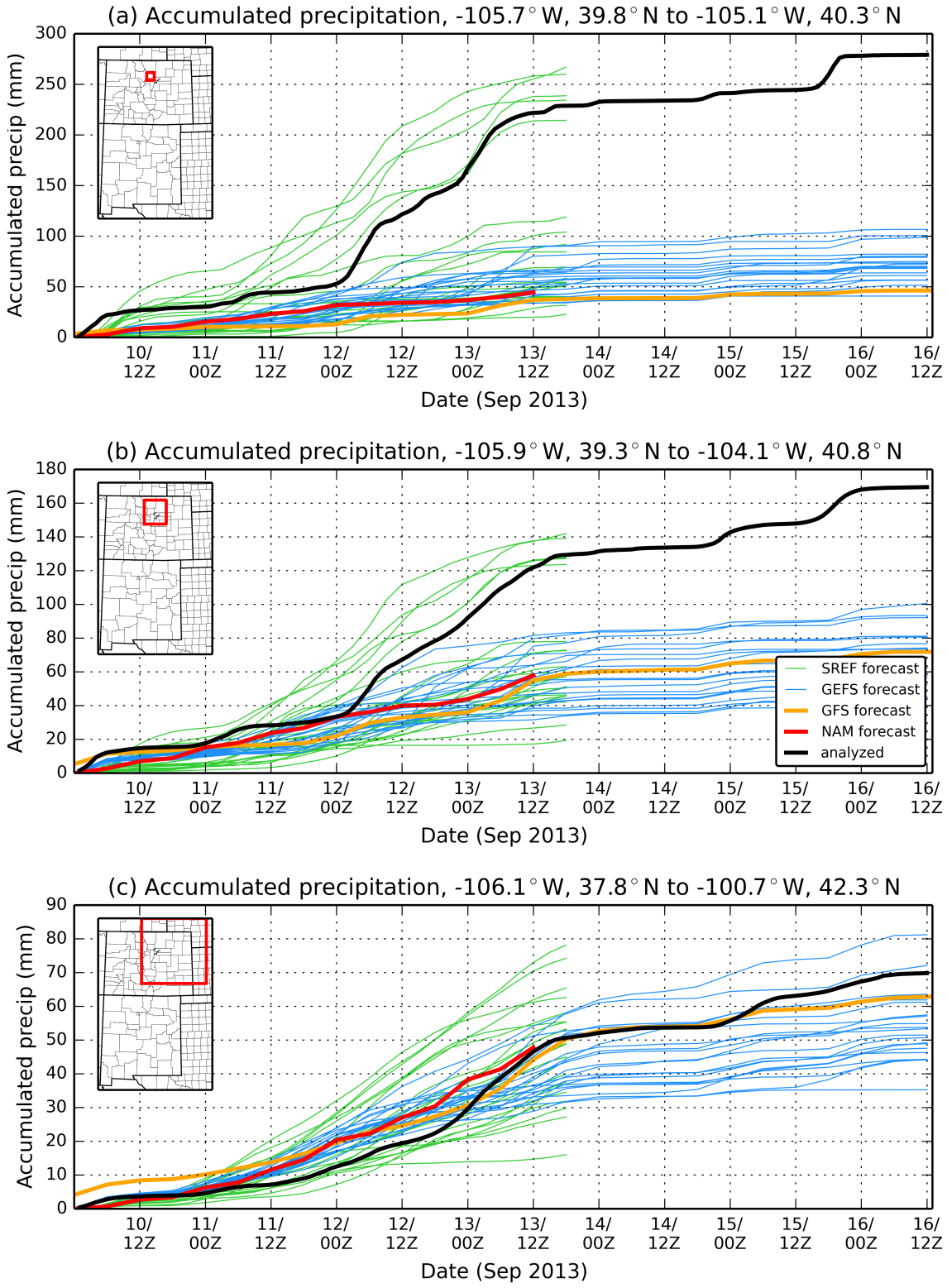

Figure C3: As in Fig. C1, but for forecasts initialized on 00 UTC 10 Sep 2013.

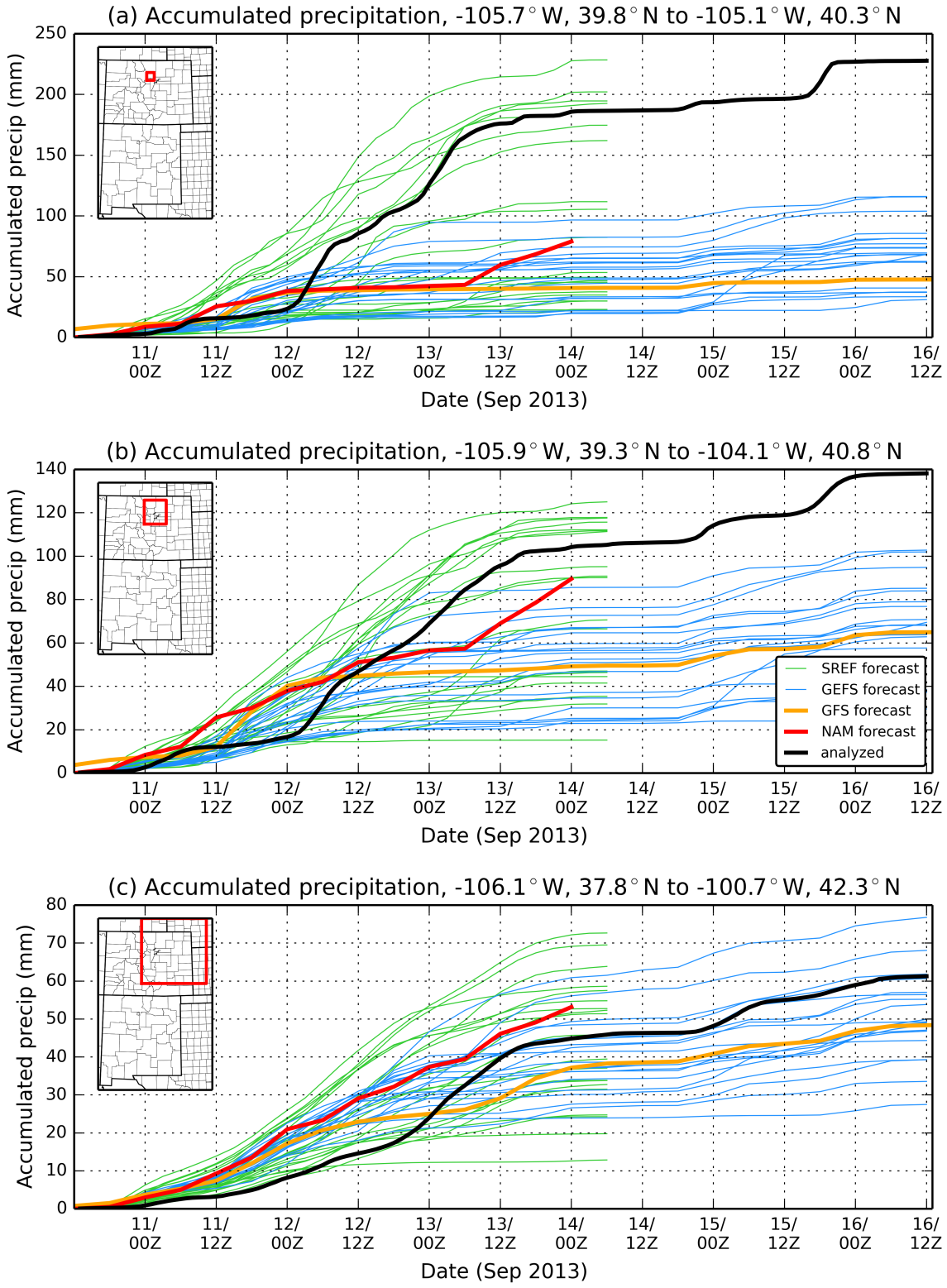

Figure C4: As in Fig. C1, but for forecasts initialized on 12 UTC 10 Sep 2013.

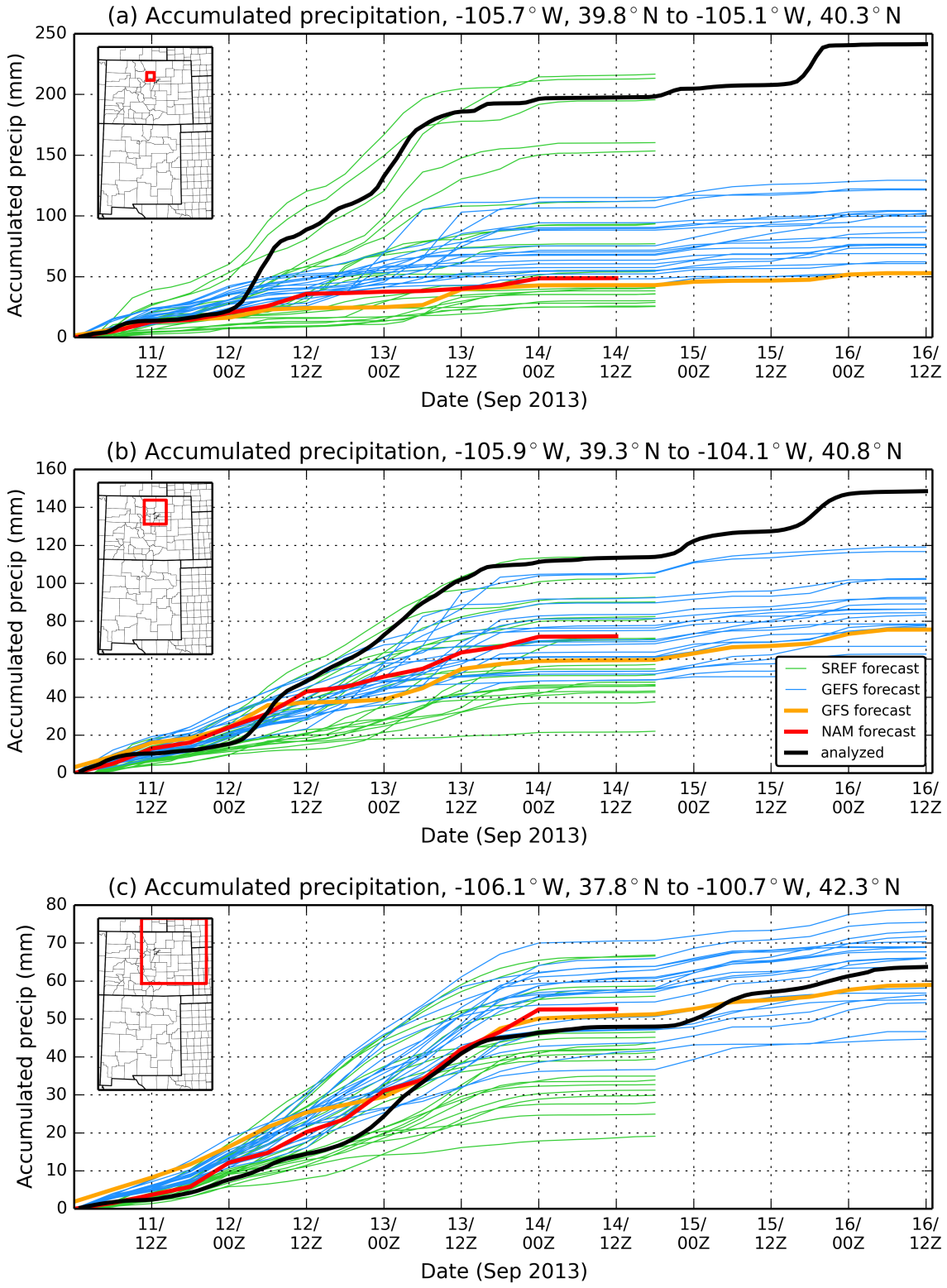

Figure C5: As in Fig. C1, but for forecasts initialized on 00 UTC 11 Sep 2013.

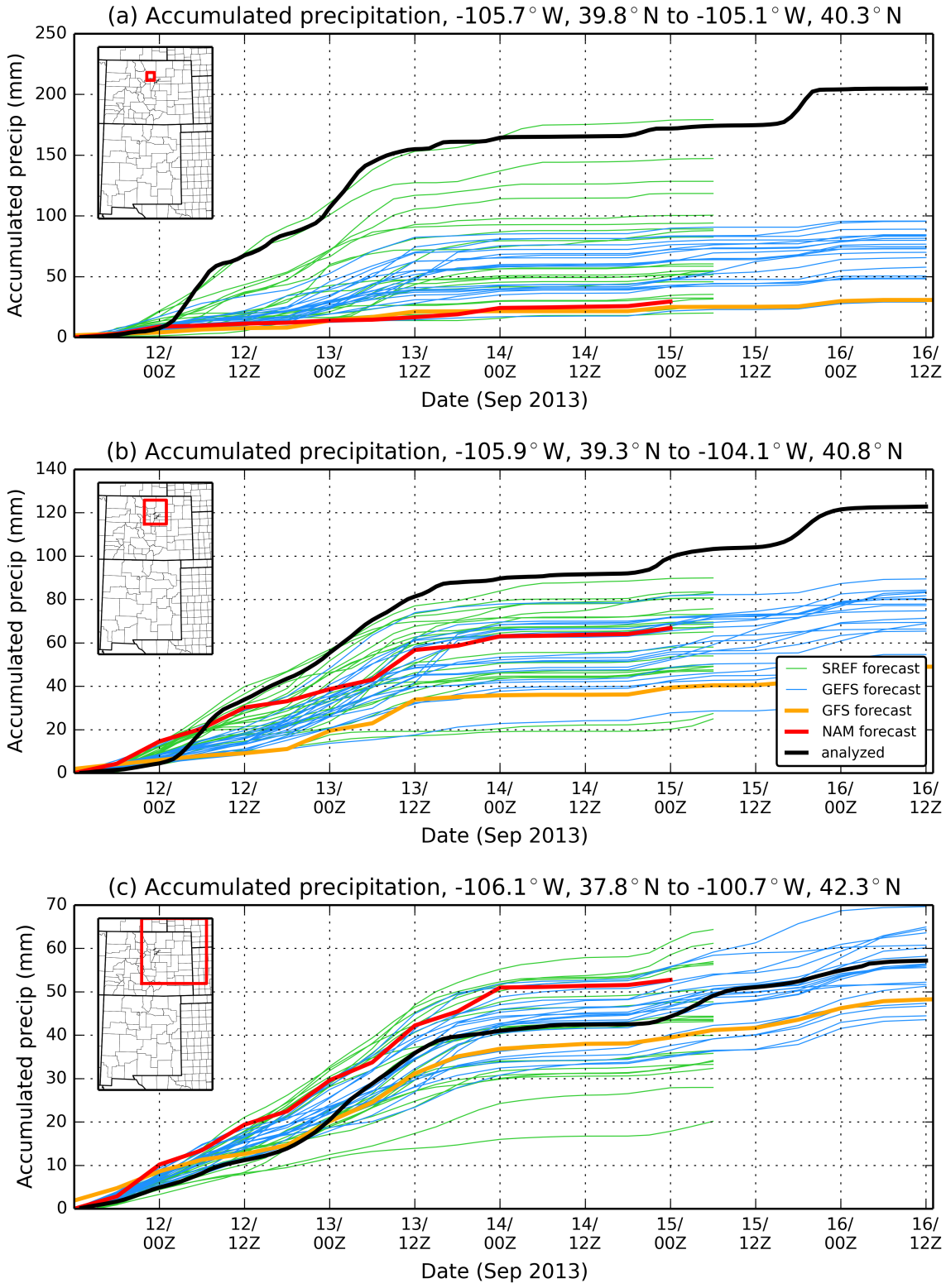

Figure C6: As in Fig. C1, but for forecasts initialized on 12 UTC 11 Sep 2013.

