

ATOVS Microwave Sounding Observation Cycling Assimilation on a Tropical Cyclone Case in 2012

Presenter: Shuang xi Email: xishuang@cma.gov.cn

Authors: Shuang Xi, Peng ming Dong, Peng Zhang, Danyu Qin, Gang ma, Hui Liu
National Satellite Meteorological Center, China Meteorological Administration

Introduction

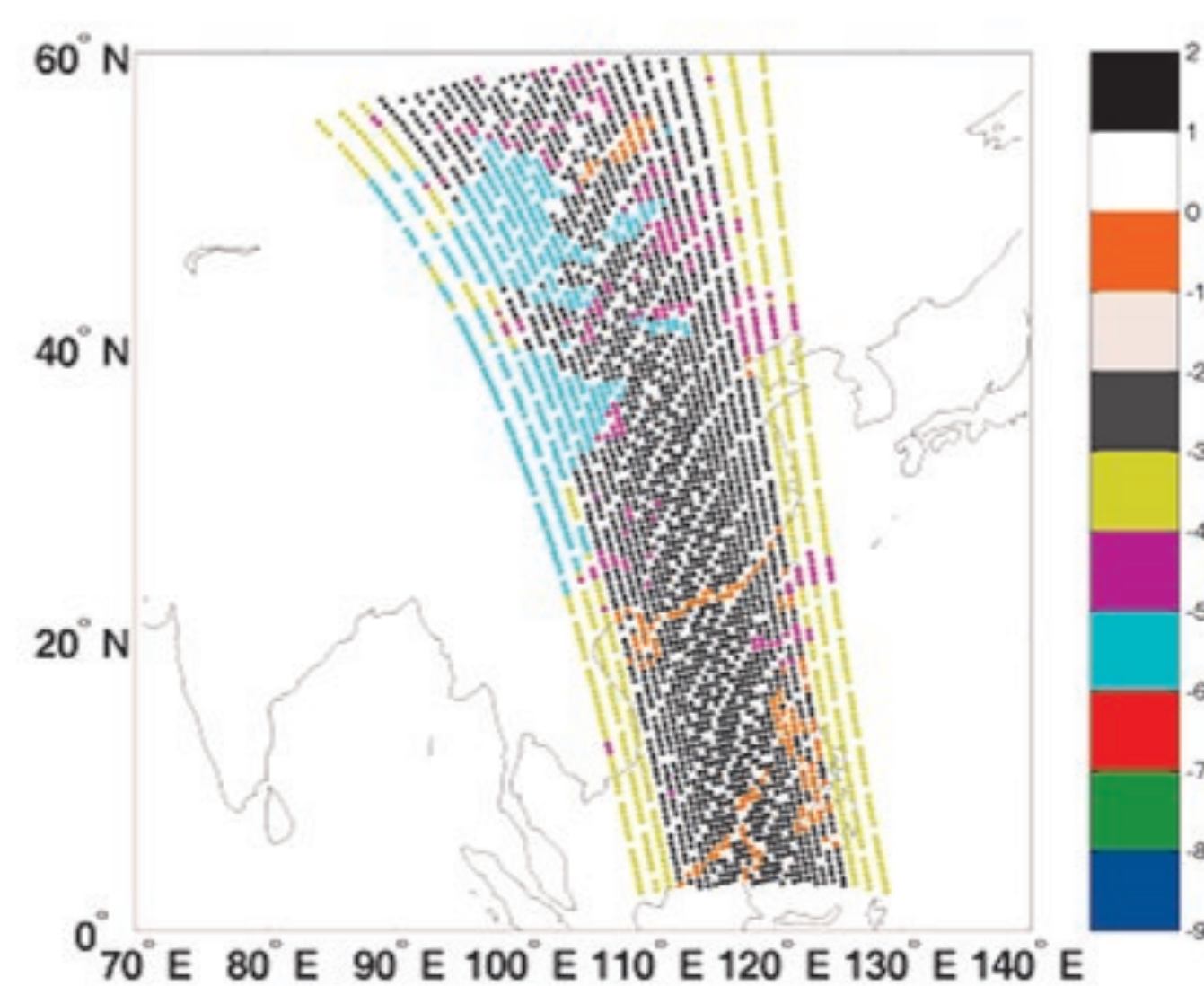
In order to get information from satellite data continuously, A cycling assimilation system is developed for satellite assimilation and forecasting in NSMC. This system is designed to assimilating various satellite data, now with direct assimilated ATOVS data under clear sky, with retrieval data under cloudy or rainy sky in future.

