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IMPACT EXPERIMENTS ON NWP OF RAPID SCAN AMVs

This document describes the result of impact experiments of Atmospheric Motion Vectors on a Numerical Weather Prediction Model. The experiments were performed for two Typhoon cases. The result shows the rapid scan winds upgrade the accuracy of the prediction of typhoon.

No action is required on this subject.

IMPACT EXPERIMENTS ON NWP OF RAPID SCAN AMVs

1 INTRODUCTION

JMA reported on an impact experiment of rapid scan Atmospheric Motion Vectors (AMVs) with a numerical weather prediction model at CGMS XXIX, and the session called for further studies on related model impacts with rapid scan AMVs (action 29.35). JMA subsequently performed the impact experiment with its 3D-Var assimilation system. The detailed particulars of the experiment was reported to the sixth International Wind Workshop held in Madison, USA in May 2002.

This document briefly describes the configuration and the results of the experiments with both 3D-Var and OI assimilation systems.

2 DESIGN OF THE EXPERIMENT

The target domain of rapid scan AMVs is the area between equator and 50N for latitude, 90E and 170E for longitude. Wind vectors are extracted each 0.5 degree interval in latitude and longitude from three consecutive IR, VIS and WV imageries in 15 minute interval up to 04 UTC. Two types of pattern matching are used in the experiment to determine wind vectors; one's matching area is 16 X 16 pixels and the other's is 32 X 32 pixels. The pixel sizes of IR, VIS and WV imagery are 5km, 1.25km and 5km respectively.

The forecast experiments up to 72 hours for two typhoon cases in 2002 with JMA's operational global NWP system in which OI assimilation system was employed were carried out at first. JMA introduced 3D-Var assimilation system in the global NWP system in September 2001, and the experiments were re-executed using this new assimilation system. Consequently, the six types of predictions including the control run shown below are compared. The best tracks of the typhoons are shown in fig.1. Both typhoons moved westward in early stage and later turned northward, one of which further moved eastward, along with the mid latitude westerly.

(1) Control run used OI (Cntl1)
(2) Control run used 3D-Var (Cntl2)
(3) OI + 16-pixels rapid scan data (OI+R16)
(4) OI + 32-pixels rapid scan data (OI+R32)
(5) 3D-Var + 16-pixels rapid scan data (3D_Var+R16)
(6) 3D-Var + 32-pixels rapid scan data (3D_Var+R32)

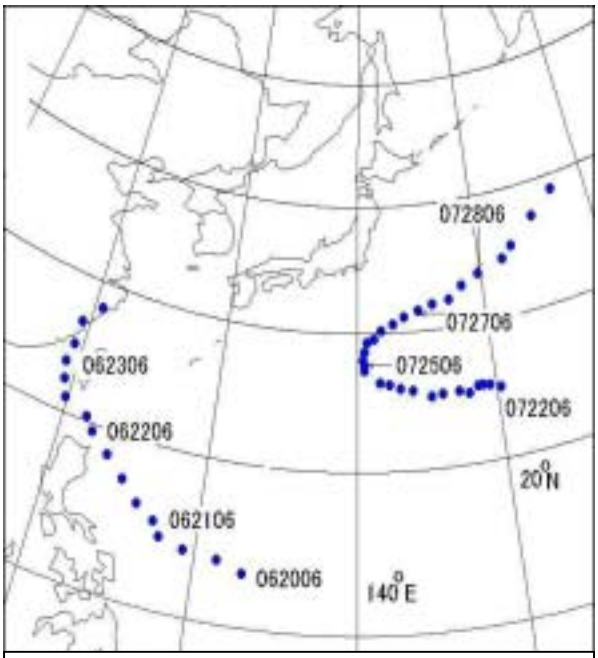

Fig. 1 Tracks of Typhoon 0102 and Typhoon 0106, They are shown every 6 hours.

3 RESULT OF THE EXPERIMENT

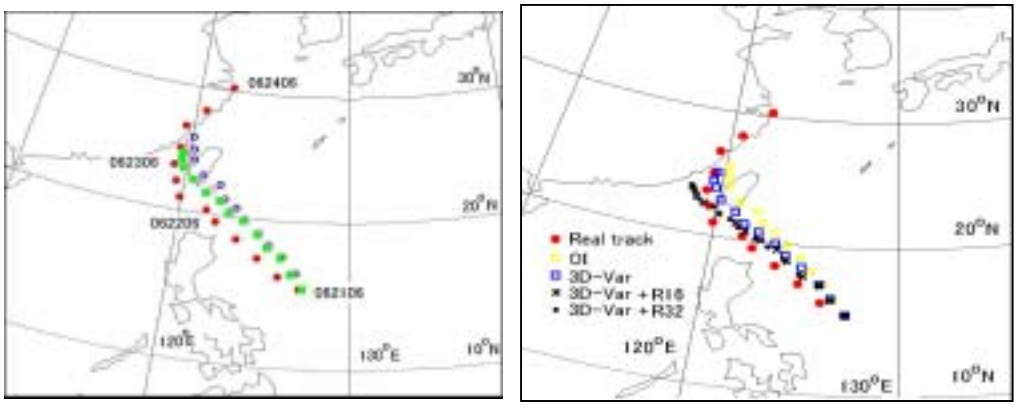

Fig.2 An example of predictions of typhoon. In the figure left red dots show real typhoon track. Blue open circles show OI, purple squares show OI+R16, green squares show OI + R32.

Fig.2 shows a case of the comparison of predictions of the typhoon. Totally, the model with 3D-Var assimilation predicts better than that with OI assimilation does and rapid scan AMVs improve the prediction of typhoon track up to 48 hours.

As for the pattern matching methods for AMVs generation, AMVs derived from 32-pixel pattern matching seems to have more positive impact than that from 16-pixel one in the experiment with OI assimilation, on the other hand, the opposite result is given in that with 3D-Var. It is thus difficult to conclude clearly at this stage that which pattern matching method is more effective for NWP.

4 PROBLEMS AND FUTURE STUDY

Through this experiments of AMVs, it is found that QI for 15-minute interval observation doesn't perform so well as QI for 30-minute interval observation. Causes and a solution should be investigated.

There is two hours difference between observation time and analysis time. In the OI assimilations, we adjusted the effect of time difference using FGAT (First Guess at Appropriate Time). As the result, FGAT improved typhoon track prediction up to 48 hours. JMA has implemented meso 4D-Var operational system in March 2002 and it will be employed in the global model in 2004. Introduction of future global 4D-Var system will possibly solve this problem. We are considering the investigation on the effect of 4D-Var with satellite winds to typhoon track forecast.