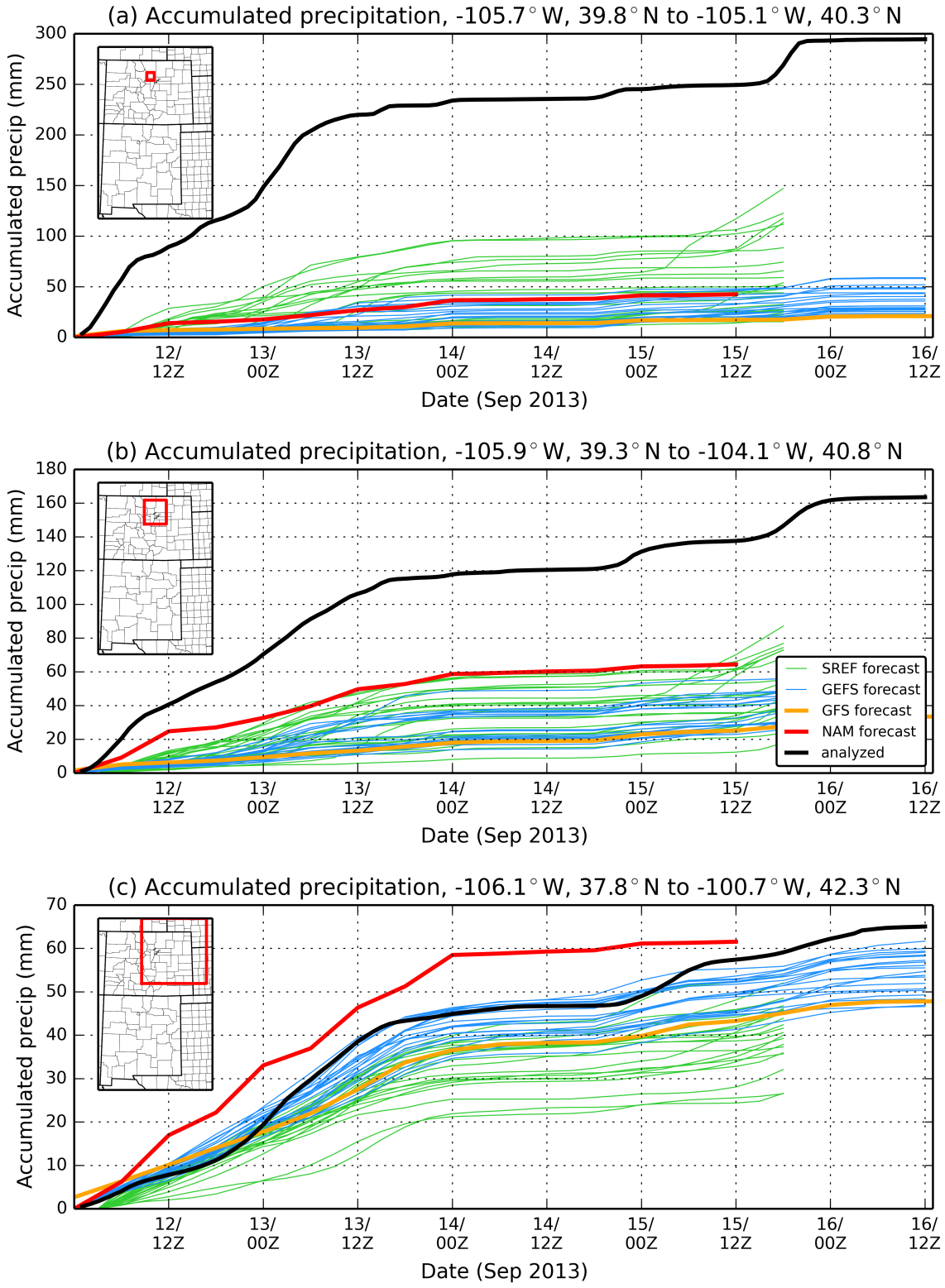

Figure C7: As in Fig. C1, but for forecasts initialized on 00 UTC 12 Sep 2013.

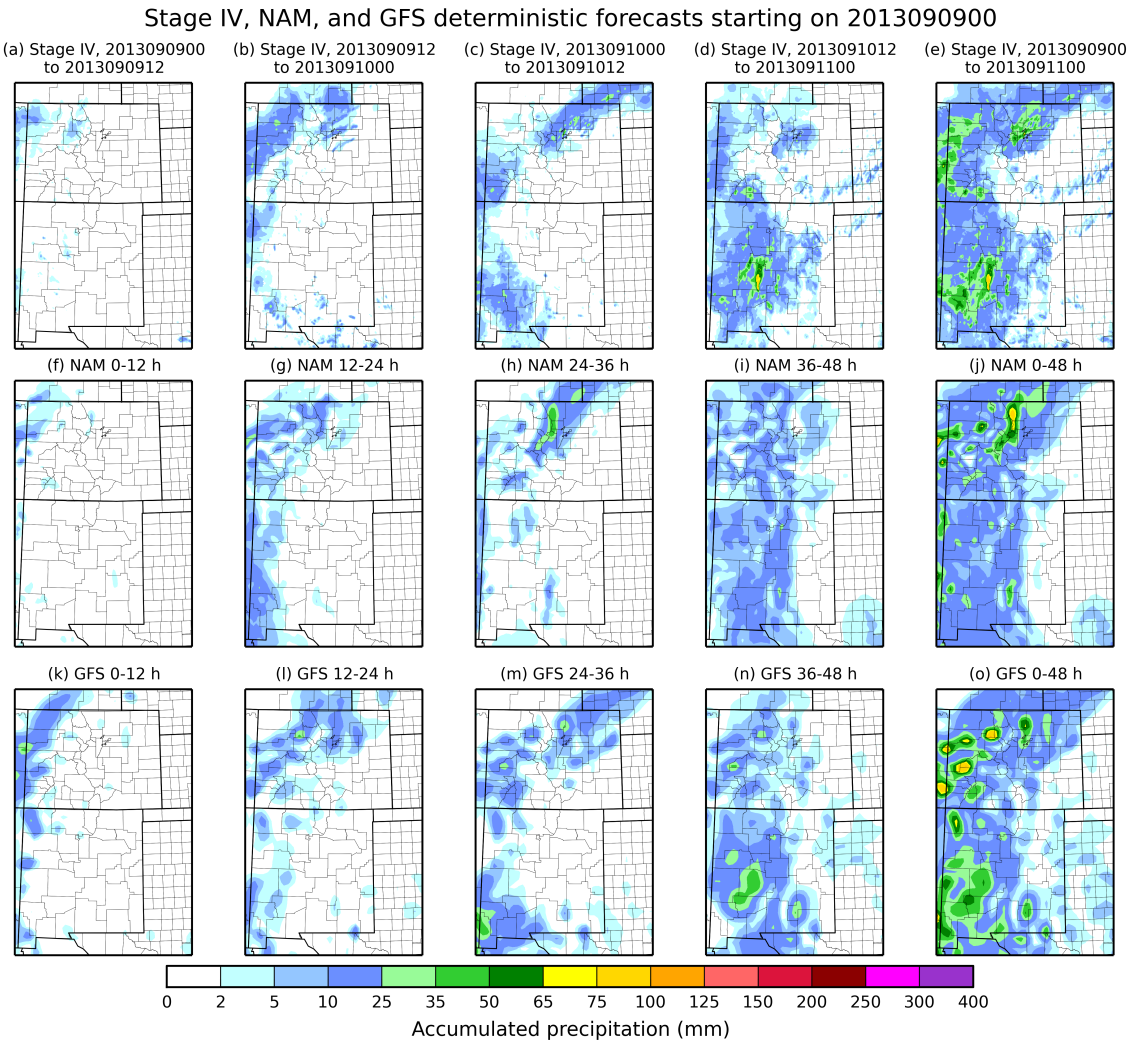

Figure C8: Analyzed precipitation (top row) and accumulated precipitation forecasts from the NAM model (middle row) and GFS (bottom row) from the 00 UTC 09 Sep 2013 initial time. The left-most four panels show the accumulation over consecutive 12-hourly periods, and the right-most panel shows the accumulation over the full 48 hours.

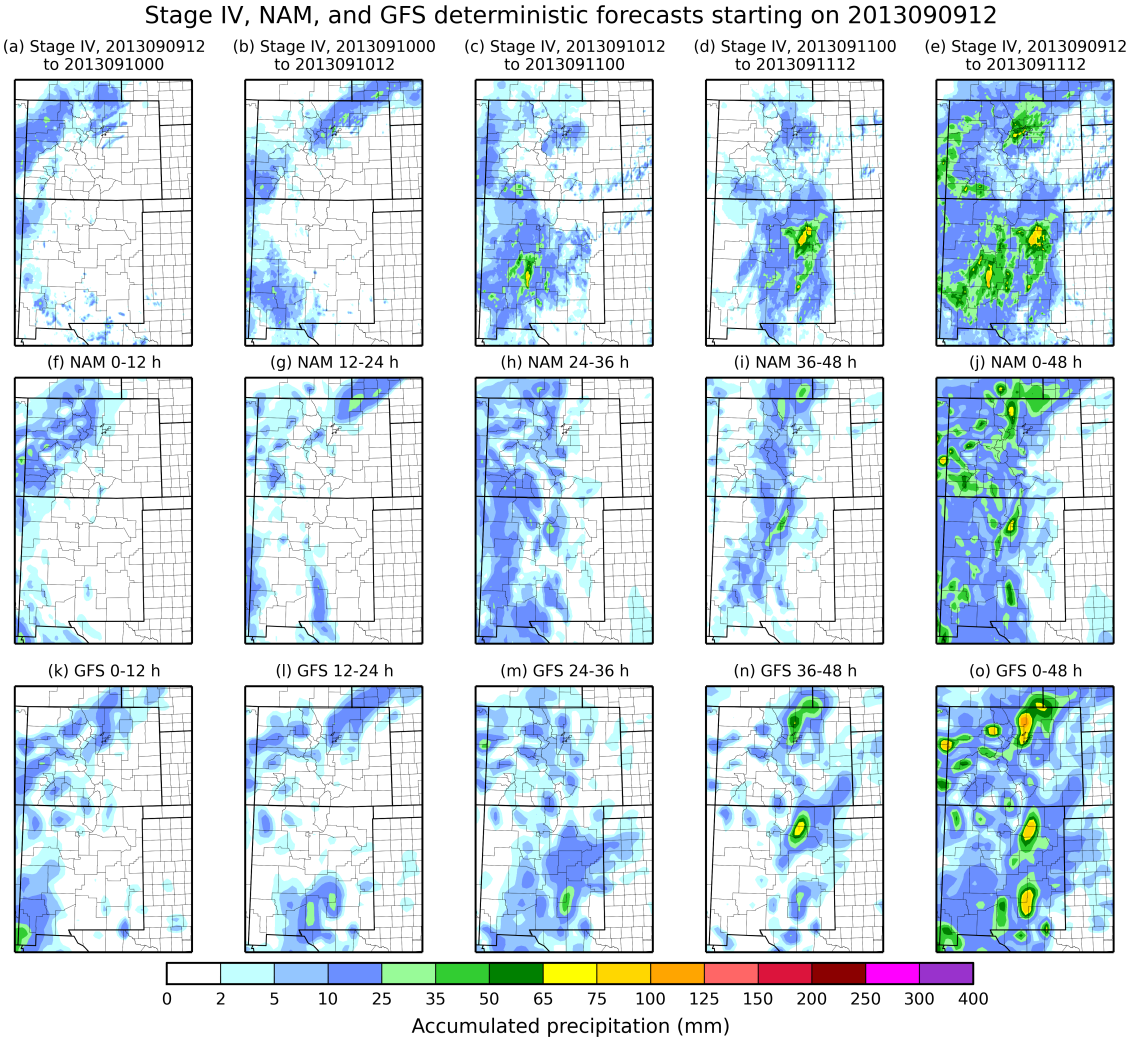

Figure C9: As in Fig. C8, but initialized at 12 UTC 09 Sep 2013.

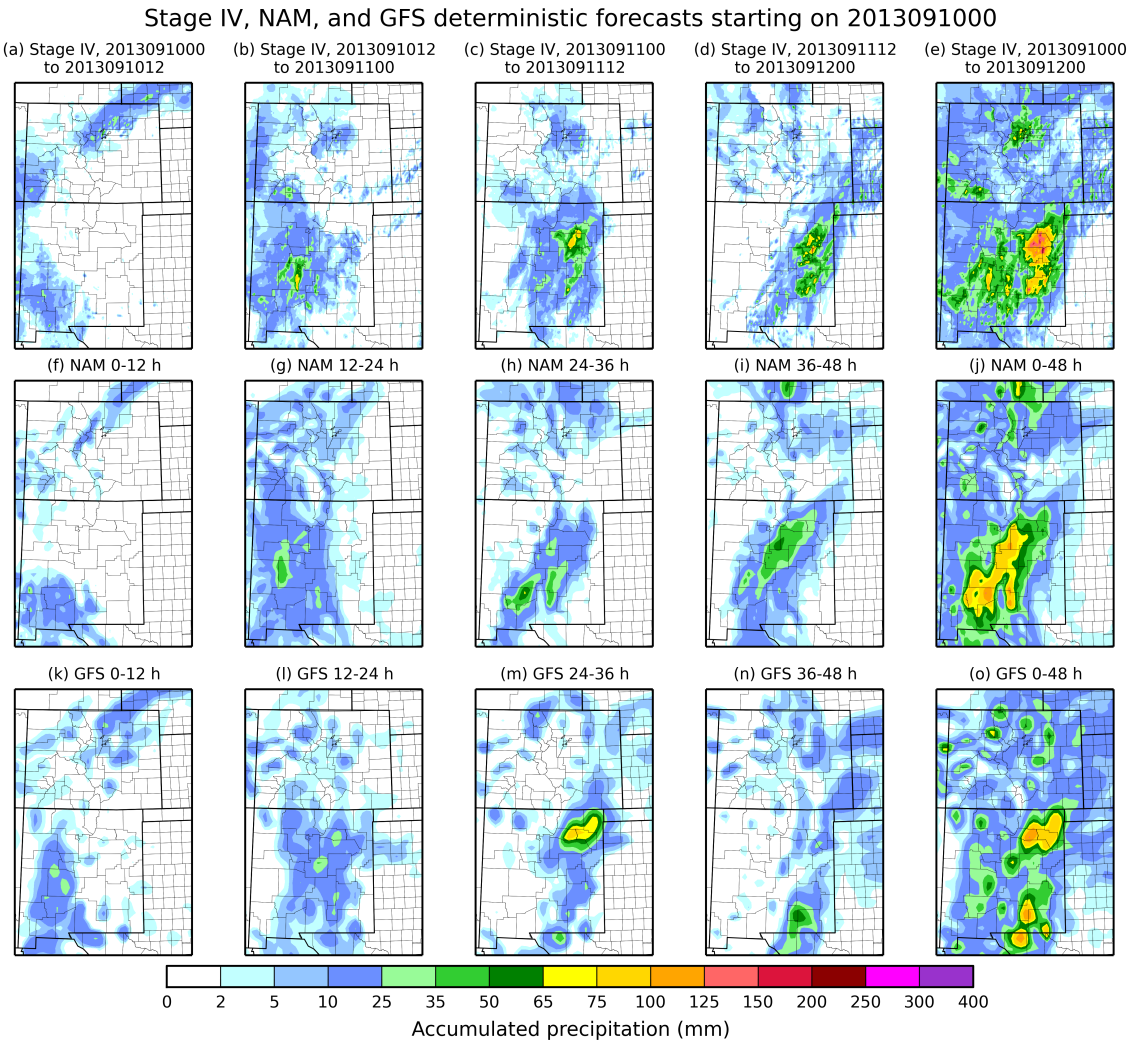

Figure C10: As in Fig. C8, but initialized at 00 UTC 10 Sep 2013.

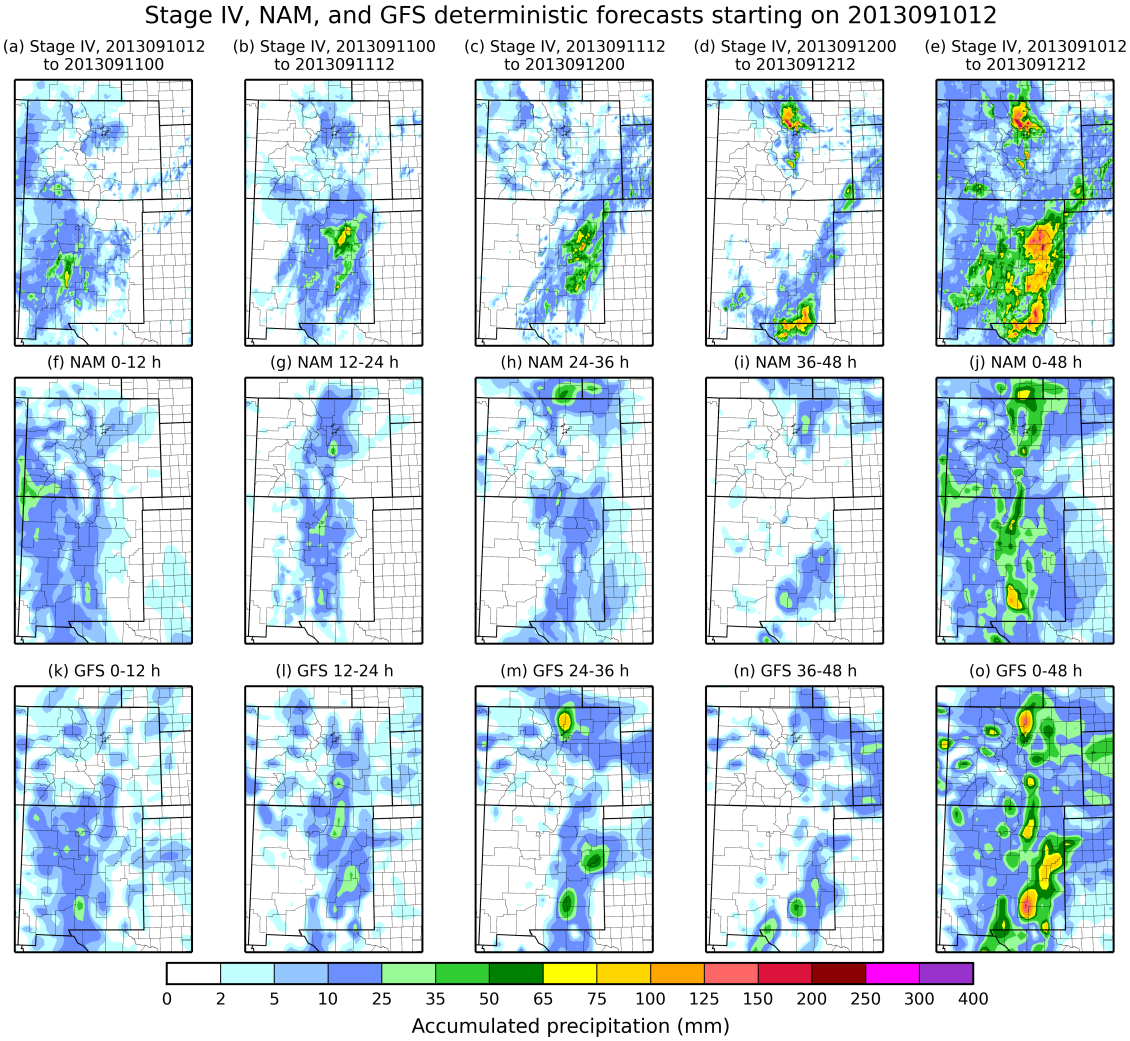

Figure C11: As in Fig. C8, but initialized at 12 UTC 10 Sep 2013.