Models

WRF model is used for forecasting and WRF DA for assimilating. The numerical model is start based on NCEP FNL data in case study now, and CMA T639 forecast data for probable operational use.

Satellite data and QC

ATOVS satellite NOAA 18 AMSU-a data (channel 5-9)is used, with 7 steps of quality control as Fig 1 below.



Quality Control of Micro-wave data:

Cloudy test,
mixture surface type,
limb data,
precipitation check,
Surface height/pressure check,
Innovation check:
Absolute departure check (>15k)
Relative departure check(>3*tb_error)
...

Fig 1 Data rejected in every step of miro-wave quality control

Test typhoon case and experiments design

A cycling assimilation system(Fig 2 and Fig 3) is developed for satellite sounding data, as a test case , ATOVS NOAA 18 AMSU-a data are used , to check the impacts on the track forecasting of Tropical Cyclone ‘SAOLA’ in 2012.

Three experiments are designed (in a period of 120 hours):

control experiment:

cold experiment: assimilating per 6hr, with a cold start.

cycling experiment: assimilating per 6hr, with a warm start.

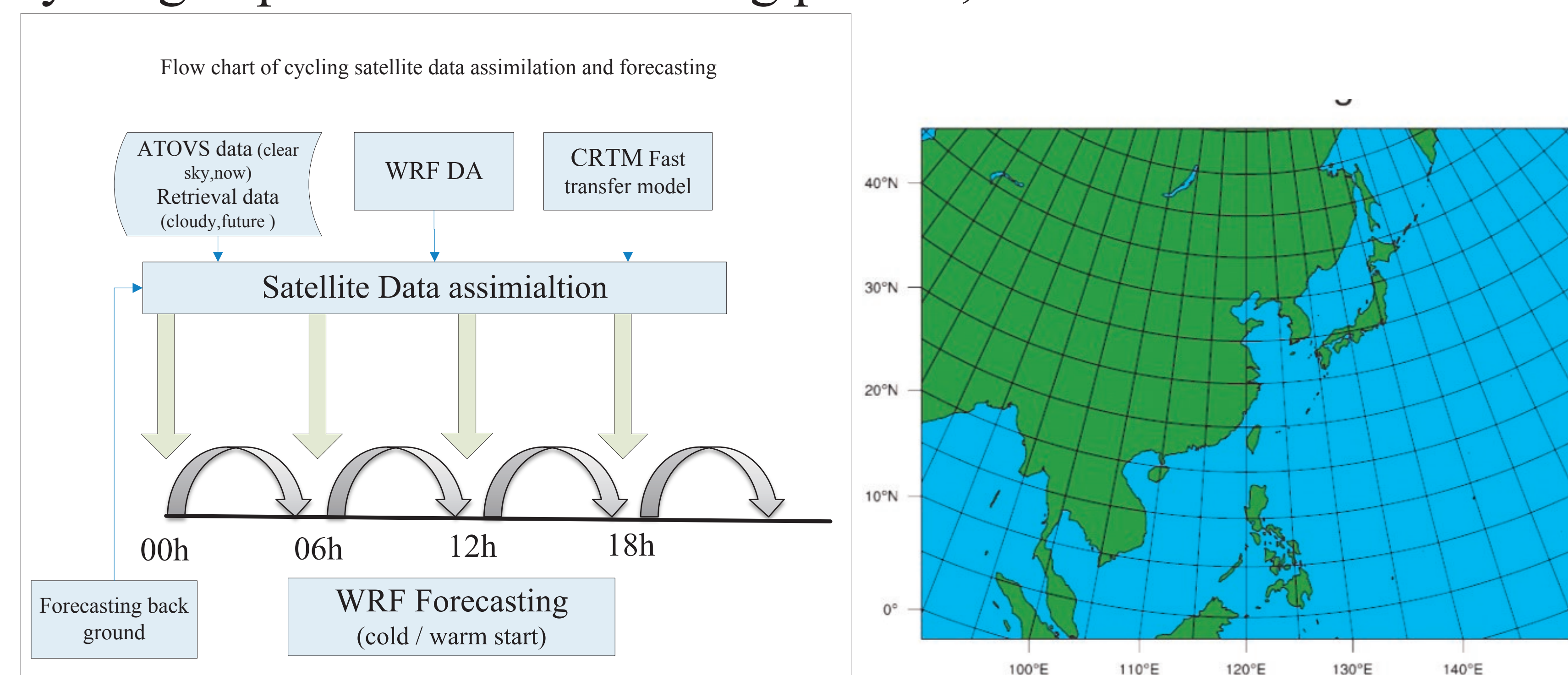


Fig 2 The flew chart of cycle assimilation

Fig 3 The model domain, where most of typhoons occur.

