17C-6 JAPANESE LONG-TERM REANALYSIS PROJECT (JRA-25) : IMPACTS OF WIND RETRIEVAL TROPICAL CYCLONE DERIVED FROM BEST TRACK DATA

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1. INTRODUCTION

Leading meteorological centers in US and Europe have performed "reanalysis" projects since early 1990's. In Japan, recent urgent needs for more accurate environmental and climate diagnostic information boosted the plan to produce another reanalysis dataset by its own system based on the operational models of Japan Meteorological Agency (JMA). Thus, we started the Japanese long-term (25 years) reanalysis project (JRA-25) in 2001 under a collaborative research between JMA and Central Research Institute of Electric Power Industry (CRIEPI). The period of the contract is for the fiscal years from 2001 to 2005. The target years of the reanalysis are from 1979 to 2004.

2. OUTLINE OF JRA-25

Our global data assimilation system consists of a spectral forecast model with a horizontal resolution of T106, various quality control processes featuring a unique database format, and a 3D-VAR assimilation method. We are using conventional and satellite observation data from various sources, mostly provided from the European Centre for Medium-Range Weather Forecast, and boundary data of sea surface temperature and sea-ice distribution from the latest assimilation system of JMA. One of the aspects that distinguish our product from existing reanalysis datasets is use of wind retrieval data (Fiorino, 2002) derived from tropical cyclone (TC) best track data (NCDC, 1996). This TC wind retrieval data (TCR) is supposed to improve the quality of tropical analysis regarding TC positions and associated wind and moisture fields.

3. EXPERIMENTS

TCR data covers a part of tropical waters where the quality of meteorological analysis is often degraded due to sparse observation. Thus, we examine the effectiveness of TCR data from some data assimilation and forecast experiments using up-to-date reanalysis system. Observation data including TOVS, SSM/I, and SATEM data that we use in this study are almost the same as the regular reanalysis calculation. In this study, we focused on the experiment for September 1990. First, we detected the TCs using our detecting method. Next, we made a through investigation into the SLP fields around TC centers in our and ERA40 reanalysis datasets. Finally, we investigate an effect of the TCR data on TC forecast tracking for typhoon Ed and Flo in 1990.

4. RESULTS

To verify improvements in TC representation in our reanalysis data more quantitatively, we developed an objective method to detect TC locations from gridded analysis data. In this method, a TC is detected as a disturbance that satisfies criteria of relative vorticity at 850-hPa level, SLP, and middle-to-upper tropospheric thickness. We plan to use this method to investigate analysis quality in further data assimilation experiments and the long-term reanalysis.

Figure 1 shows TC center location detected using our method in September 1990. Over eastern North Pacific and tropical Atlantic, there is no information of TCs in the case where TCR data are not merged (TCR-off). On the other hand, TCs are represented to the best track TC locations even in those regions by using TCR data (TCR-on).

Figure 2 shows SLP fields of analysis in the experiments TCR-on/-off and in the ERA40 data over the eastern North Pacific at 12UTC September 12. Four TCs were in this region in September and the two of them existed at that time. In ERA40 and experiment TCR-off (Top and Middle panels), only weak lows are identified. In the experiment TCR-on, however, there exist realistic TCs over the TC centers in the best track data even over data sparse regions like eastern North Pacific. Moisture fields around TCs were also corrected by modified wind there (not shown).

This positive impact was also verified from several forecast experiments of TC motions using the improved analysis as initial condition data. Figure 3 shows some forecasting tracks of experiments TCR-on and –off. From Fig. 3-a to 3-c, we cannot find any good nor bad influences in the TC center forecasts. On the other hand, we found that TCR gives positive impacts on TC motion forecasts especially during recurving process in Fig. 3-d and 3-e. By using TCR, TC location in a three to four days forecast approaches to the best track. Thus, modification of TC locations and moisture field with realistic wind field is useful not only for climate representation but also for improving a forecast skill.

