Numerical Study of 1998 Late Summer Flood in East Asia

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I. INTRODUCTION

The Purdue Regional Model (PRM), a 3-D hydrostatic model with detailed physics and all phases of water, including vapor, cloud water, ice, snow, rain, and supercooled water (Sun 1993a, b, 1995, Chern 1994, Haines et al. 1997, Bosilovich and Sun 1999) was used to study the flooding in China and Korea in the late summer of 1998.

II. RESULTS

There were are 28 layers from the surface up to the top at 20 mb hPa with a higher resolution in the lower atmosphere. The domain is 6300 x 5850 km^2, consisting of 141 x 131 grid points with thea horizontal grid interval of $\Delta x = \Delta y = 45$ km. The model is integrated from 00Z300798 to 12Z180898 continuously without nudging. The ECMWF reanalysis is used as the initial condition and the lateral boundary condition for model simulation. The observed SST is also applied over the ocean.

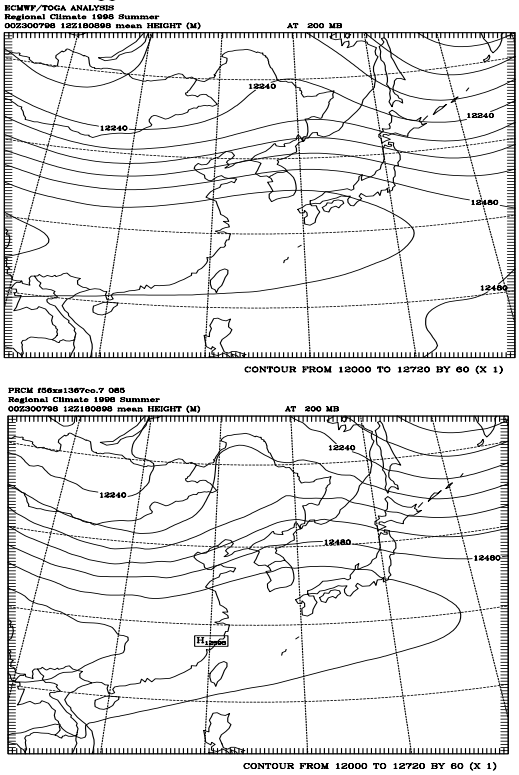

FIG. 1: 20-day mean geopotential at 200mb for ECMWF (top) and PRM (bottom)

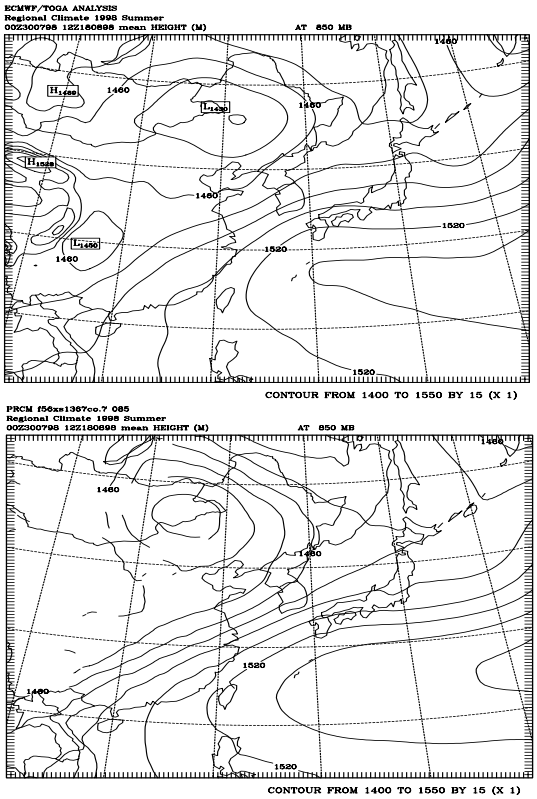

FIG. 2: 20-day mean geopotential at 850mb for ECMWF (top) and PRM (bottom)

Fig. 1 and 2 show the mean geopotential at 200mb and 850 mb from ECMWF reanalysis and PRM simulation, respectively. The observed pattern is reproduced by the model. However, we also see the simulated 200mb ridge over Tibet is stronger than observed; the simulated 850 mb subtropical high over ocean is also stronger than observation. Therefore, the simulated rain fall (Fig. 3b) is more than the amount derived from GPCP (Fig. 3a) during this period, although the model did predict the floods in Korea, Manchuria, and Changjiang River basin, but the amount is more than observations.

III. CONCLUSIONS

The Purdue Regional Model is capable of reproducing the evolution of weather system during heavy precipitation over Korea and China between 30 July and 18 August 1998. The results show that heavy rainfall along the Baiu/Mei-Yu front was maintained by: (1) an anomalous 850 hPa subtropical

high, which intruded westward and enhanced the low-level jet over southeastern Asia, (2) a stronger baroclinicity around 40 °N over eastern Asia and a low pressure located to the north of the front, which not only enhanced southwesterly wind along the frontal zone but also blocked the northward movement of the front, and (3) an excessive evaporation from abnormal wet, warm land. The precipitation ended by 18 August when the subtropical high had retreated and the low-pressure in Manchuria also moved away from Asia continent. They are consistent with the ECWMF reanalysis and precipitation estimated from GPCP. High correlations are also found on most variables between model simulation and ECMWF reanalysis for the 20-day means. However, it is also noted that the propagation of the simulated low pressure in Manchuria is slower than observed, which may be responsible to the deepening of that low as well as an excessive heavy precipitation in that area.

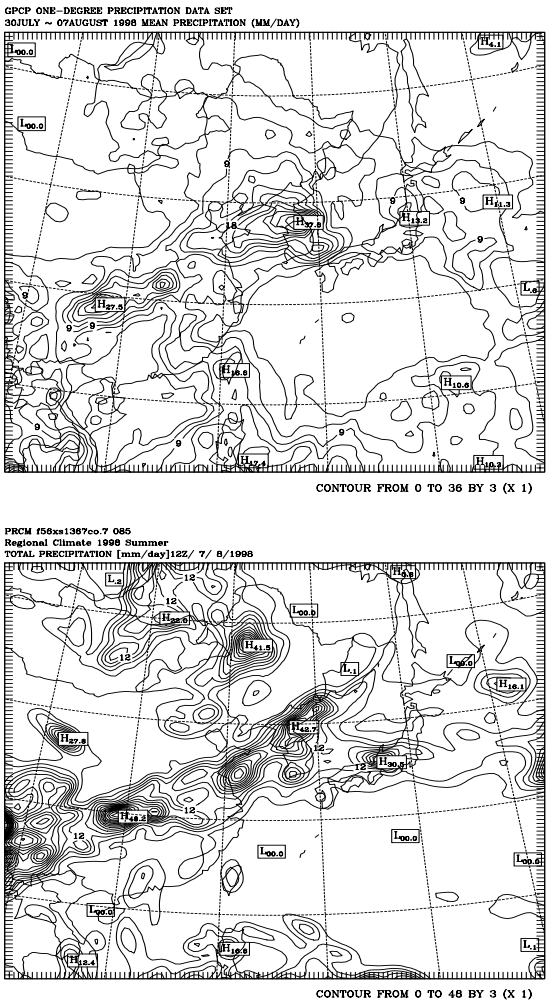

FIG. 3: Mean daily precipitation estimated from GPCP during 00Z300798-12Z180898 (top) and PRM (bottom)

IV. AKNOWLEDGMENTS

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