P9.7 SHORT-TERM AVIATION CLIMATE PREDICTION STUDY AND SOME PRELIMINARY RESULTS AROUN CHINA

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1. INSTRUCTION*

Short-term climate prediction is essential for various social-economic activities, climate disaster, such as extreme drought (or flood), low (or high) temperature, lack of sunshine and any other severe weather procedures cause uncountable loss of lives and properties, It affects agriculture, industry, communication, transportation, military action, as well as social stability. Earlier prediction of short-term climate disaster is important to reduce undesirable damage and save lives and properties, which is the first priority for cost-effective aviation operation as well.

There are, however, several techniques in aviation short-term climate forecasting, of which the statistical methods prevail (Barnston and Linear, 1994). Besides, the weather rhythm analysis (Wang, 1984), high-level wind currency tracing etc are also basic techniques of short-term aviation climate forecasting. But it is no doubt that the present accuracy of short-term climate prediction requires to be raised further.

This paper presents a numerical technique for short-term aviation climate forecast. The forecast period covers 30 days from the initial time; the main frame of the forecast system is composed of a fine-grid regional climate model (RCM) and a coarse-grid global circulation model (GCM). Besides the conventional nesting techniques, the present system also involves some new approaches to raise the prediction accuracy, which include the weekly SST updating, the latest LULC fed from the satellite observation, downscaling interpretation to the interesting routes or flight zones, as well as an integrating technique with the popular statistical models (see Fig. 1).

2. MODEL DESCRIPTION AND RESULTS DISCUSSION

The GCM used in the system is known as T63L16, which is the operational model by National Climate Center of China and the RCM is a modified version of the meso-scale model MM5(V3). The system output products include the main weather procedures that might affect the aviation activities within the 30-day forecast period, the average, maximum, and minimum temperature, and precipitation of each 10-day period.

The system was run since July of 2001 and has performed very well. System validation was carried on according to the four critical parameters commonly used in short-term climate validations (Chen and Zhao, 1998); these are prediction score (P), climate skill-scores of forecast (SS1), random skill-scores of forecast (SS2) and the abnormal correlation coefficient (ACC) with respect to monthly averaged temperature, precipitation as well as 500hpa potential heights at each grid within the domain of RCM that covers an area of 14.10°N-49.60°N, 84.60°E-140.50°E. The preliminary results are listed in Table 1 in comparison with the operational forecasts issued by National Climate Center of China during a period from 1975 to 1990, we satisfy with the significant accuracy improvement.

Fig 2 and Fig. 3 are simulated precipitation and surface temperature for a single month of June, 2003. As compared with GCM's outputs of T63L16, the nesting model gives out more distributional details of both temperature and precipitation. For instance, nesting model simulated the heavy rainfall center at the southeast part of Tibetan Plateau but GCM failed to do so. It also illustrates that the rain belt along the Yangtze River valley extended to China's east cost and Japan, the satellite observation showed this rain belt extension though there are no observation data available. Nevertheless, both GCM and nesting model virtually predict a heave

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rain center in the west boundary of the model domain that is not appeared in the observations. This might be caused by boundary condition transitional zone setting technique.

The simulated surface temperature by nesting model is in good agreement with observations (Fig. 3). Both T63L16 and NCEP reanalysis data just show the general latitudinal pattern of temperature, they failed to simulate the temperature high in the south part of Tibetan Plateau and the complexity in Xinjiang Autonomous Region, but our nesting model does it well as compared with observational data.

Table 1 preliminary results of short-term aviation climate numerical prediction system in comparison with operational forecast of National Climate Center of China

	P	SS1	SS2	ACC
NCC (t)	64.58	0.028	-0.059	0.004
Nest (t)	75.6	0.230	0.163	0.629
NCC (R)	60.6	0.009	0.16	0.013
Nest (R)	85.5	0.61	0.67	0.14

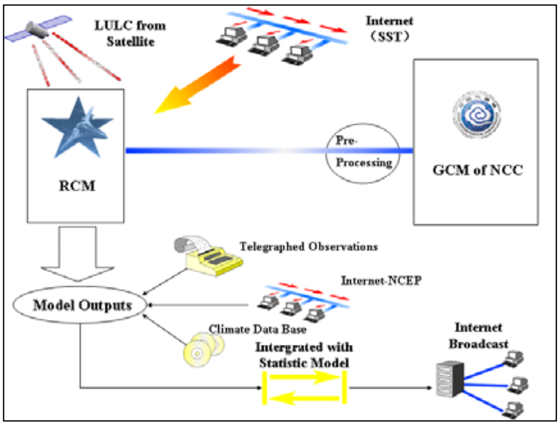

Fig. 1 The Configuration of short-term aviation climate numerical prediction system

3. SUMMARY AND CONCLUSIONS

It is feasible to nest the mesoscale model MM5V3 into a GCM and form a forecast system for a month-period short-term climate prediction. The numerical system can be used as an operational tool in short-term aviation climate prediction. The new system has run stably since July of 2001 and produce month-long prediction twice a month. The system validation was carried on according to the four critical parameters: the prediction score (P), random (SS1) and climate skill-scores (SS2)，and the abnormal correlation coefficient (ACC). The prediction accuracy was raised significantly as compared with NNC's operational forecast average in a period of 1975-1990. The simulated graphs are also compared with those from GCM, NCEP reanalysis data and the observations. The comparison shows that the new system has raised the accuracy of both the synoptical situation graphs reflected by geopotential heights on different isobar surface but also of the actual climate variables such as temperature, humidity and precipitation.