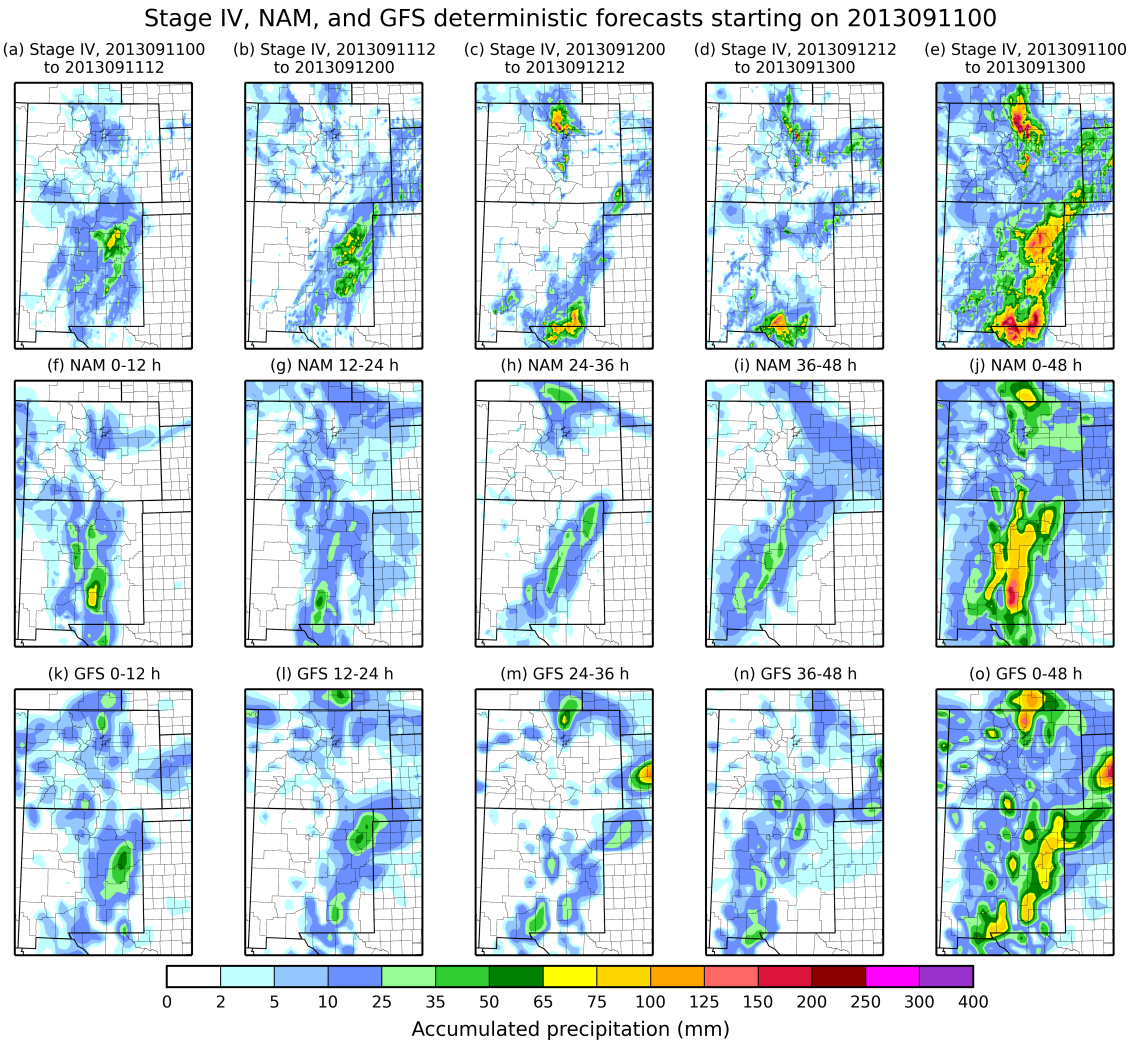

Figure C12: As in Fig. C8, but initialized at 00 UTC 11 Sep 2013.

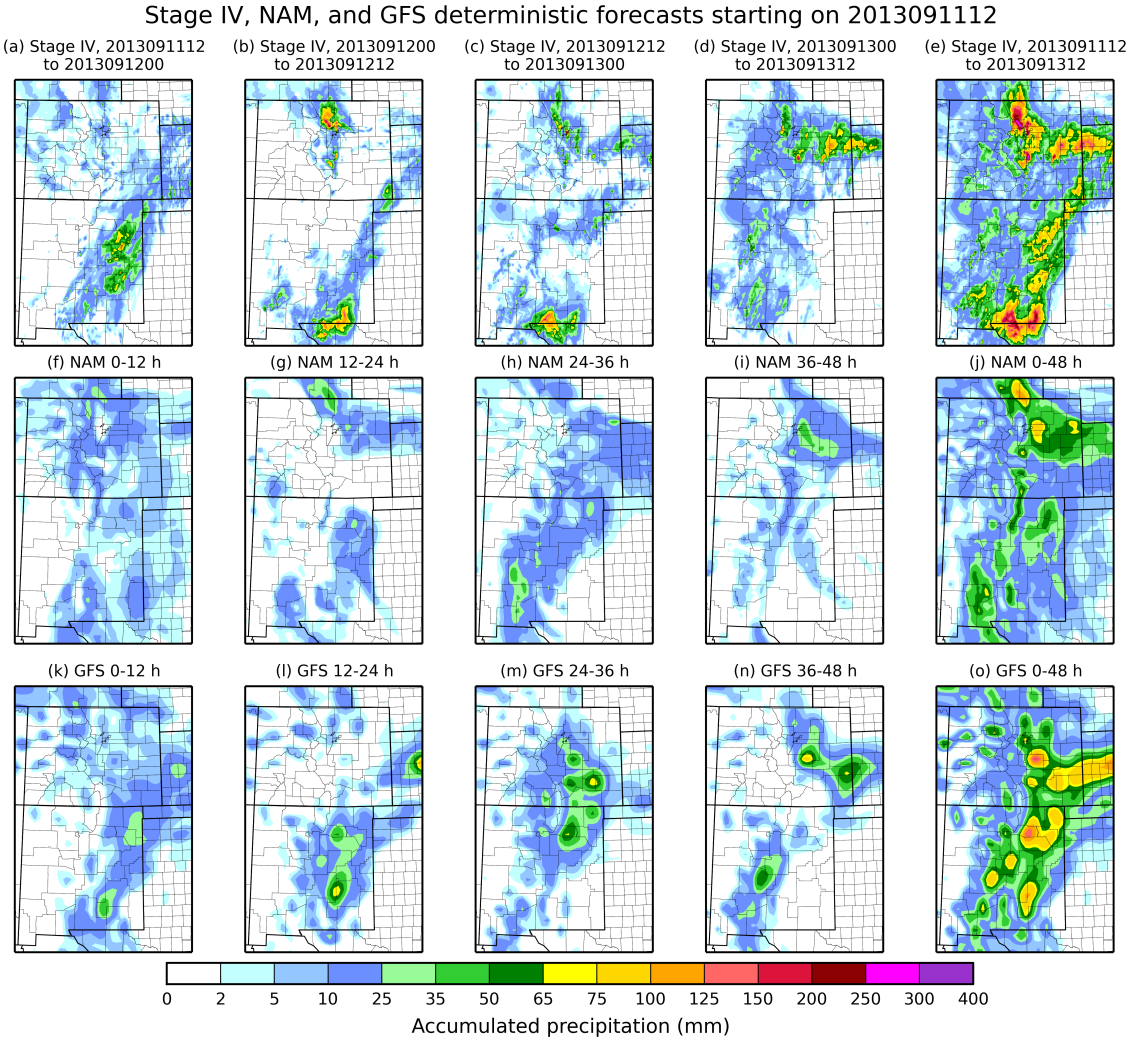

Figure C13: As in Fig. C8, but initialized at 12 UTC 11 Sep 2013.

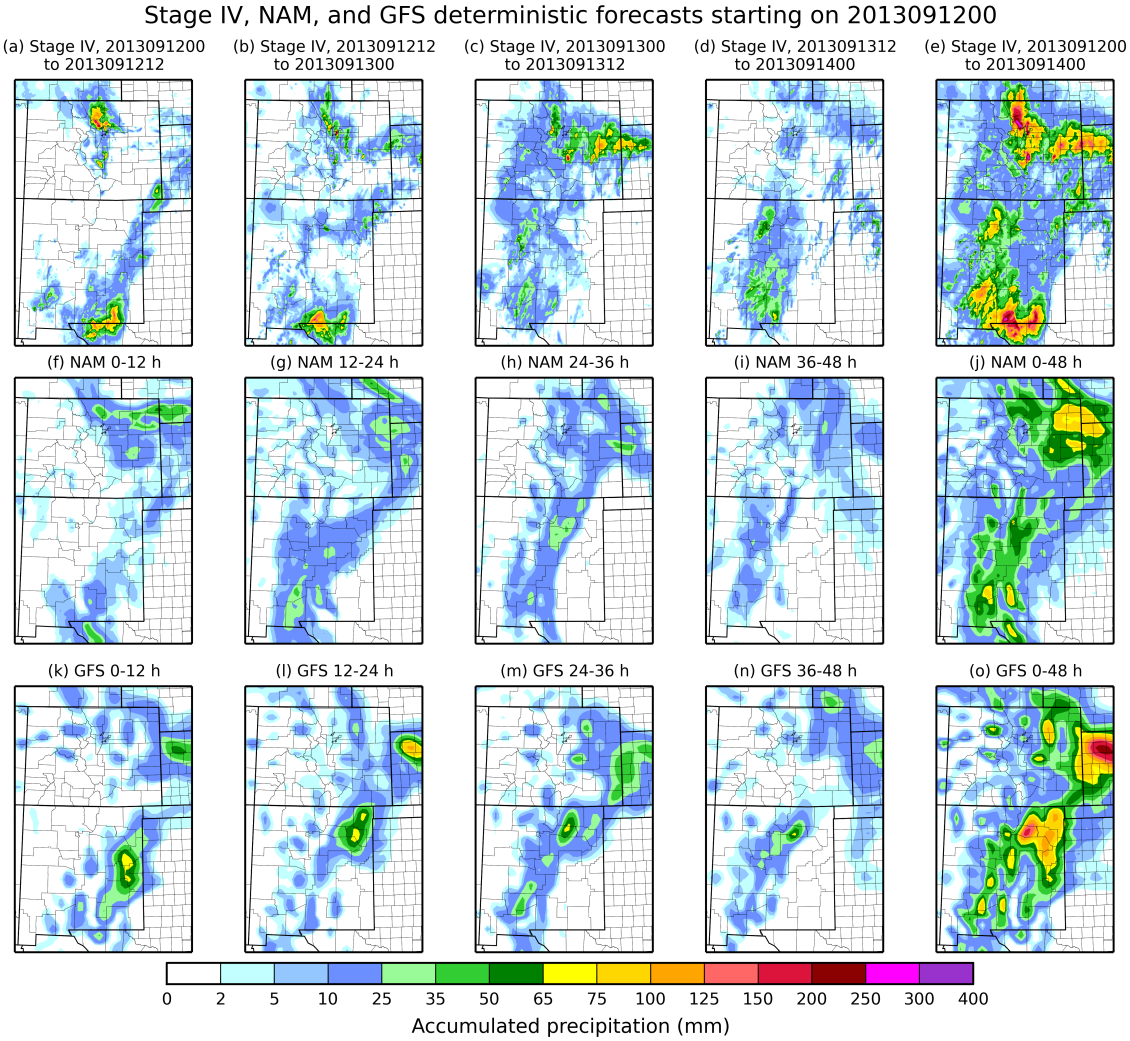

Figure C14: As in Fig. C8, but initialized at 00 UTC 12 Sep 2013.

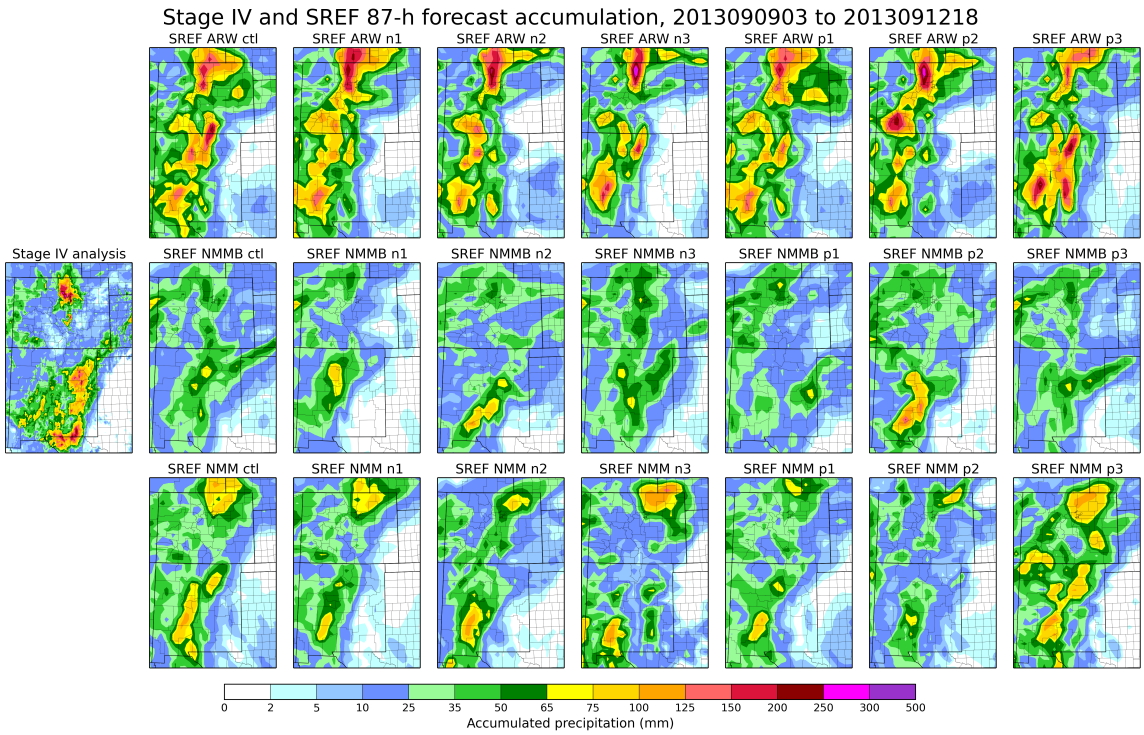

Figure C15: Stamp maps of analyzed and accumulated precipitation forecasts from the NCEP SREF system, initialized at 03 UTC 09 Sep 2013. Individual panels show the different member forecasts. The top row shows the member forecasts that used the WRF/ARW forecast model. The middle row shows member forecasts that used the WRF/NMMB forecast model. The bottom row shows member forecasts that used the WRF/NMM model. "ctl," "n1", and so on are the perturbation number.