Literature cited:

WRF DA site,
Benjamin S G, Devenyi D, Weygandt S S, et al. An hourly assimilation-forecast cycle: The RUC[J]. Mon Wea Rev, 2004, 132: 495-518.
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Min Chen, Shuiyong Fan, Zuofang Zheng,eta.,The performance of the proximity sounding based on BJ-RUC system and its preliminary in the convective potential forecast. Acta Meteorologica Sinica,69(1):181-194

Result

Compared with the cold start forecasting (Fig 4a), more detail information of the Tropical Cyclone is described by cycling forecasting (Fig 4b). That's because not only the satellite sounding observations are added, but the information from the latest forecasting cycle is also reserved in next step.

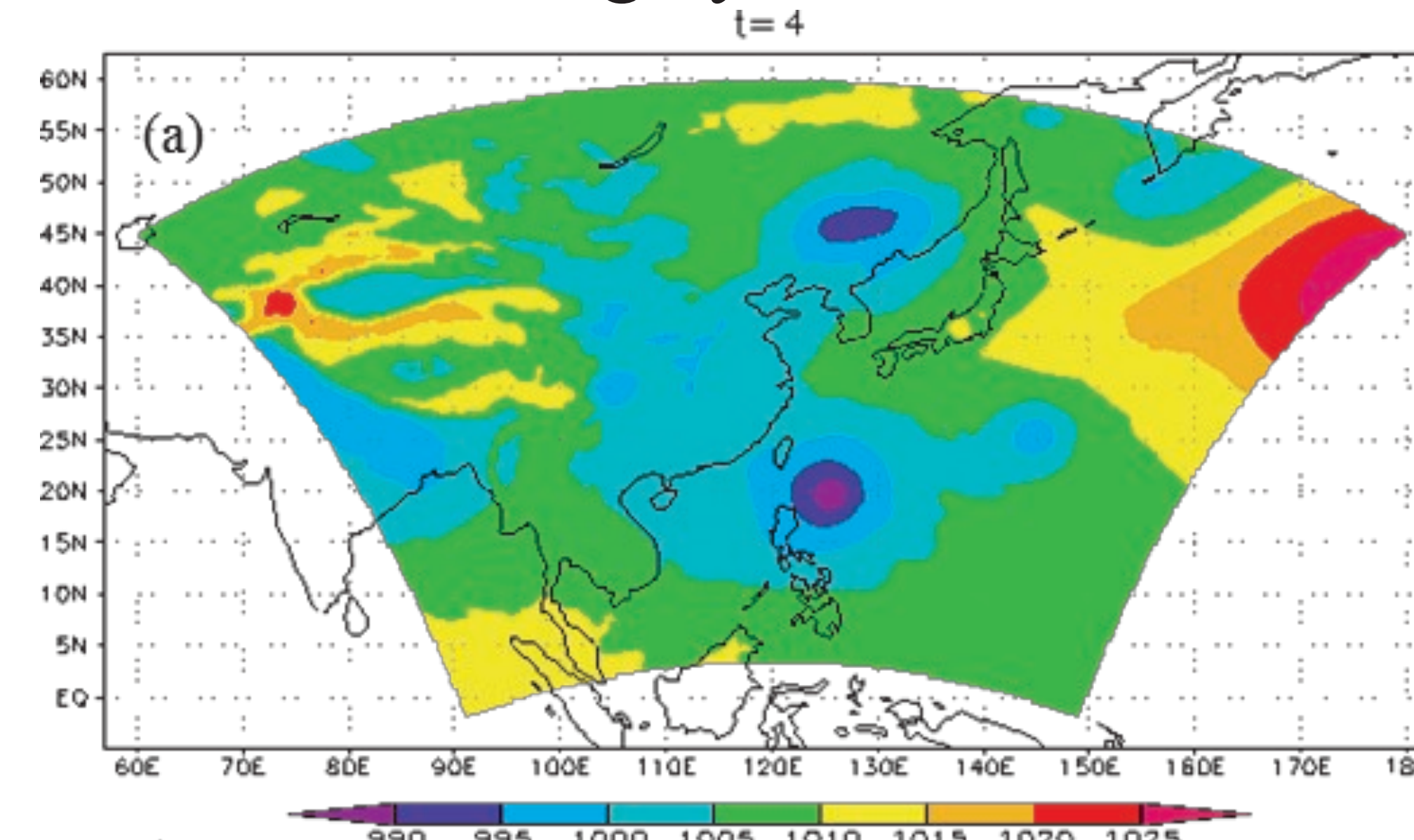


Fig.4a The sea level pressure in Control experiment (UTC2012073000),unit: hPa

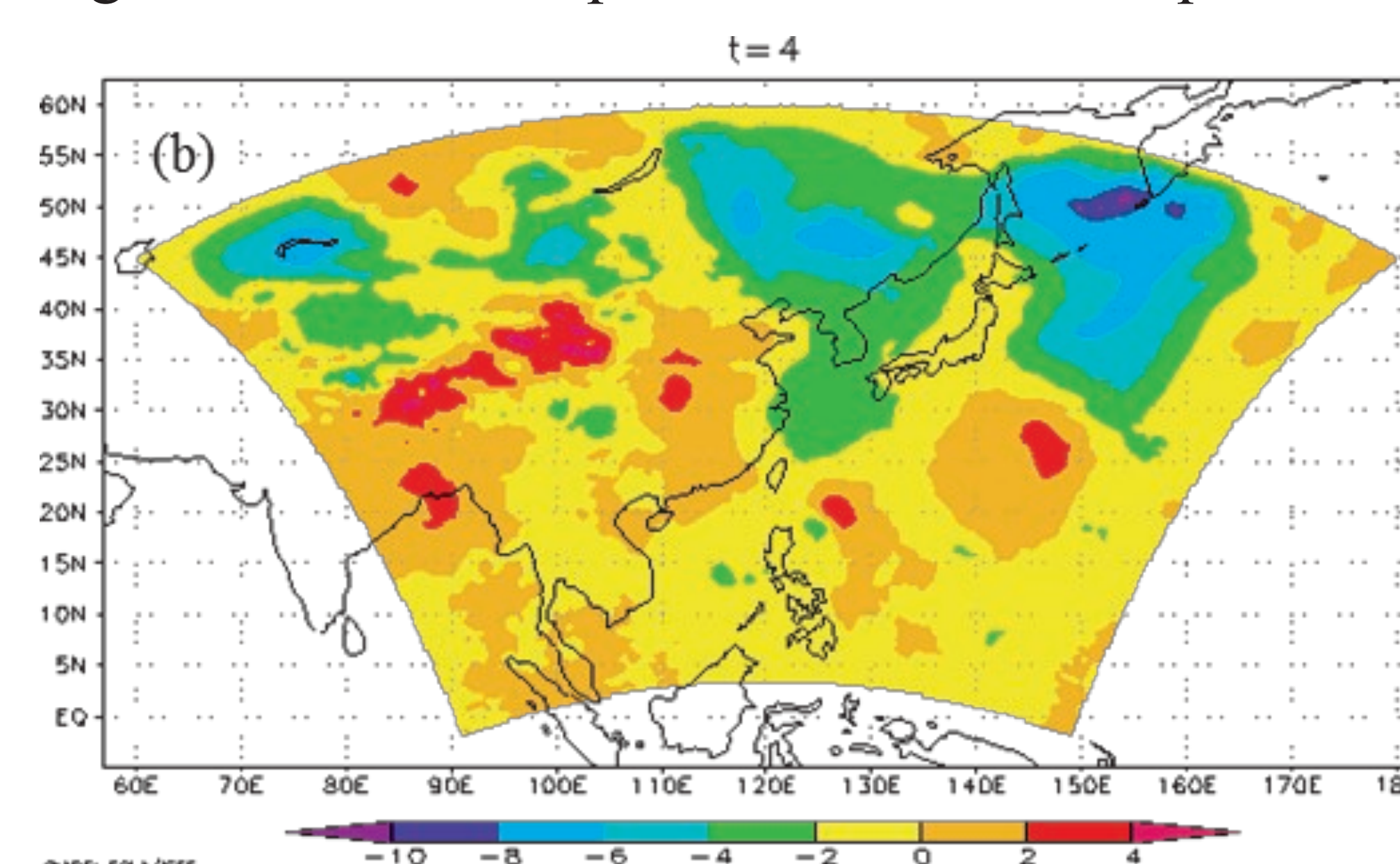


Fig.4b The increments of sea level pressure in Cycle experiments(at the same time) ,unit: hPa