Acknowledgments

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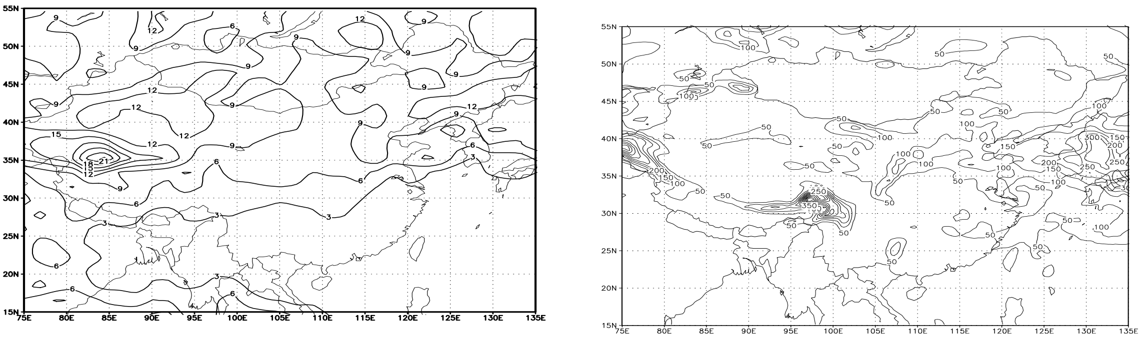
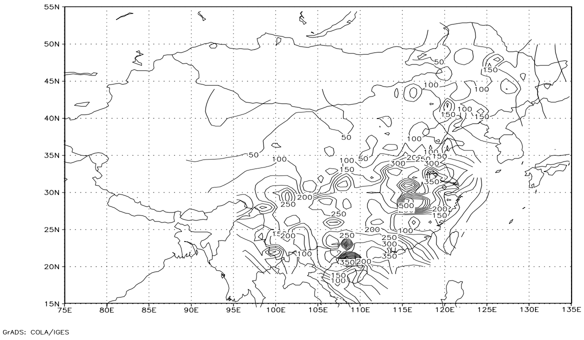


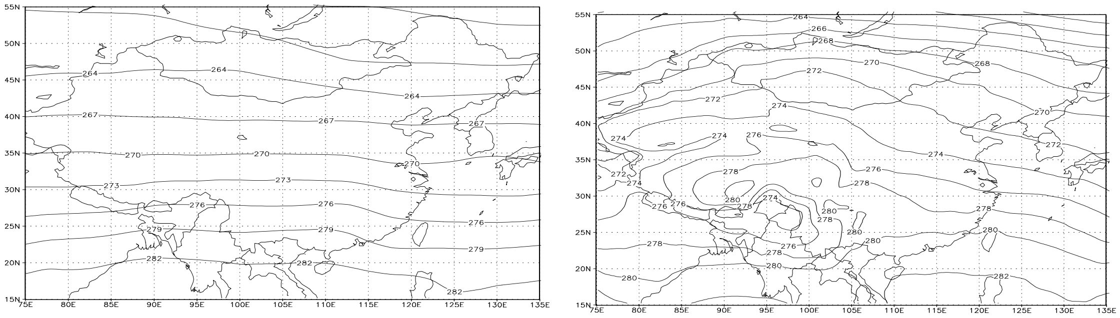
T63L16 outputs

Present Model



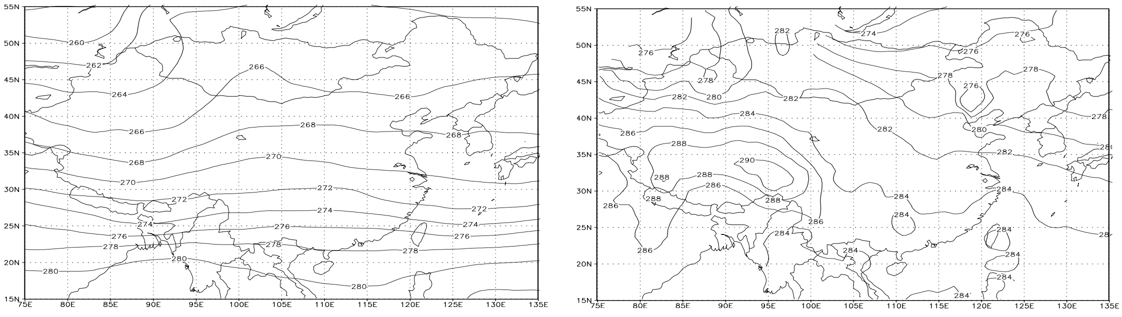
Observations

Fig. 2 The monthly accumulated precipitation comparison (June 2003)



T63L16 outputs

Present model



NCEP reanalysis

Observations

Fig. 3 The monthly averaged surface temperature comparison