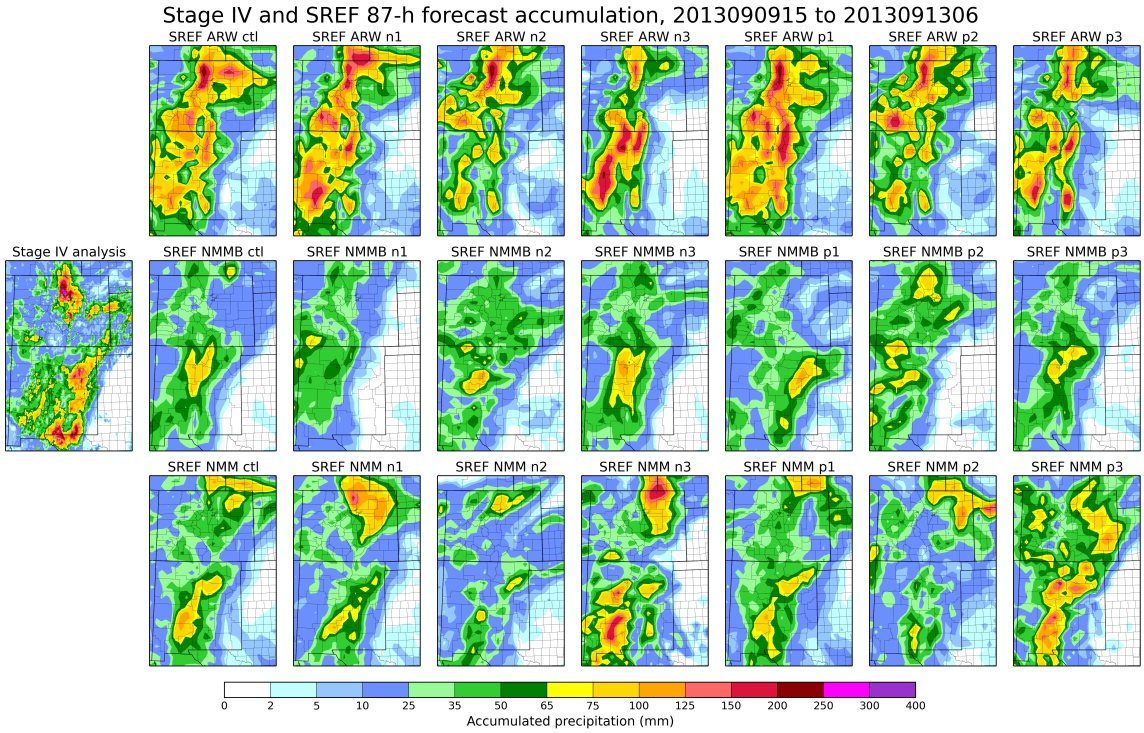

Figure C16: As in Fig. C15, but for forecasts initialized 15 UTC 09 Sep 2013.

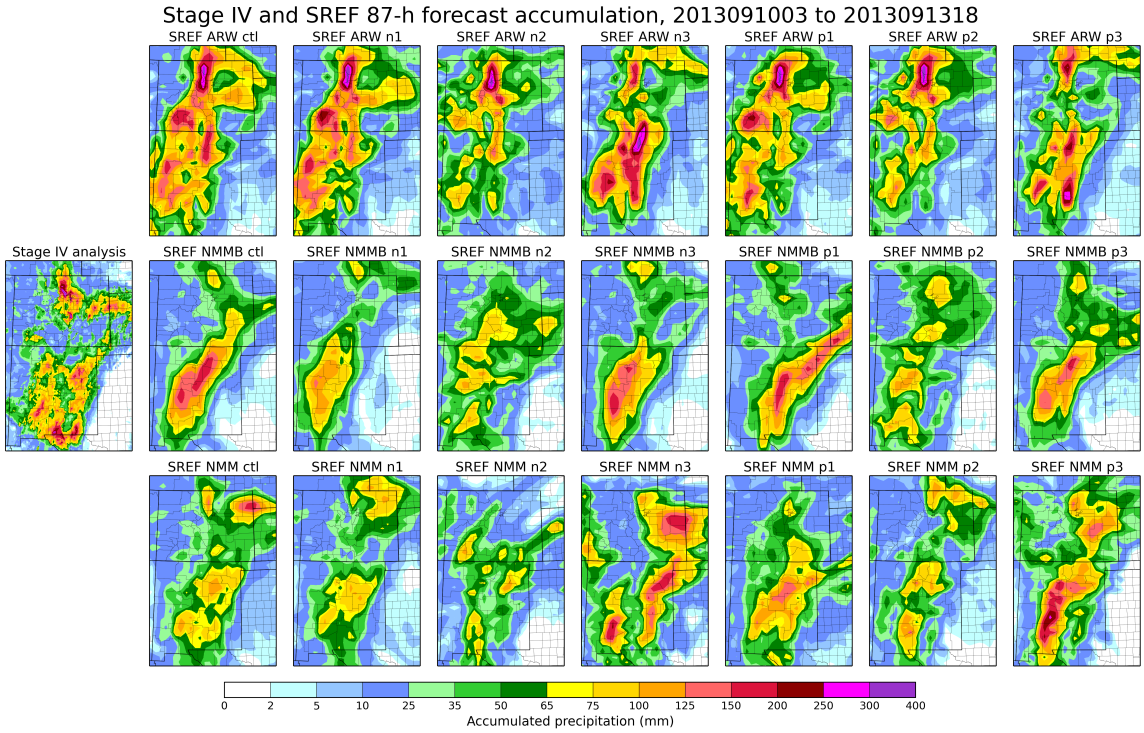

Figure C17: As in Fig. C15, but for forecasts initialized 03 UTC 10 Sep 2013.

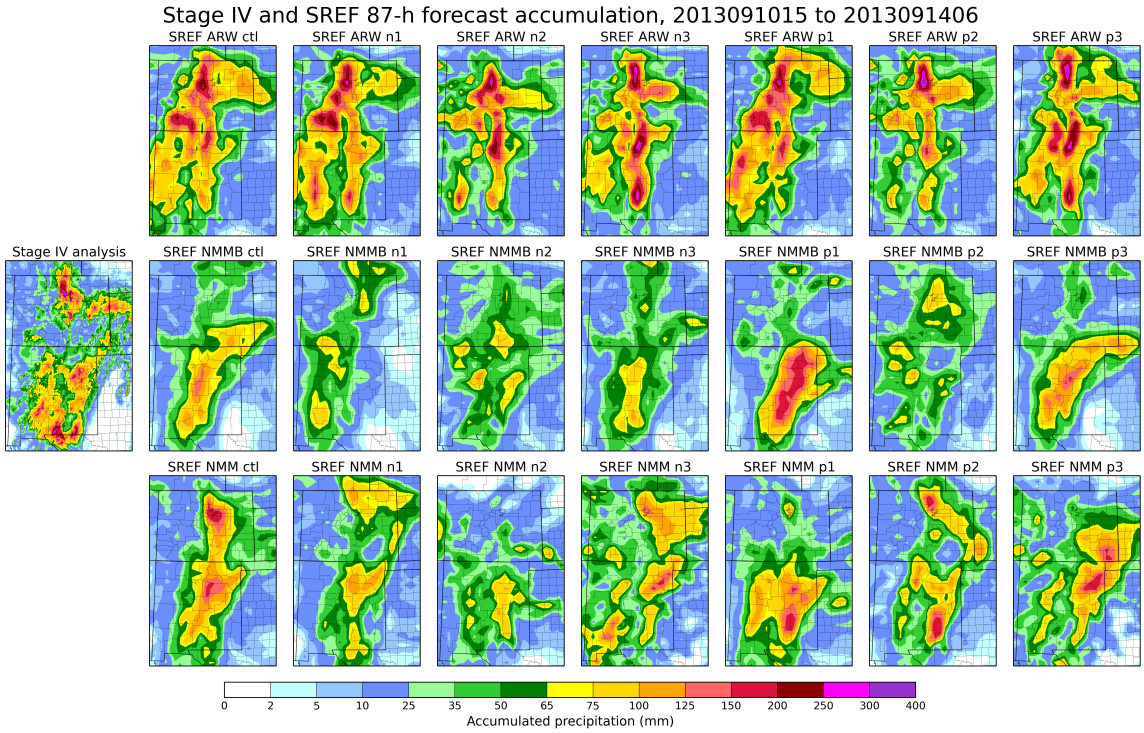

Figure C18: As in Fig. C15, but for forecasts initialized 15 UTC 10 Sep 2013.

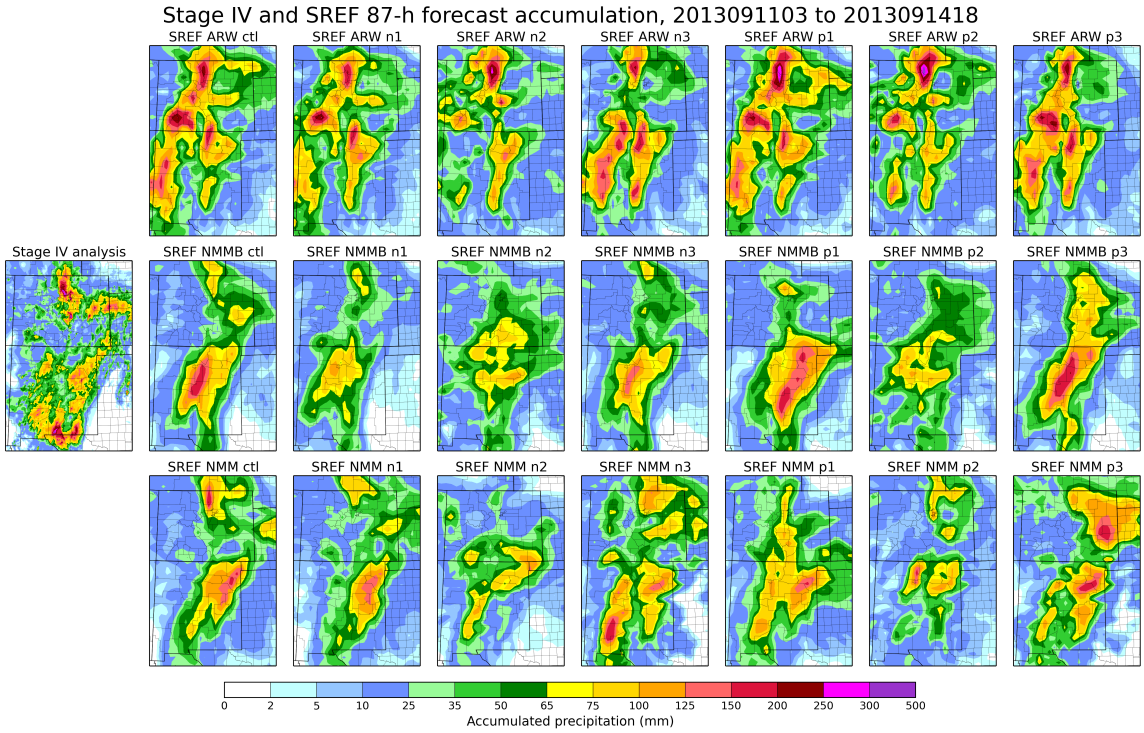

Figure C19: As in Fig. C15, but for forecasts initialized 03 UTC 11 Sep 2013.

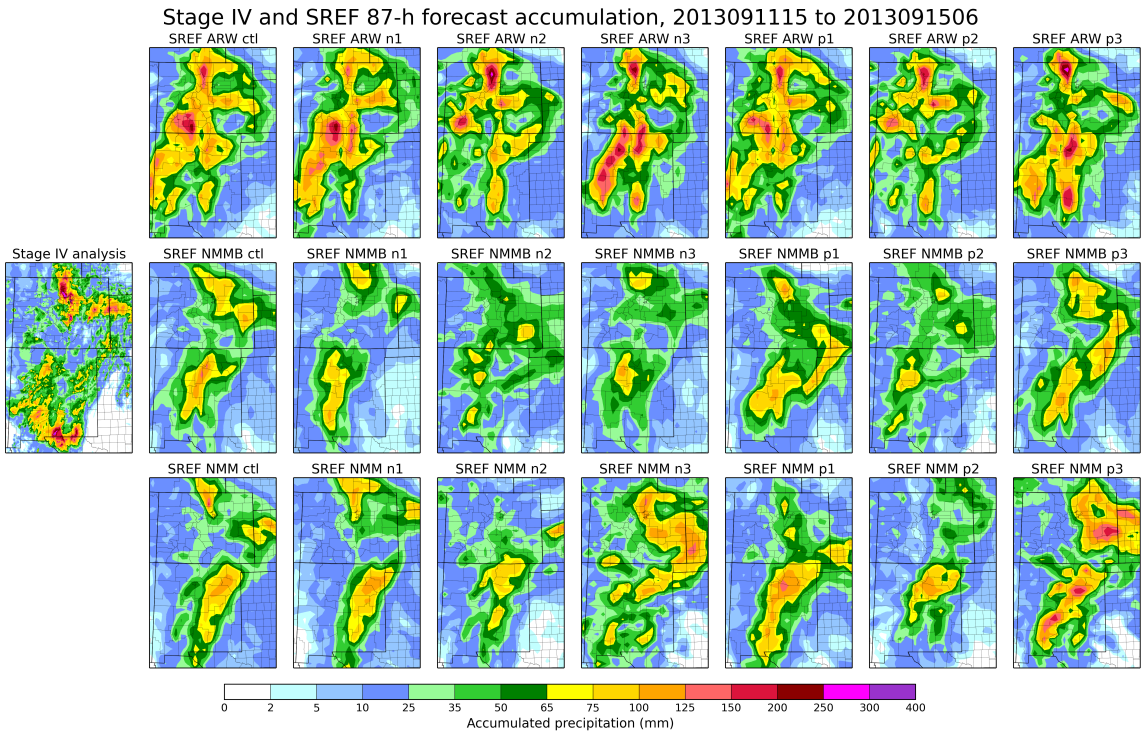

Figure C20: As in Fig. C15, but for forecasts initialized 15 UTC 11 Sep 2013.

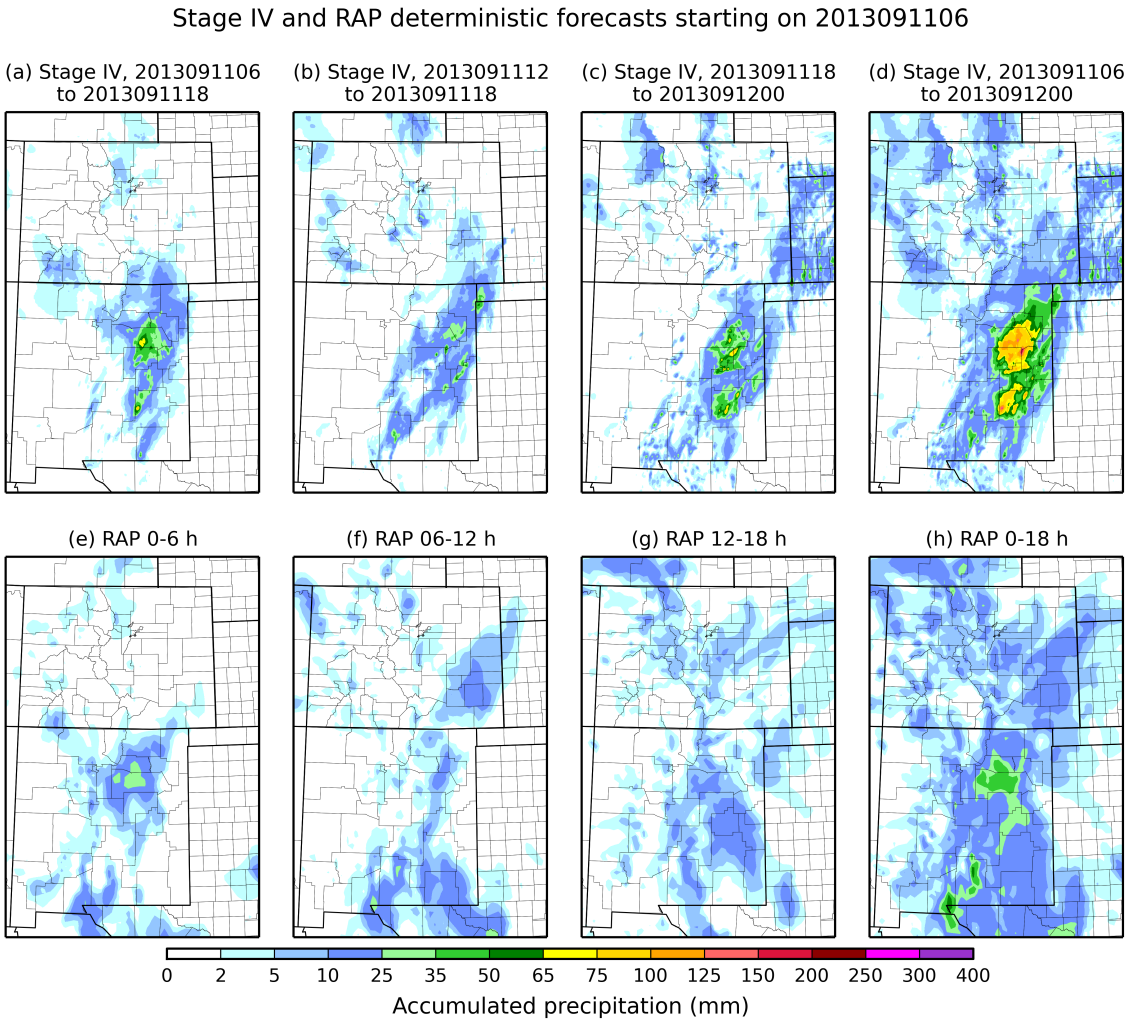

Figure C21: Accumulated precipitation in Stage IV analyses (top row) and in RAP model forecasts (bottom row) starting from 06 UTC 11 Sep 2013. Left-hand 3 panels show accumulations over successive 6-hourly periods and right-hand panel shows accumulation over the full 18-h period of the RAP forecasts.

