The IPRC–Regional Climate Model

Accurate regional climate predictions are important but difficult to make. **Yuqing Wang**, IPRC associate researcher, and **Omer Sen**, IPRC postdoctoral fellow, have developed the IPRC–Regional Climate Model (IPRC–RegCM), designing it for regional climate research and prediction, especially for studies of the Asian-Australian monsoon. To evaluate the model's performance, they have used it to simulate the 1998 summer monsoon, which caused severe flooding in China. The model domain covered the East Asian summer monsoon region with a resolution of 0.25° in both latitude and longitude. The simulation was run from April 28 to August 31, and results were compared to available station observations in the combined Yangtze-Huai River basin and southern China (23-34°N, 105-122°E) region.

Figure 3 shows the observed and modeled daily precipitation (a) and their spatial standard deviations (b) for the area defined above. The model realistically reproduces the trends and fluctuations of precipitation over the region. The spatial patterns of modeled and observed rainfall variability also agree reasonably well. (Note that the precipitation was underestimated between Julian days 200–220.) Table 1 below summarizes monthly statistics related to precipitation. The table shows that the correlation coefficients of the spatial precipitation patterns indicate good simulation skill in all months except July.

Figure 3c shows observed and modeled daily minimum and maximum temperatures. The estimated daily temperatures are in good agreement with the observations, though there is a small cold bias in the daily minimum temperature during the last two months.

Overall, the model captures the unique features of the Meiyu fronts, the associated rainfall, including a severe flood during the period, and land-surface processes. It can thus be used to study regional climate over East Asia, and to make climate predictions by nesting it in a GCM.

The IPRC–RegCM is based on a mesoscale tropical cyclone model developed by Y. Wang (*Mon. Wea. Rev.*, 2001). It incorporates an advanced radiation scheme (Edward and Slingo, 1996) and an advanced land-surface model (BATS; Dickinson et al., 1993), together with high-resolution vegetation and soil classification data to simulate the land-surface processes realistically. Using hydrostatic, primitive equations in longitude/latitude grids with sigma as the vertical coordinate, the model physics include an E-ε turbulence closure scheme for subgrid vertical mixing, a modified Monin-Obukhov scheme for the surface-flux calculations over the ocean, a mass-flux scheme with CAPE (convective available potential energy) closure for subgrid-scale cumulus parameterization, an explicit treatment of mixed-ice phase cloud microphysics for grid-resolved moist processes, and frictionally-induced dissipative heating. For initial and lateral boundary conditions, the model uses NCEP-NCAR reanalysis, and weekly Reynold's SST for lower boundary conditions over the ocean. The soil moisture fields were initialized such that the initial soil moisture was based on the vegetation and soil type defined for each grid cell.

Table 1. Monthly mean statistics of observed and simulated precipitation (mm day^{-1}) over the region.

Month	Observed Mean (mm)	Estimated Mean (mm)	Spatial Correlation	Temporal Correlation	Bias (mm)
May	5.74	7.78	0.49	0.92	2.34
June	9.45	8.90	0.67	0.69	-0.33
July	6.70	5.64	0.05	0.67	-1.07
Aug.	5.04	4.00	0.51	0.56	-1.17

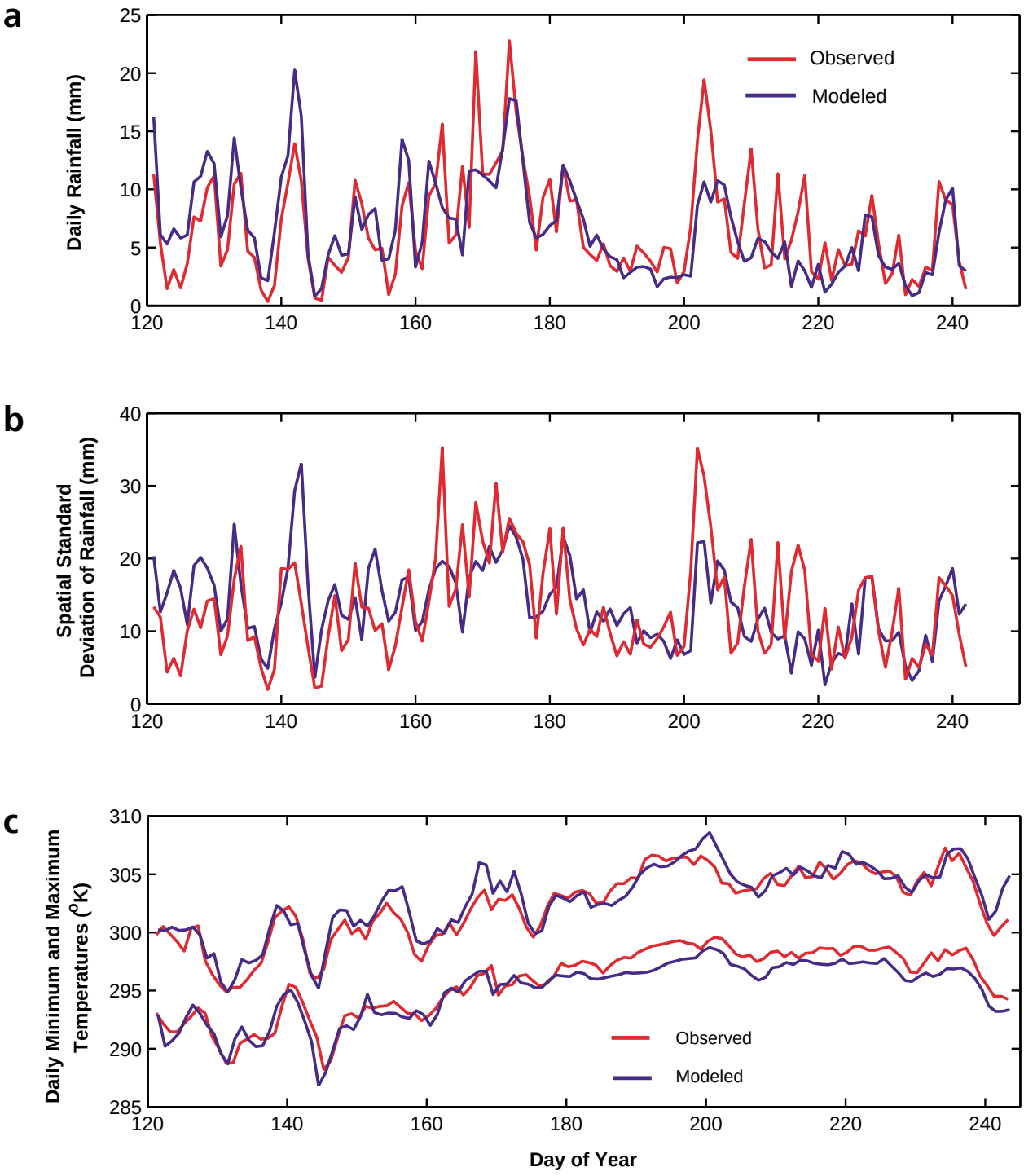

Figure 3. *Results from the IPRC–Regional Climate Model simulation of the 1998 Asian summer monsoon for the region 23-34°N, 105-122°E: (a) observed and modeled daily precipitation; (b) the spatial standard deviations of the observed and modeled daily precipitation; and (c) observed and estimated daily minimum and maximum temperatures.*