Analysis of the evolution and motion of tropical cyclones on the basis of calculations using the ETA model and satellite data

(Section 5)

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It has been investigated whether it is possible to take into account multiple interaction of tropical cyclones in the forecast of their motion in the north-west of the Pacific based on calculations of pressure fields and the wind using the ETA model and the comparison of the calculation results with the GMS satellite data and actual TC trajectories. The performed analysis of the behavior of the interacting TCs has revealed, in particular, strange motion of the vortices and their sudden disappearance. In the typhoon season of this year two TC pairs, which interacted during definite time intervals, were of particular interest for investigation. These were Chataan and Nakri (9 - 10 July); Halong and Nakri (12 - 14 July). In the first case Chataan was the leading one. The distance at which their interaction became detectable was 1000 km. It is well seen at the fields calculated using the ETA model (Fig. 1a). Simultaneously Chataan breaks in two vortices, its south part keeps interacting with Nakri: on 10 July the trajectory of Nakri sharply changes its direction, and the TC moves right the east towards the newly formed vortex. On 11 - 12 July they merge into a single vortex, which can be easily seen from the satellite data. On 13 July at midday the distance between the centers of the approached by that moment TC Halong and Nakri constitutes 800 - 900 km. Intensive interaction is observed, with the stronger typhoon Halong entrapping Nakri and the last one ceasing to exist as a separate formation (Fig. 1b). Further motion of the typhoon takes place with a 90° turn. Having turned the TC moves along the polar front in the north-east direction.

The calculation of the wind and pressure fields using the ETA model reflects rather well the location of strong formations (STS and Ty), whereas weak vortices are not distinctly detectable in the analysis of fields. Besides that, the pressure in the center of vortices is not consistent with actual pressure. As far as the character of the vortex interaction is concerned, it depends to a considerable extent on the parameters of the vortices themselves. It has been shown in our previous works devoted to the experiments with vortex pairs using barotropic and baroclinic models /1, 2, 3/. So, to obtain good calculation results, it is necessary to synthesize the algorithm of the restoration of the initial vortex, which models the TCs in the fields of objective analysis (“vortex initialization”).

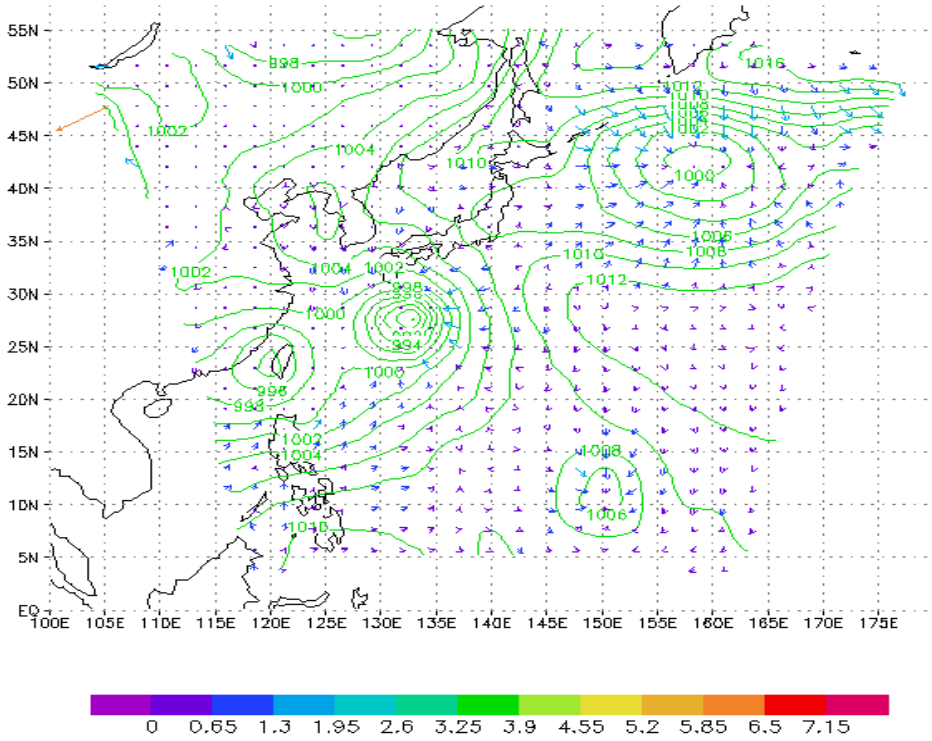
For understanding the evolution of vortices and their interaction the comparison of calculations with the satellite data is quite useful.

References

1. A.E.Pokhil, A.V.Nikolaeva. The behavior of a pair of interacting cyclonic vortices in the barotropic model of the atmosphere. Meteorology and Hydrology., 2000, No. 11.
2. Pokhil A.E., Sitnikov I.G.Diagnostics of motion and development of two series of tropical cyclones for the 2000 typhoon season. -CAS/JSC Working Group on numerical experimentation. Research activities in atmospheric and oceanic modelling. Report N 31, april 2001. WMO/TD-N 1064.
3. A.E.Pokhil, A.V.Nikolaeva. Numerical experiments with a pair of interacting vortices in a baroclinic model. Meteorology and Hydrology, 2002, No. 3.

Sea level pressure, wind 1000 hPa

a)



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b)

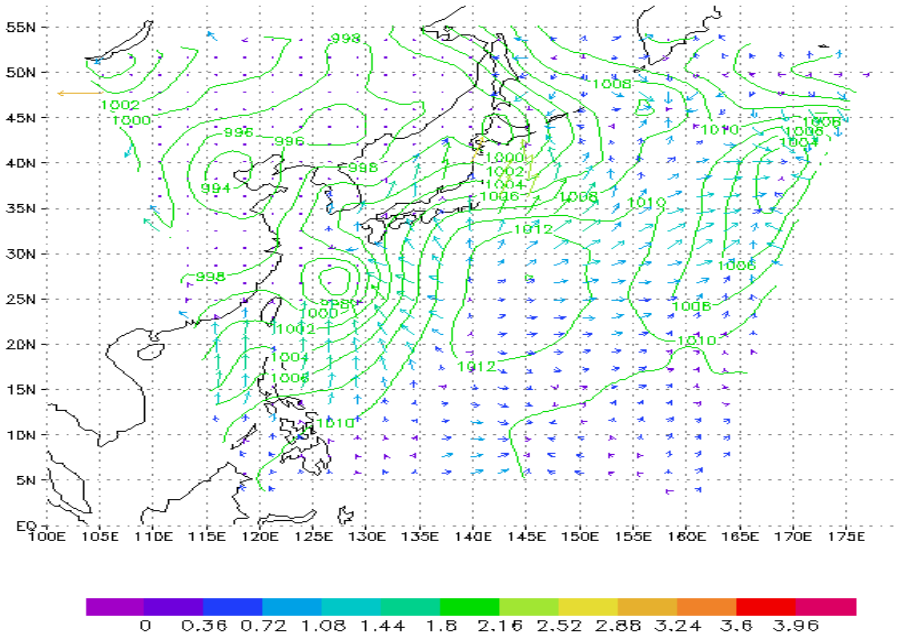

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Fig. 1a,b.