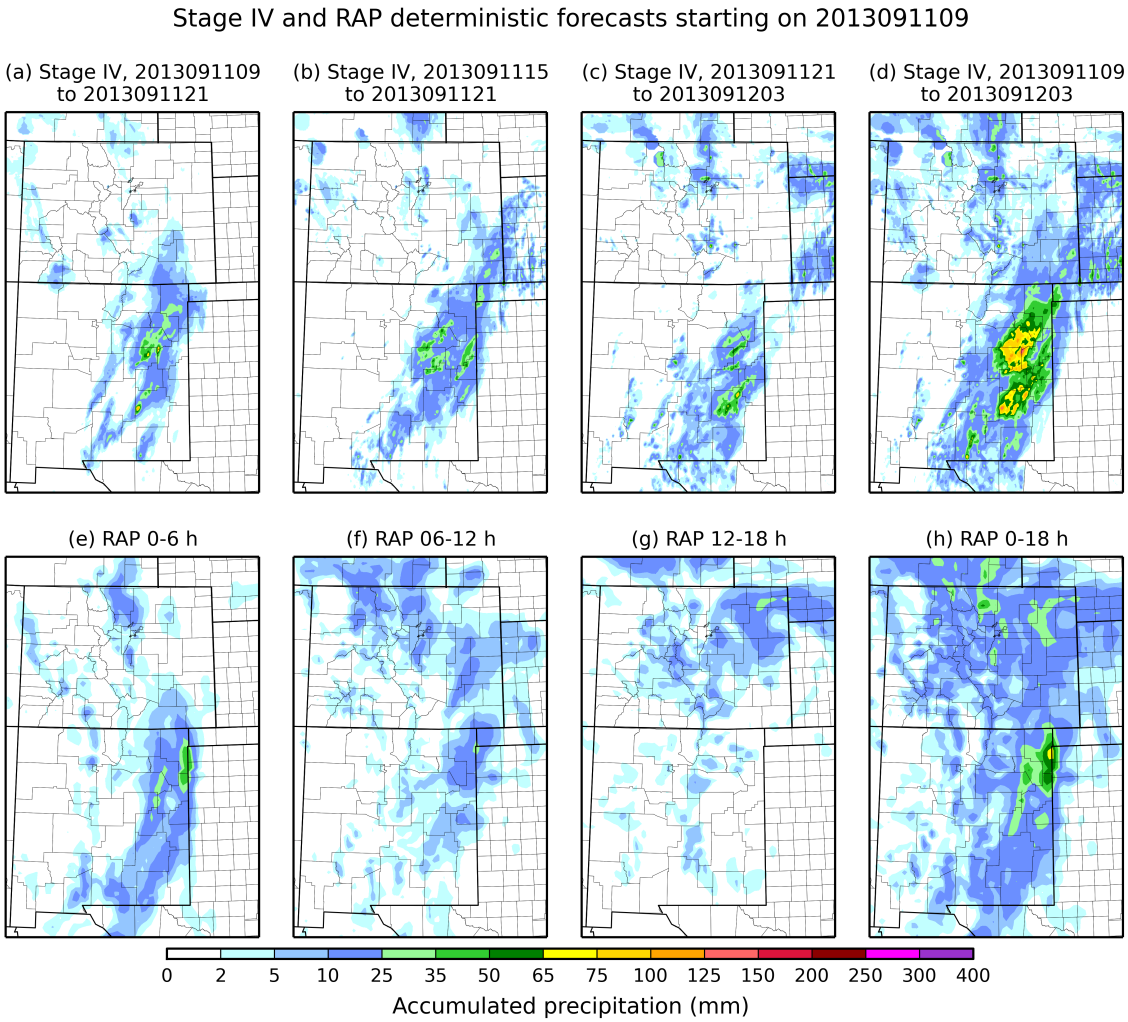

Figure C22: As in Fig. C21, but for data starting from 09 UTC 11 Sep 2013. Note that precipitation analyses from 09 UTC (and in subsequent plots, for initial times starting at 15, 21, and 03 UTC) estimated the 6-hourly Stage IV from the sum of six hours of hourly data. Because the hourly data is not subject to the same level of quality control as the 6-hourly data, there may be discrepancies (generally, less precipitation) for estimates based on the hourly data.

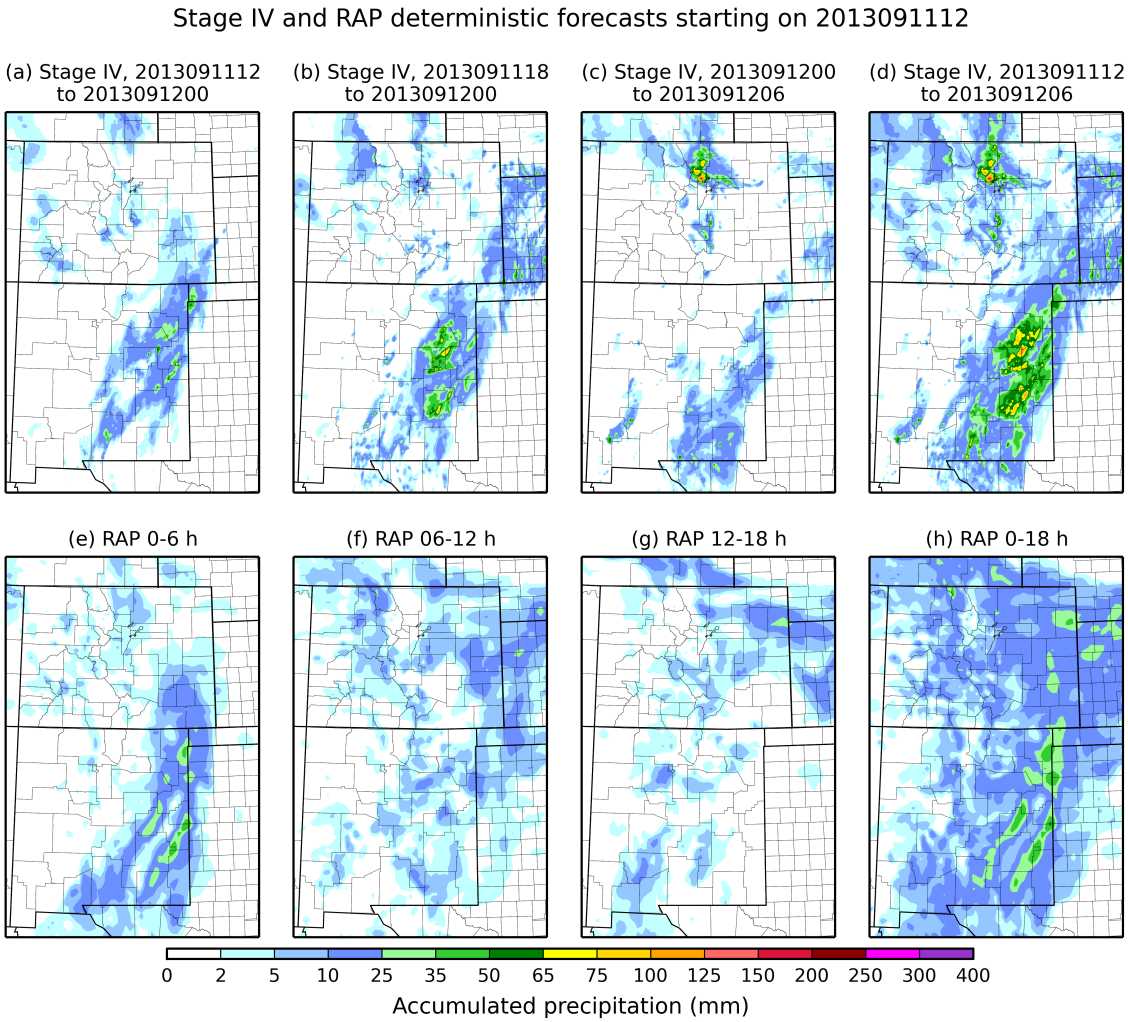

Figure C23: As in Fig. C21, but for data starting from 12 UTC 11 Sep 2013.

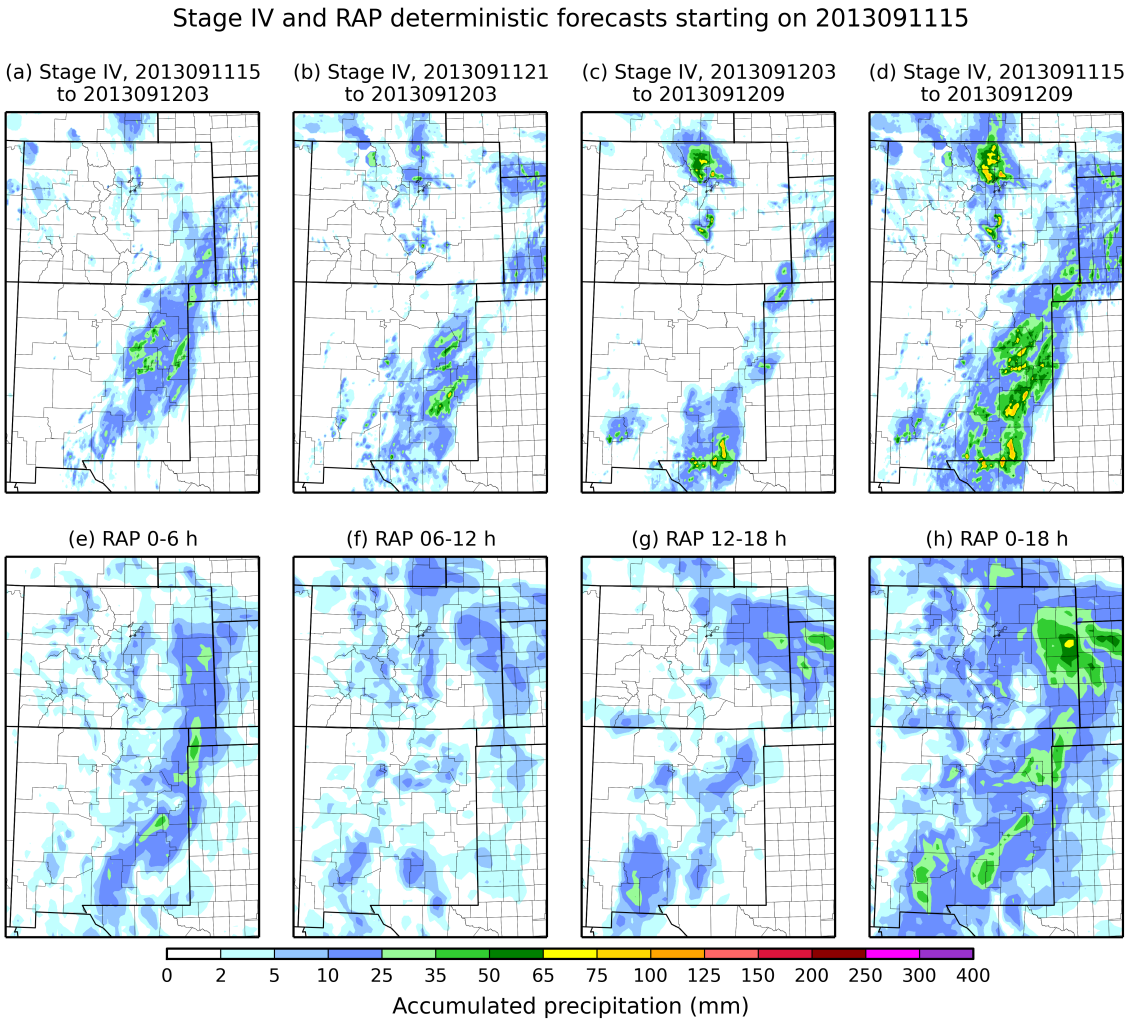

Figure C24: As in Fig. C22, but for data starting from 15 UTC 11 Sep 2013.

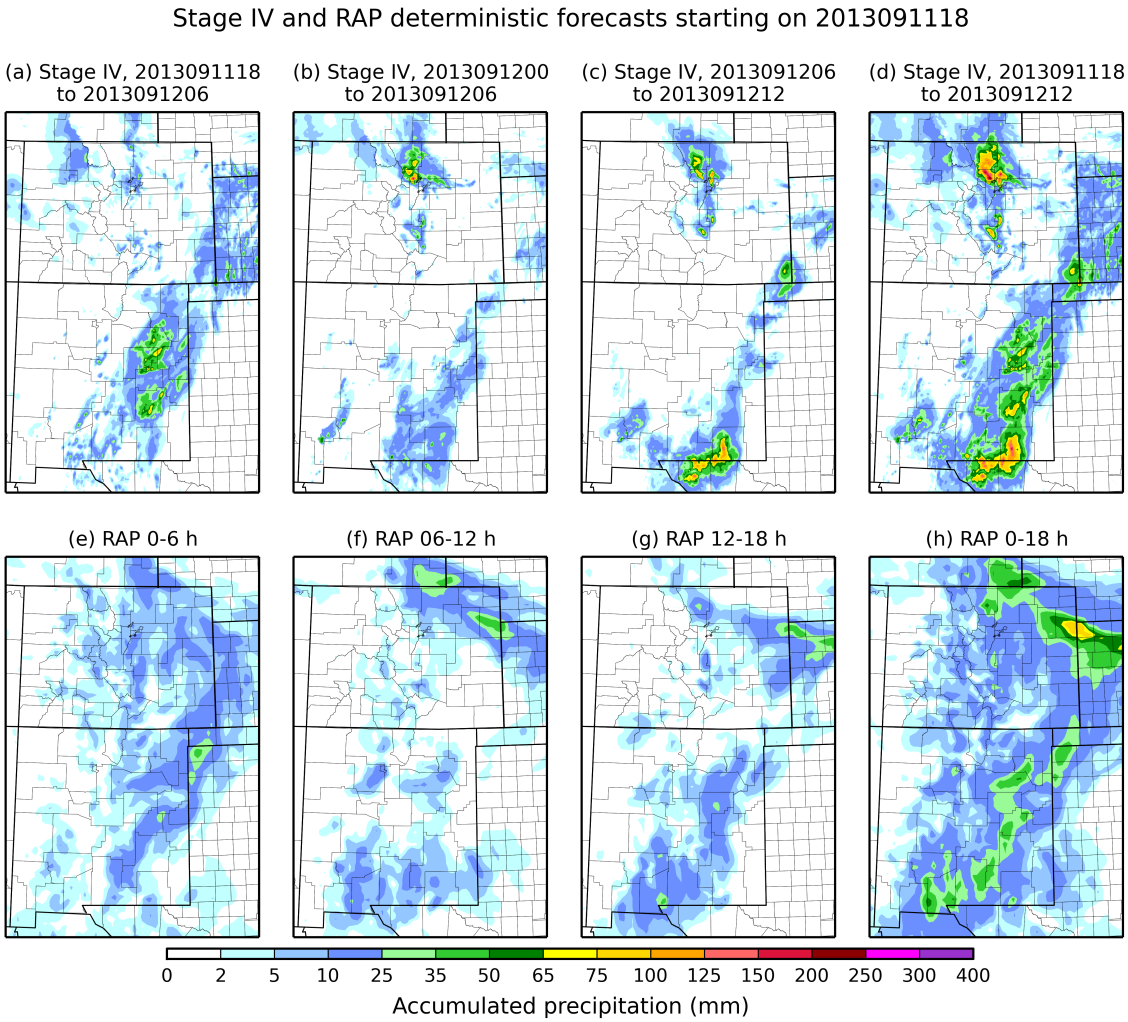

Figure C25: As in Fig. C21, but for data starting from 18 UTC 11 Sep 2013.

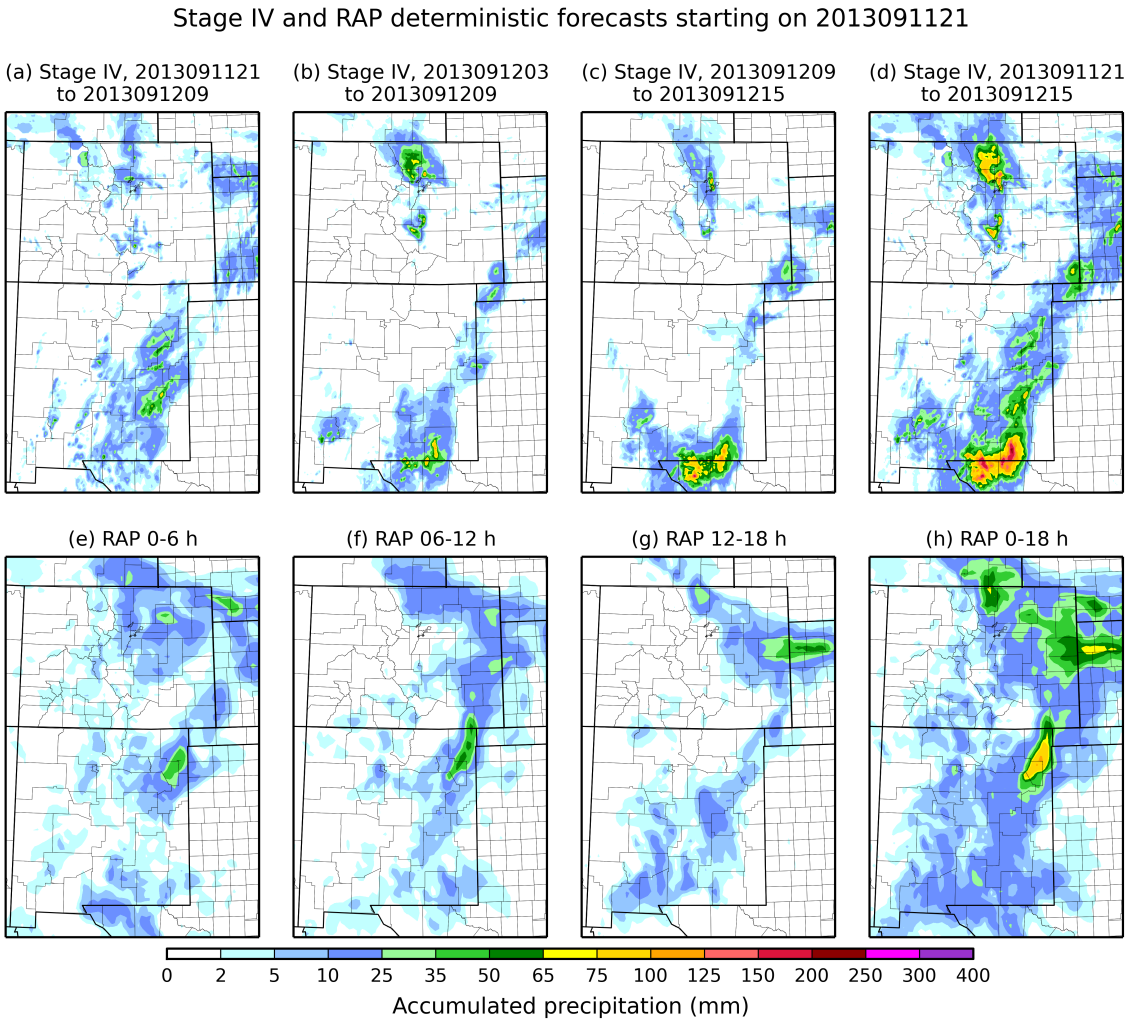

Figure C26: As in Fig. C22, but for data starting from 21 UTC 11 Sep 2013.