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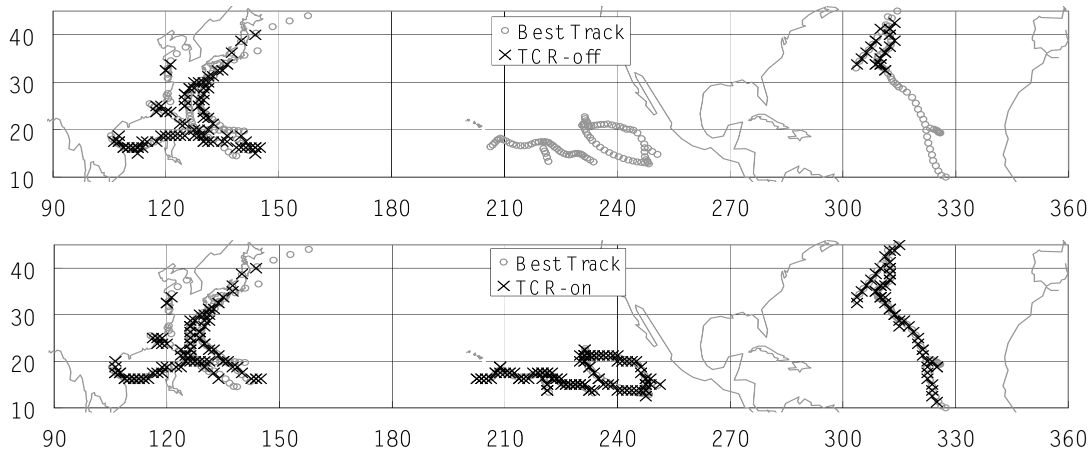

Fig.1 TC center locations in September 1990. Closed circle denotes best track and open rectangle denotes detected TCs from analysis data. Top: TCR-off, Bottom: TCR-on.

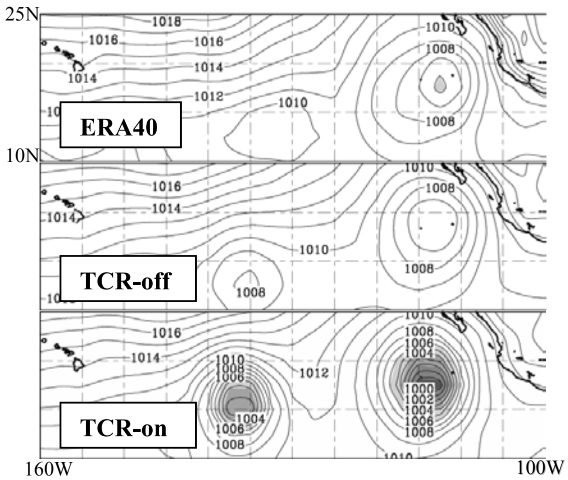

Fig.2 SLP fields in the eastern North Pacific at 12UTC September 12 calculated from 2.5 degree gridded data. Less than 1006hPa is shaded. Top: ERA40, Middle: TCR-off, Bottom: TCR-on.

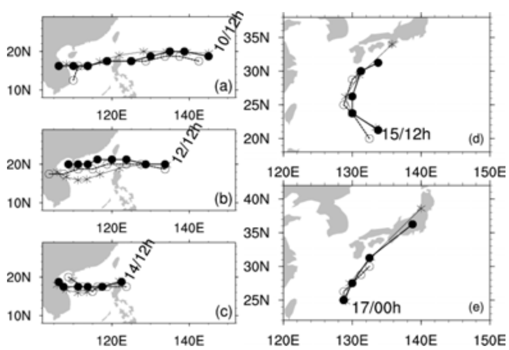

Fig.3 TC route of Ed (a-c) and Flo (d-e) in September 1990. Initial day/hour is drawn next to the initial location of the best track TC. Thick line with closed circle denotes best track for each time period, asterisk denotes the experiment of TCR-on, and open circle denotes the experiment of TCR-off, respectively.

5. SUMMARY

Data assimilation experiments using the TCR data resulted in improved analysis in terms of modifications of TC locations and intensities. TCR data is effective for reproducing TCs especially in the eastern North Pacific and tropical North Atlantic. The tracking forecast skill in the westward moving TC like Ed is not improved. On the other hand, Experiment for Flo suggests that forecast skill is improved if TCs are in the halfway of recurving. Only analysis and forecast for September 1990 was presented here. We are currently investigating the effectiveness of TCR data on the other seasons and years.

6□REFERENCES

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