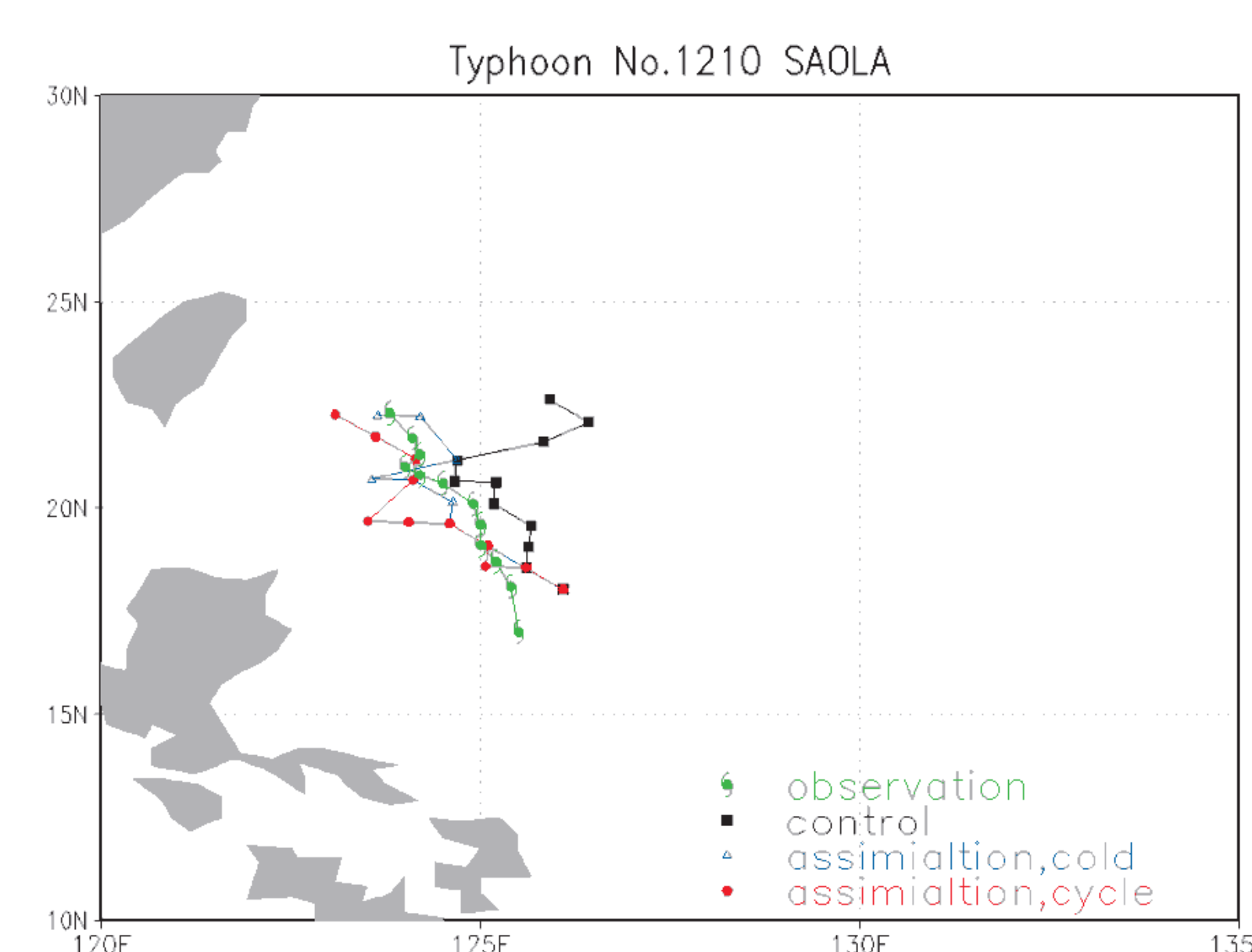


Fig5 Tracks in observation (green),control experiment (black), cycle assimilation experiments with cold starts (cold blue), and cycle assimilation experiments with warm starts(warm red).

As for track errors (Fig 5 show tracks), the assimilation exp. is better than control exp. , and the cycling exp. is prior to the cold exp. in the first one day and third day but in the second day ,there are large errors in cycling assimilation exp. The reason is unknown now.

As for the intensity (figure omitted), in the first day and early second day, there are few differences between reanalysis observation and the other 3 experiments.

Conclusion

As a test case, cycling assimilation (warm start) can give more details of the typhoon structure;

Satellite data can improve the track forecasting;

There are still some complex reasons to holding the positive impact all the way, farther study of the data is needed and conventional data should be assimilated.

Acknowledgments:

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