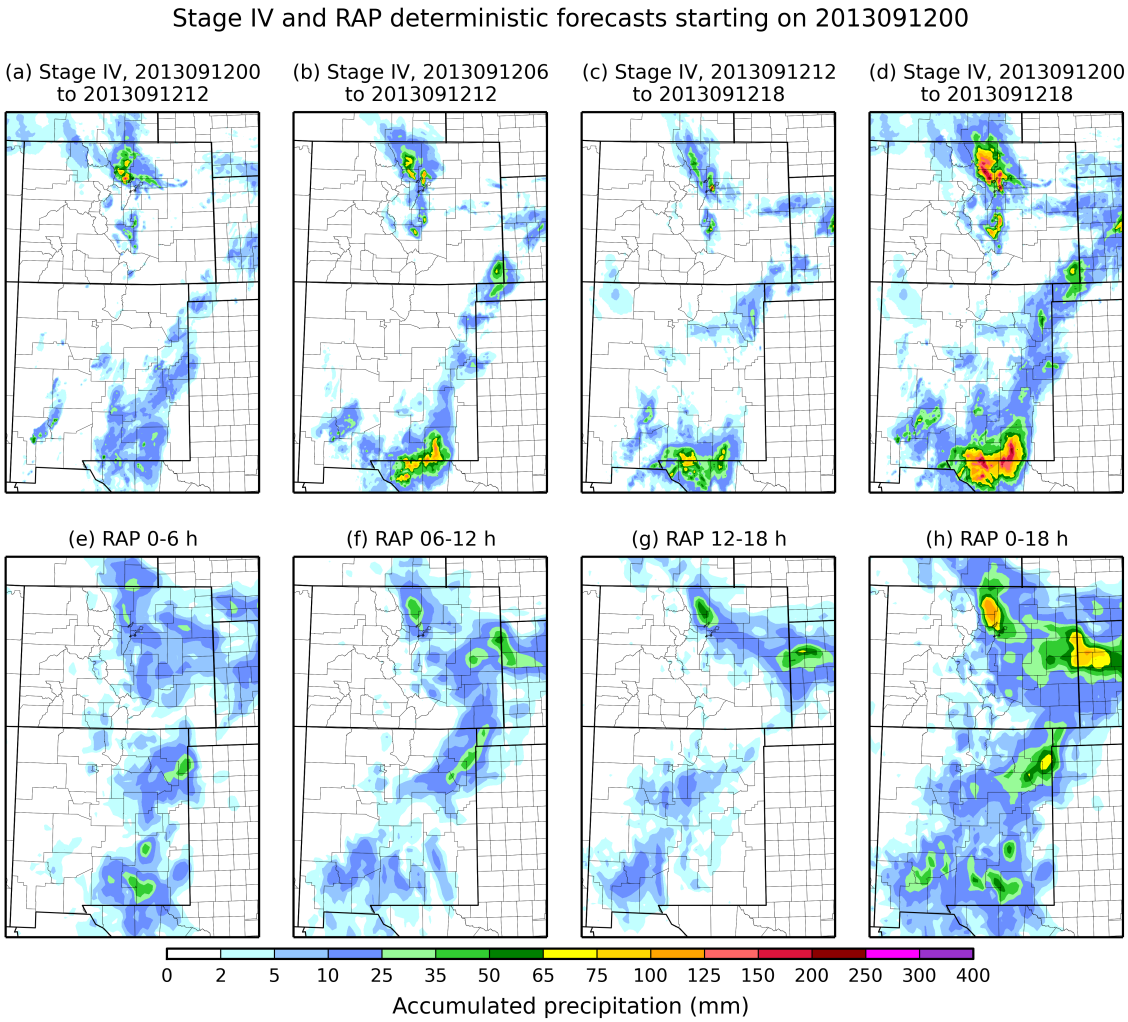

Figure C27: As in Fig. C21, but for data starting from 00 UTC 12 Sep 2013.

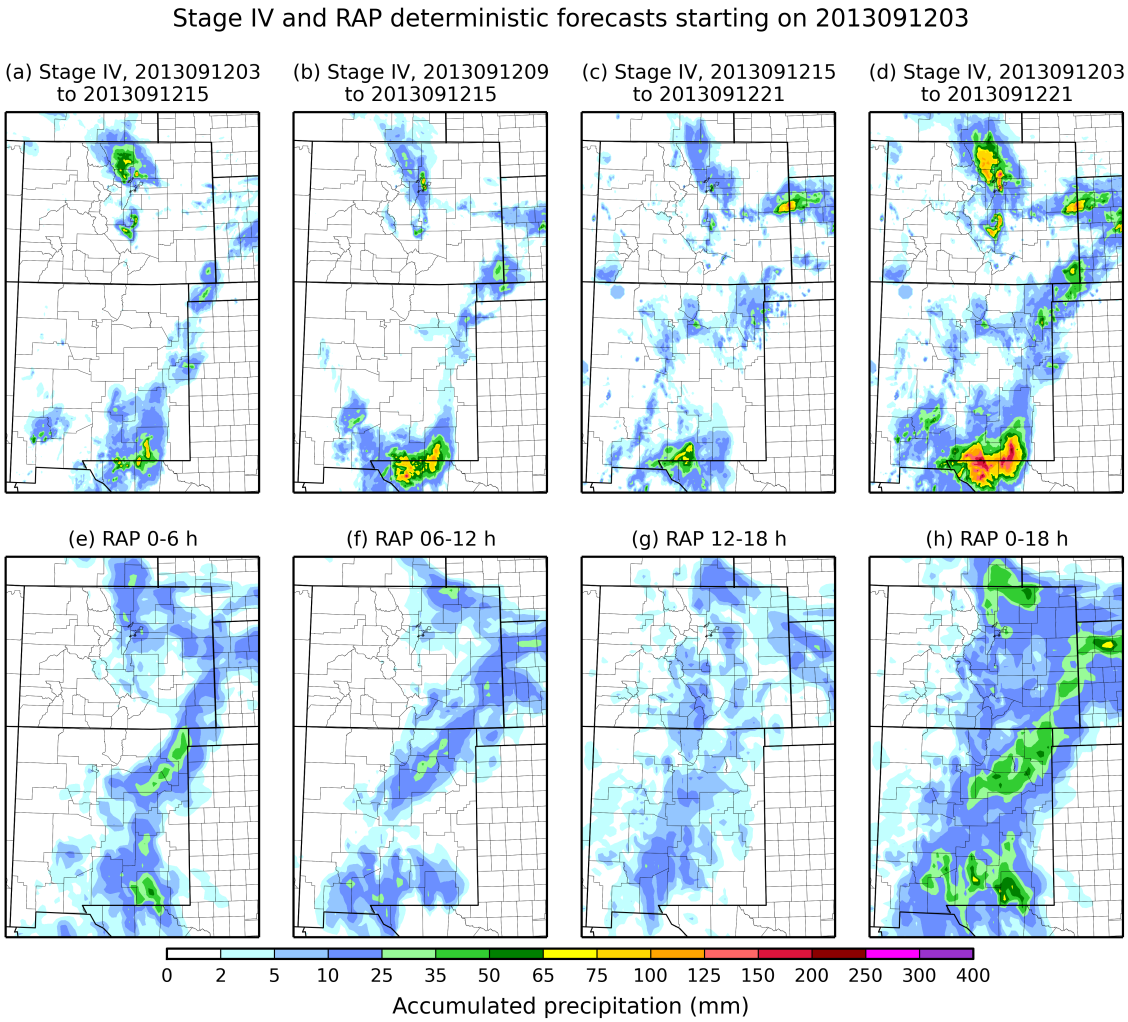

Figure C28: As in Fig. C22, but for data starting from 03 UTC 12 Sep 2013.

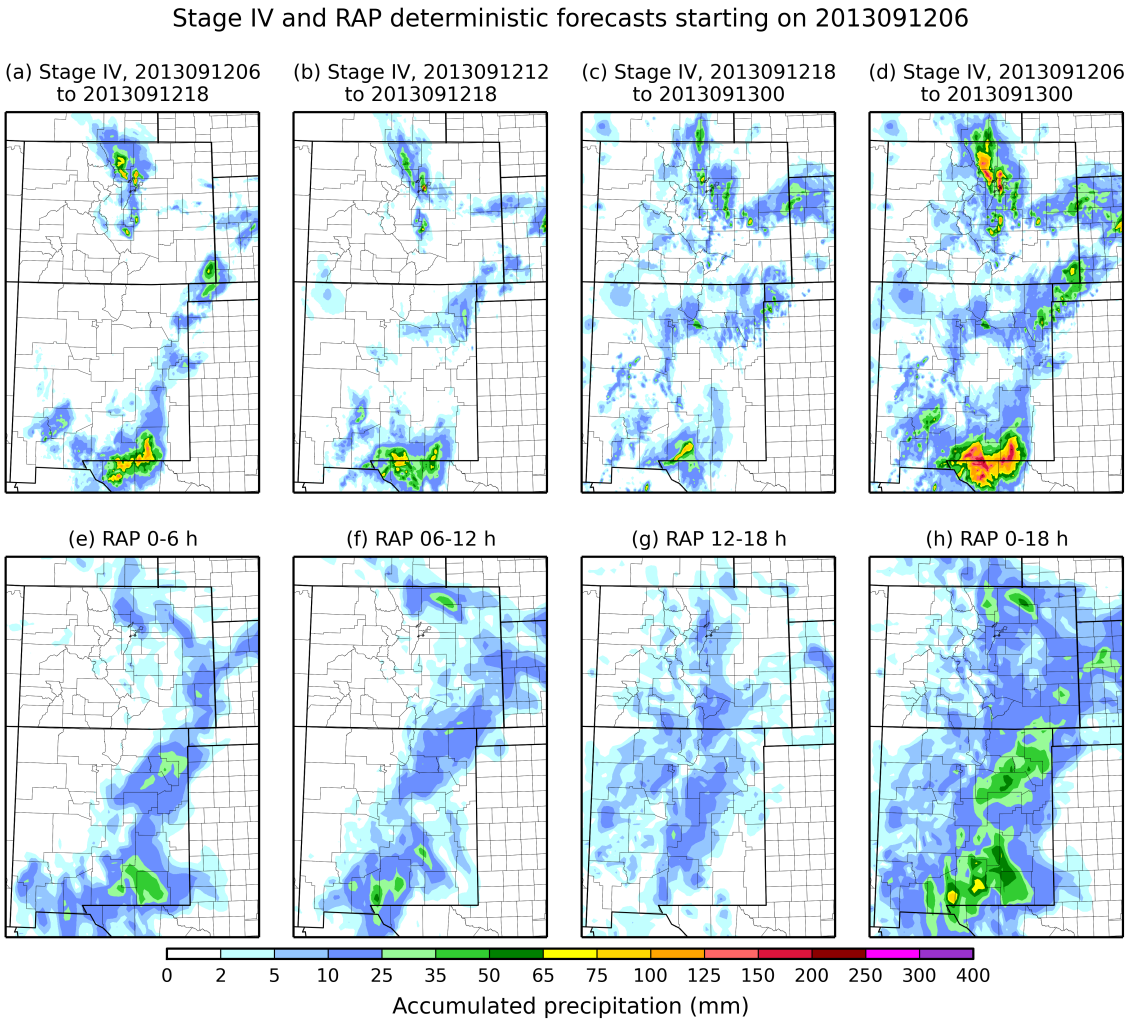

Figure C29: As in Fig. C21, but for data starting from 06 UTC 12 Sep 2013.

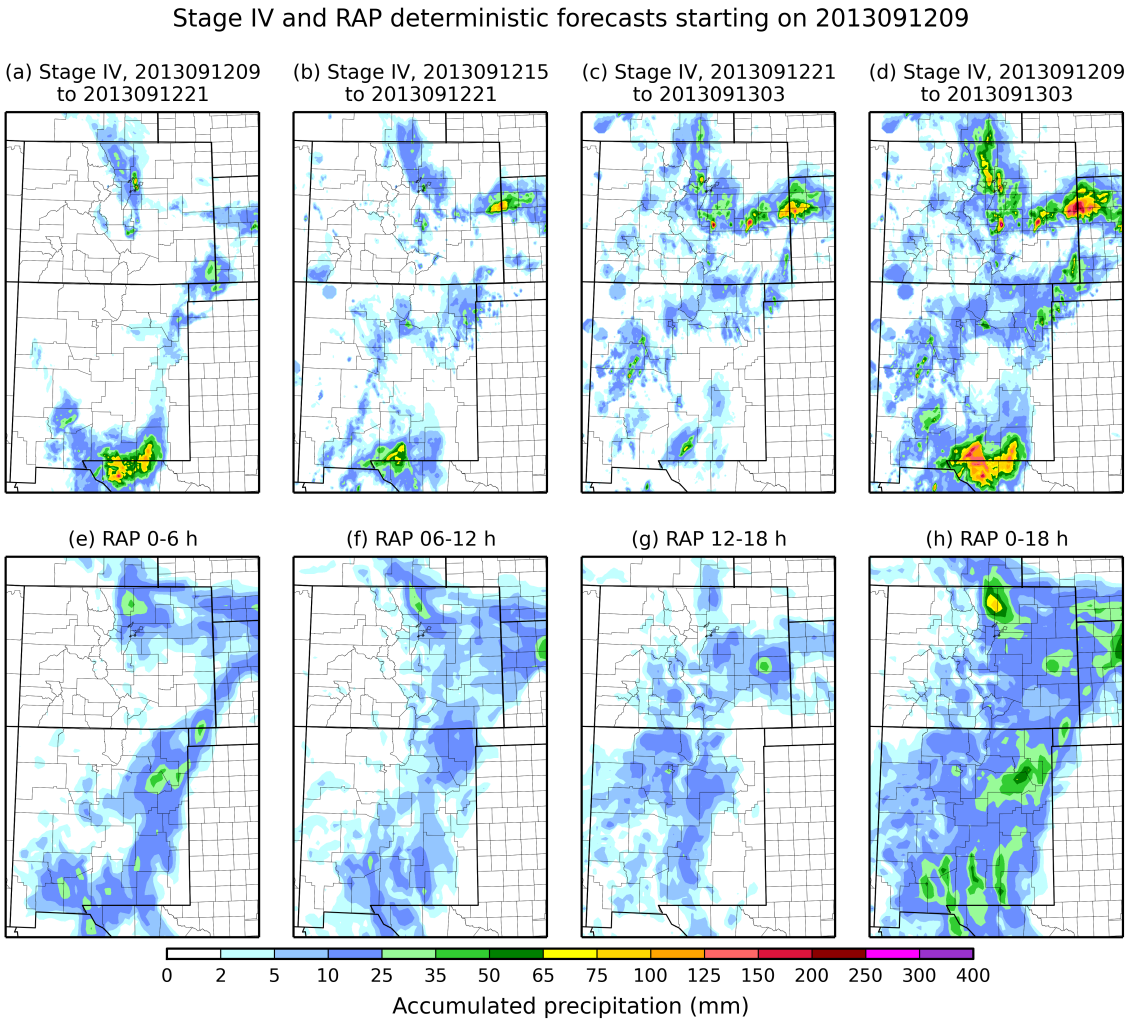

Figure C30: As in Fig. C22, but for data starting from 09 UTC 12 Sep 2013.

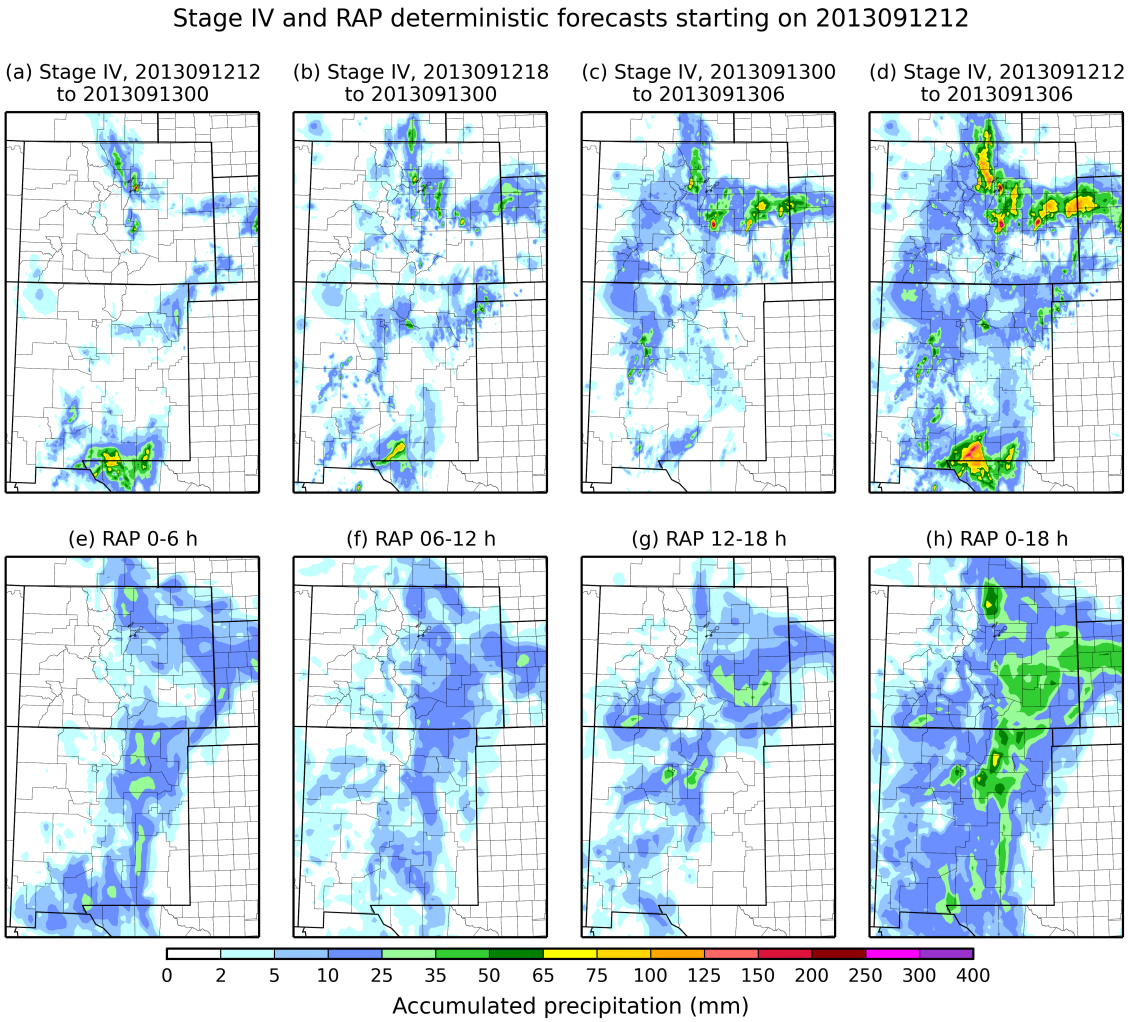

Figure C31: As in Fig. C21, but for data starting from 12 UTC 12 Sep 2013.

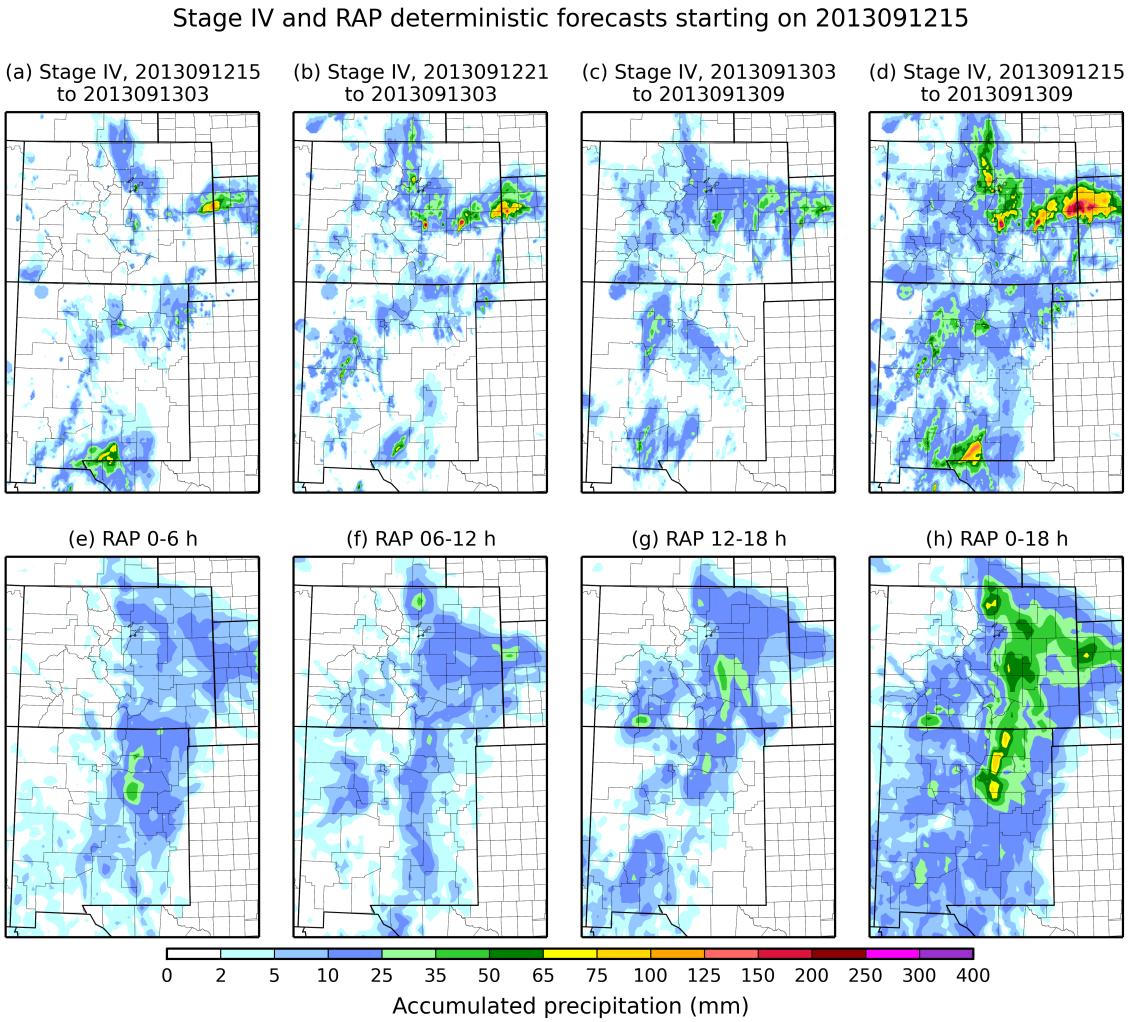

Figure C32: As in Fig. C22, but for data starting from 15 UTC 12 Sep 2013.

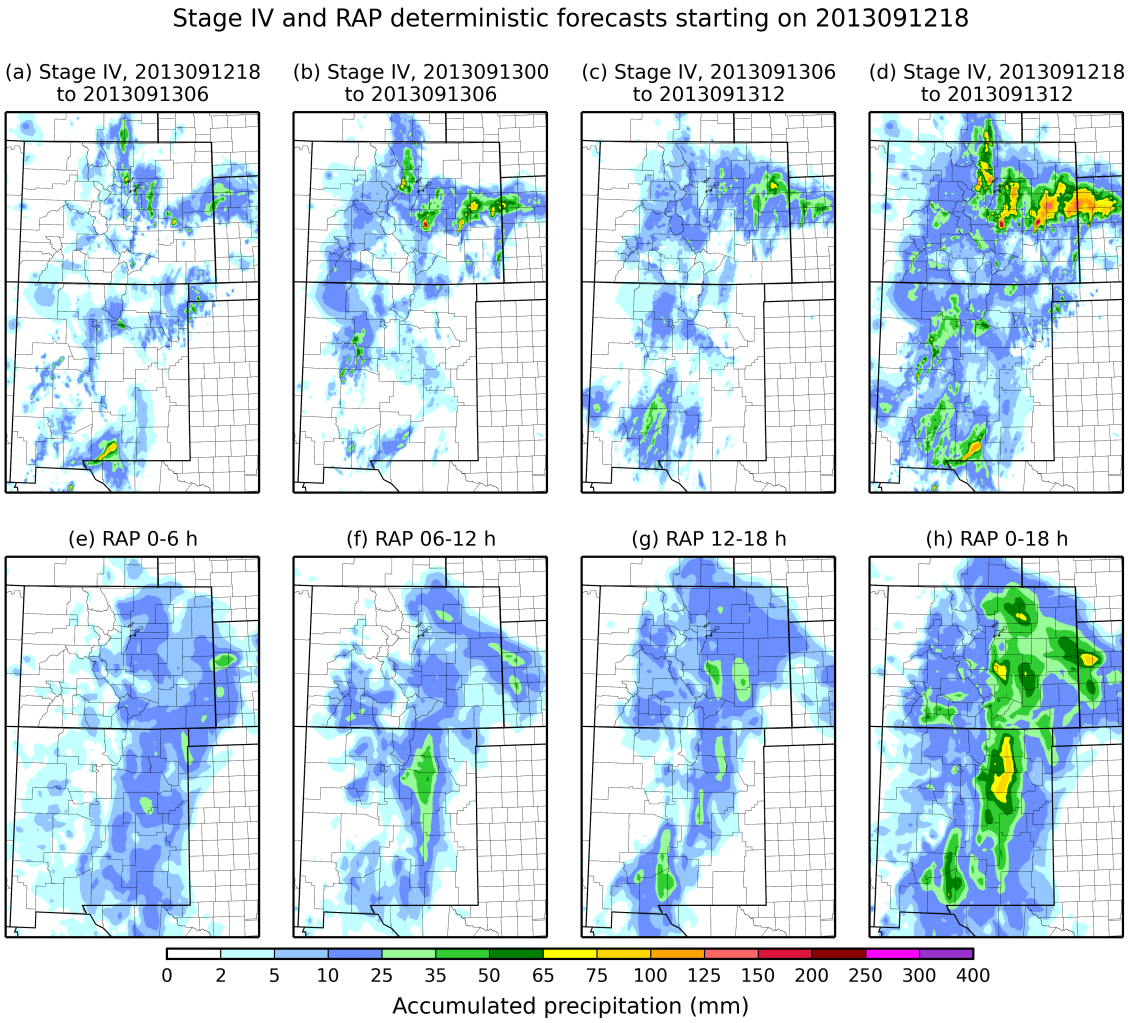

Figure C33: As in Fig. C21, but for data starting from 18 UTC 12 Sep 2013.

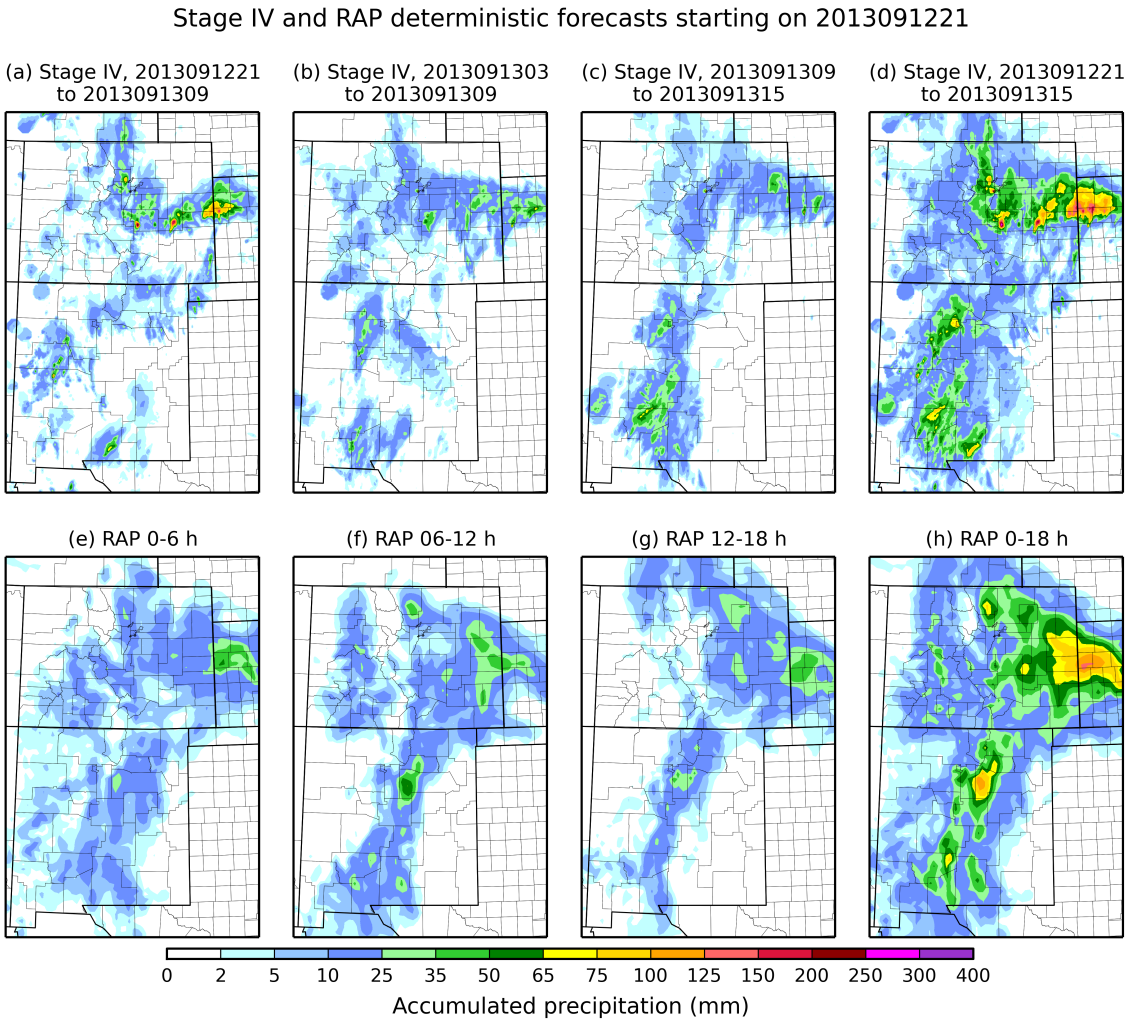

Figure C34: As in Fig. C22, but for data starting from 21 UTC 12 Sep 2013.

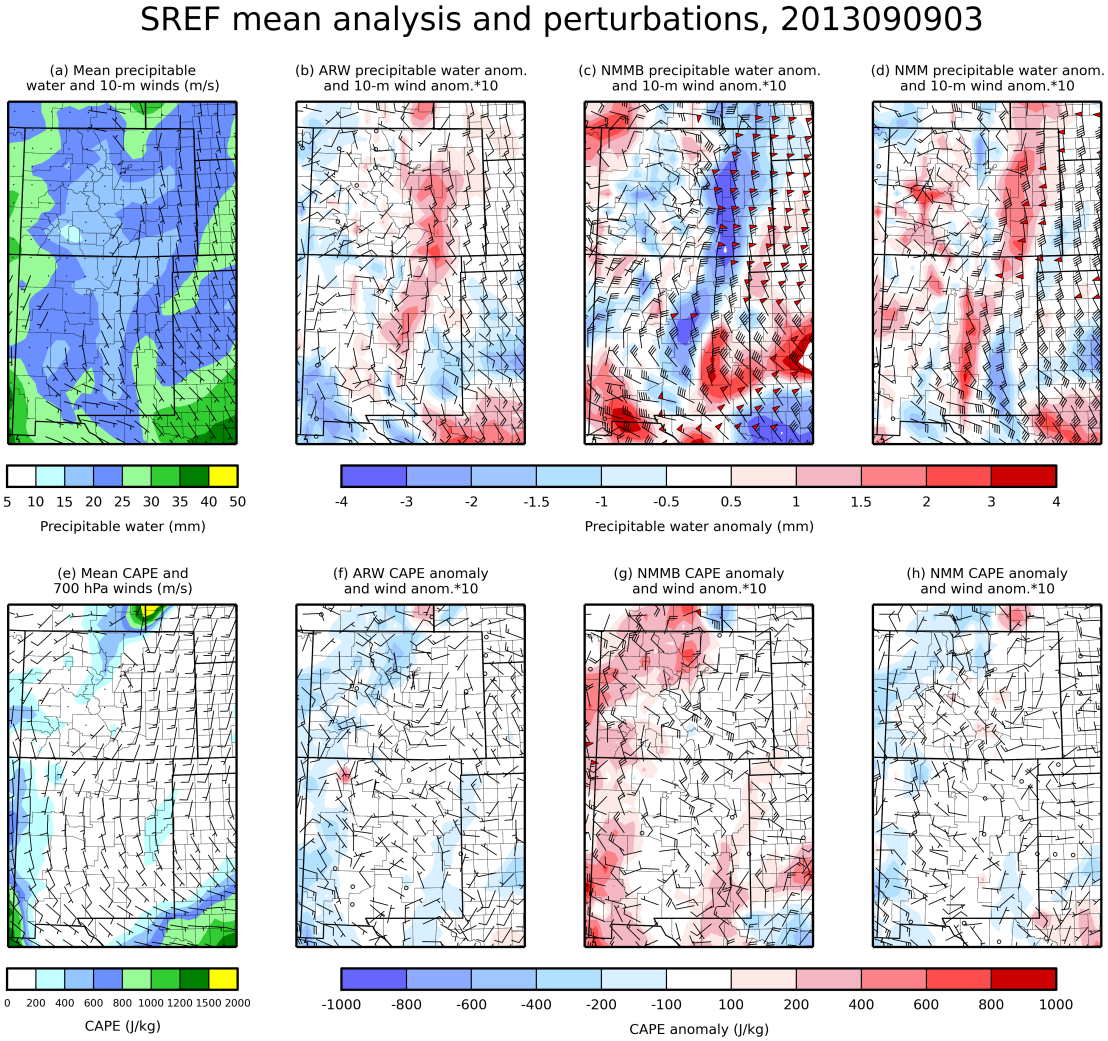

Figure C35: (a) Mean initial condition for precipitable water and 10-m wind speed for SREF members initialized at 03 UTC 09 Sep 2013. Short barbs are 5 ms^{-1}, larger barbs 10 ms-1, and flags are 50 ms-1. (b)-(d) Deviations of the average of initial conditions for the WRF/ARW, WRF/NMMB, and WRF/NMM from the overall mean presented in panel (a). Wind speed deviations are scaled by a factor of 10 to highlight the differences. (d) As in (a), but for mean initial CAPE and 700 hPa winds. (e)-(g) as in (b)-(d), but for initial CAPE and 700 hPa wind deviations. Short barbs are 5 ms^{-1}, larger barbs 10 ms^{-1}, and flags are 50 ms^{-1}.

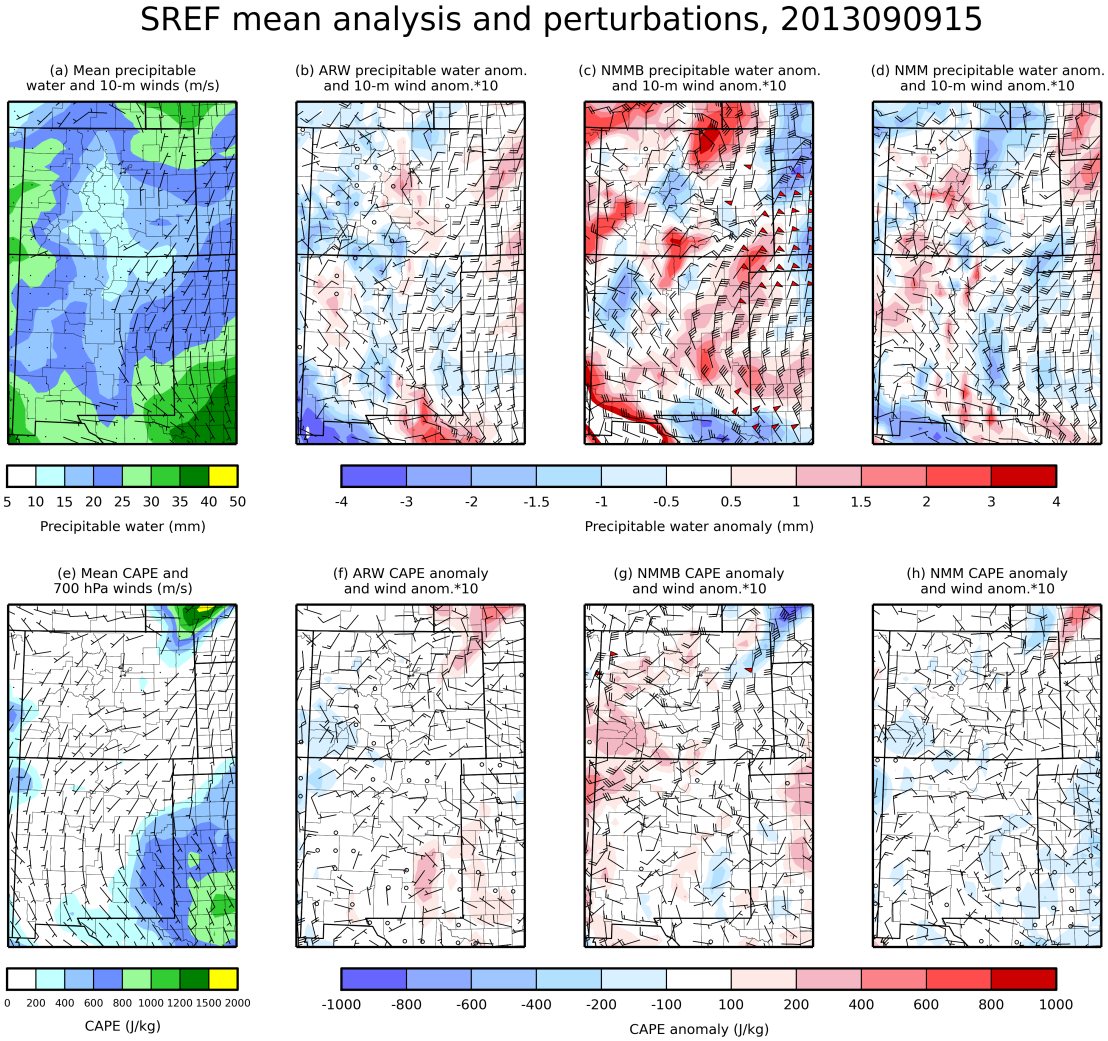

Figure C36: As in Fig. C35, but for SREF members initialized at 15 UTC 09 Sep 2013.

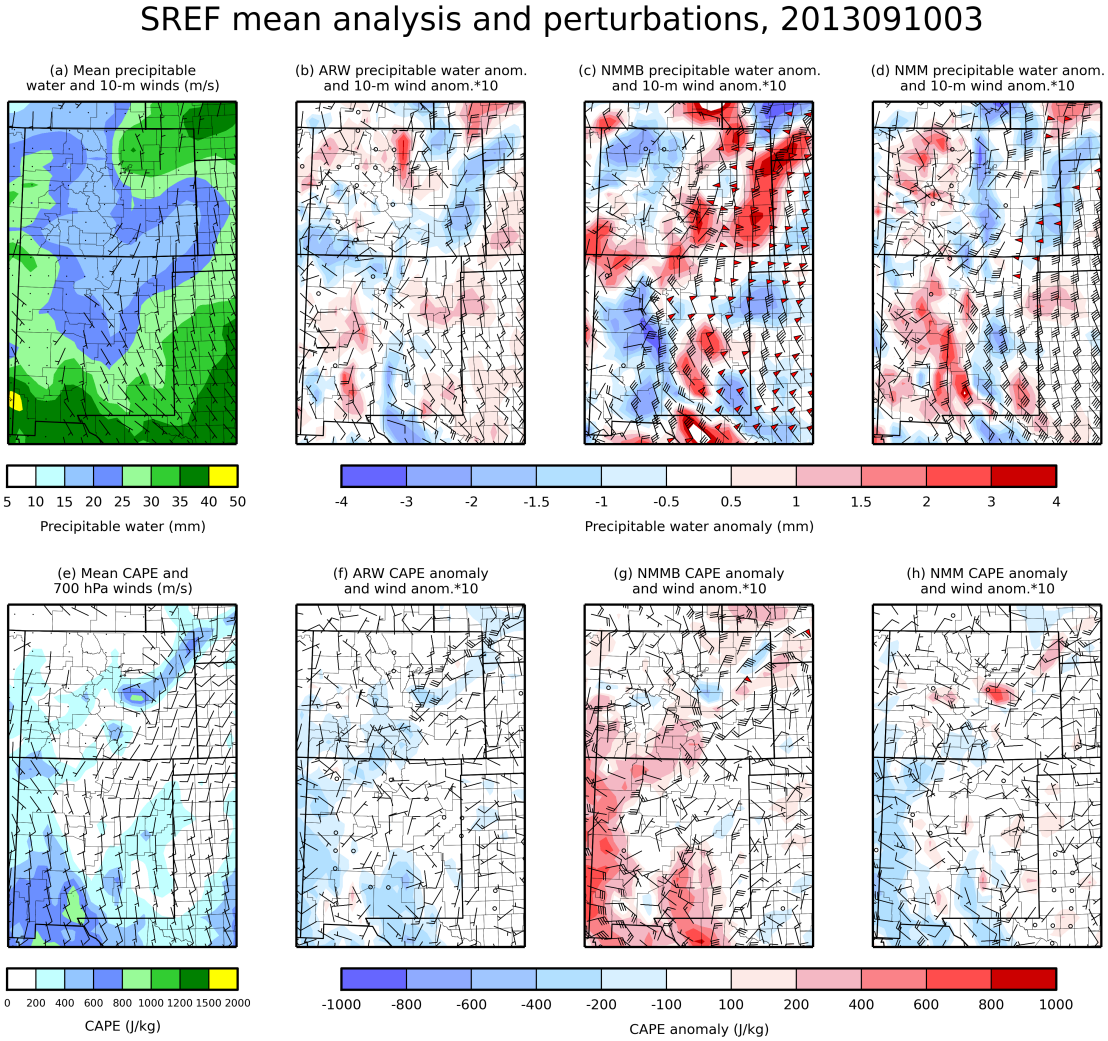

Figure C37: As in Fig. C35, but for SREF members initialized at 03 UTC 10 Sep 2013.

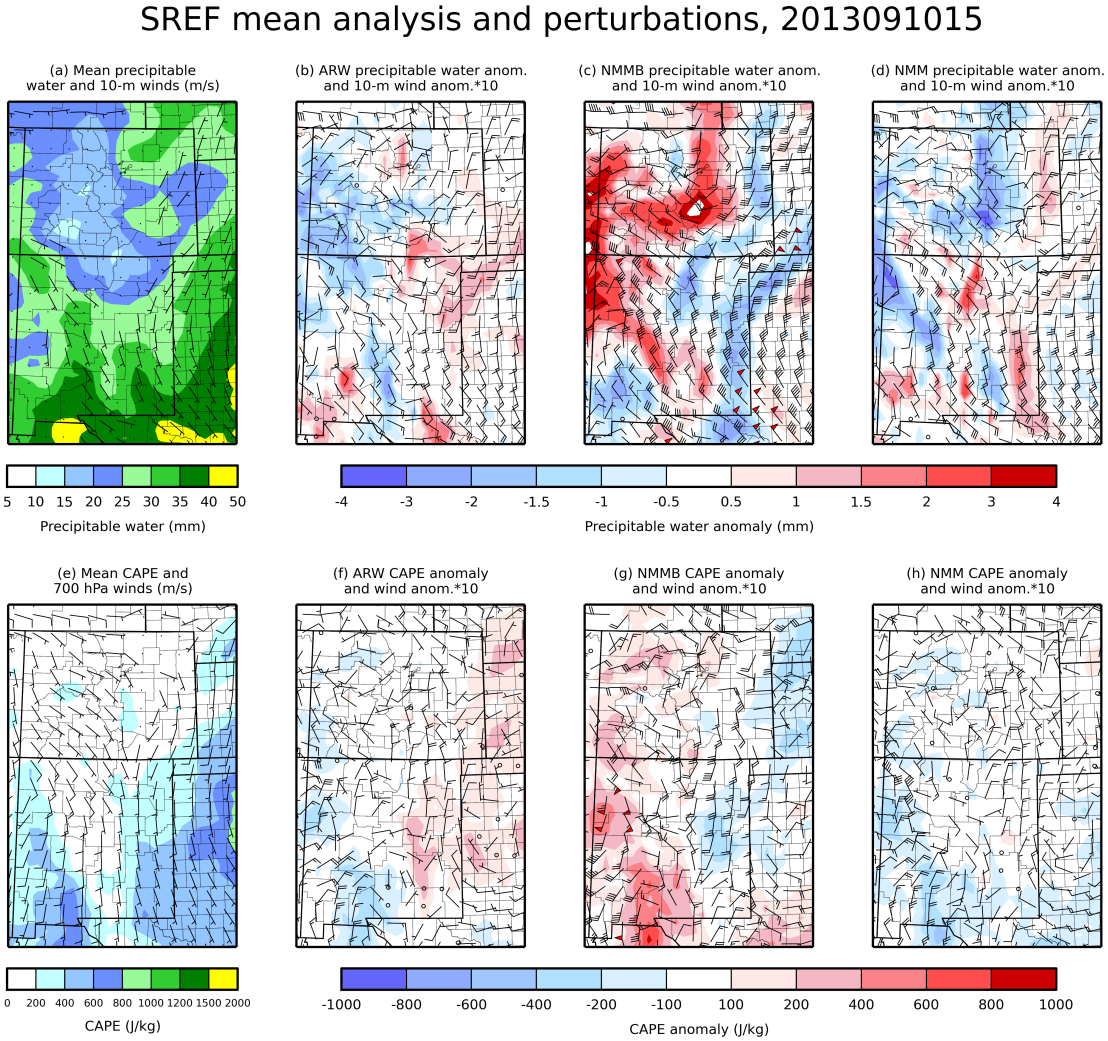

Figure C38: As in Fig. C35, but for SREF members initialized at 15 UTC 10 Sep 2013.

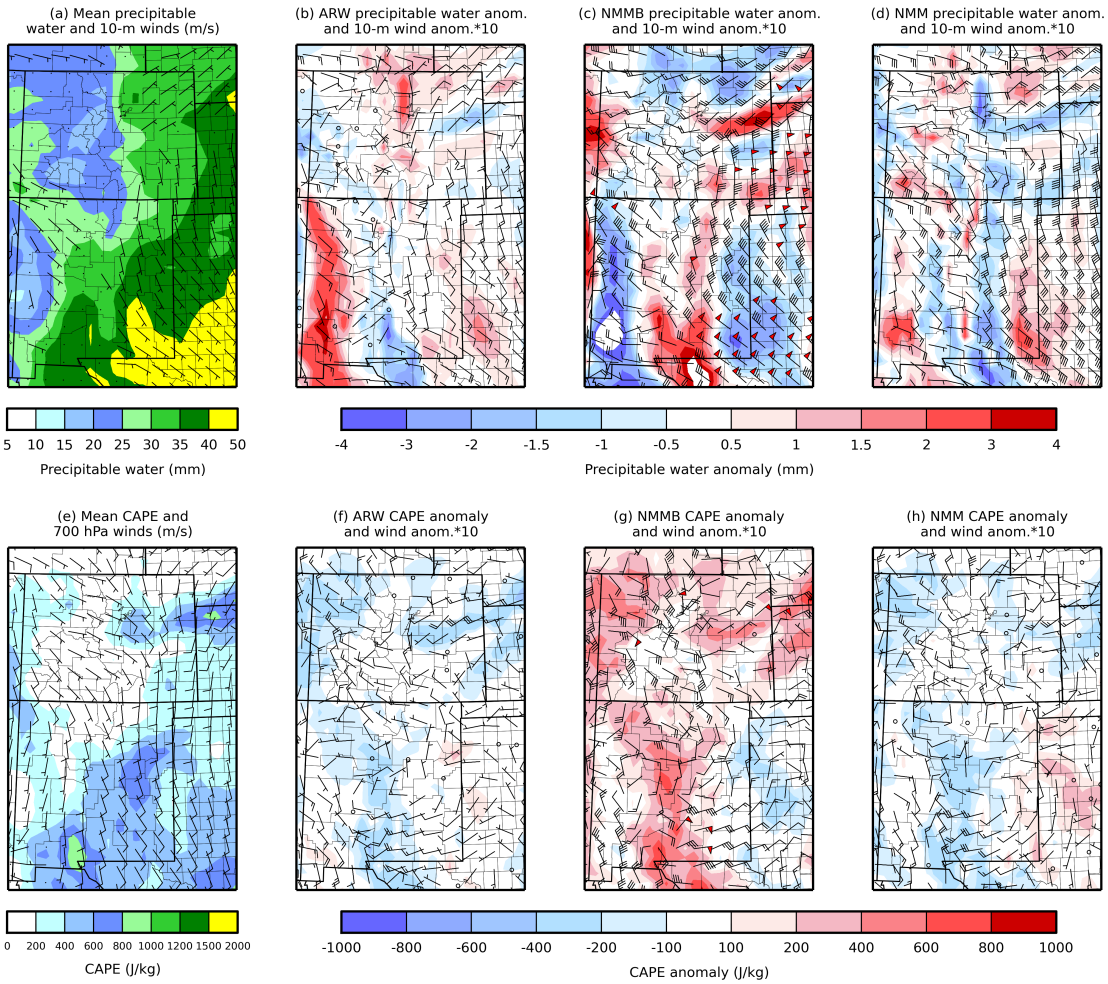

Figure C39: As in Fig. C35, but for SREF members initialized at 03 UTC 11 Sep 2013.