Blocking synoptic pattern : formation of “small” eddies in the troposphere.

A.E.Pokhil, I.A.Gorlach

Hydrometcentre of Russia, 123242 Moscow, Russia, B. Predtechenskiy per. 11-13.
E-mail: pokhil@mecom.ru, aigorl@mecom.ru

In this paper we discuss the events when “small” eddies occurred between large vortex formations. Three case studies were performed over the eastern Atlantic, Western and Eastern Europe.

We examined the events observed on June 18, 2010 (Figure 1a), January 15, 2006 (Figure 1b), and May 11, 1998 (Figure 1c). The information was derived from the METEOSAT-5-9 geostationary satellite imagery in water vapor (WV) channel 6.2 μm with high time resolution (15 min). The spatial resolution was from 3 km at the equator to 5-11 km at middle and northern latitudes.

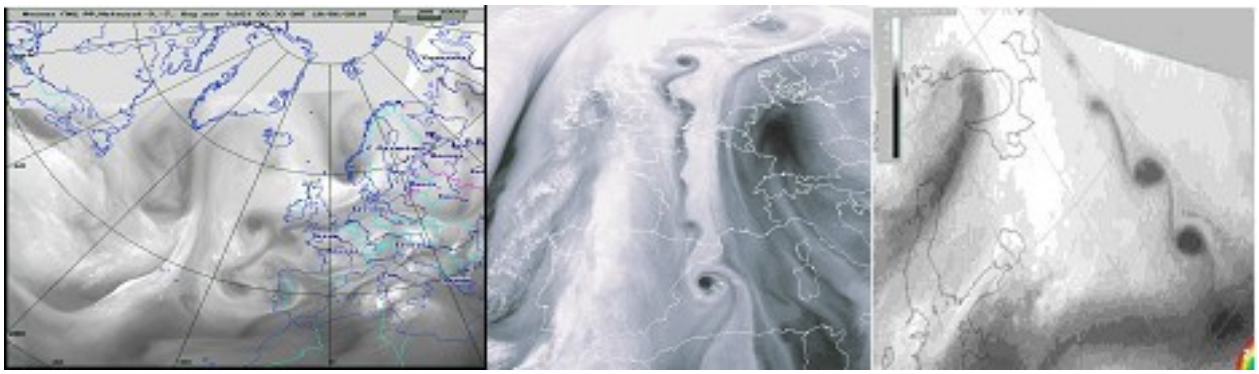
The simultaneous analysis of consequent WV imagery and synoptic maps allowed us to identify the conditions of formation and evolution of “small vortex arrays” as well as to suggest a mechanism of small-scale eddies interaction and also to examine their linkage to the blocking processes in the atmosphere.

The evolution of atmospheric processes in the areas in question can be described as follows. Two large vortex formations (cyclone and anticyclone) moving towards each other (which is an extremely rare case), deformed and narrowed the space occupied by the trough and ridge. The array of “small” eddies “floating” to the north was formed particularly along the ridge. The main feature of the flow pattern at AT500 was the existence of a powerful ridge oriented along the meridian. The highest positive pressure anomalies (up to 24 hPa) were observed there.

The research showed that the occurrence of “small” eddies can be considered as an indicator of a blocking system. Heavy storms in the North Atlantic were characterized by very low pressure in all the situations observed. Meanwhile, this is one of the prerequisites for the occurrence of blocking systems in Europe.

The satellite information demonstrated us many other examples of the effects resulting from the interaction of two large vortex formations. We also studied the interaction of two typhoons. A satellite imagery of two closely adjacent interacting typhoons (Figure 2) gives another example showing how an array of small eddies is formed between two large vortex formations. The conditions of occurrence and evolution of “small” eddies resulting from the interaction of two and more vortex formations were studied by a numerical model [1]. The results of numerical experiments simulating a real situation presented in Figure 2 are shown in Fig.3. Figure 4 confirms the possibility of occurrence of small eddies resulting from the interaction of three closely located vortices.

1. Pokhil A.E., Sitnikov I.G., Zlenko V.E. Recearch of atmospheric vortex by numerical model.- 2010: Energy, Economika, Technika, Ecology.№ 2, p.35-41.



a) b) c)

Figure1. The METEOSAT water vapor images for channel 6,2 μm (between 600-300 hPa)
a) 18 June 2010, b) 15 January 2006, c) 11 May 1998.

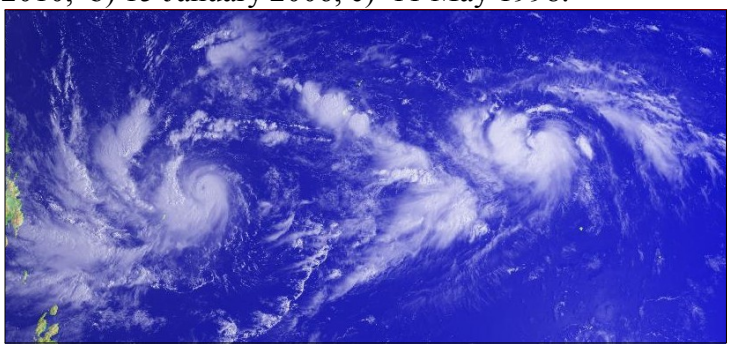
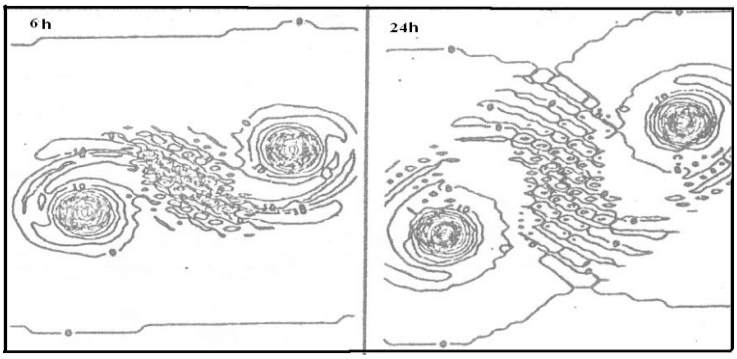


Figure 2.A satellite imagery of two closely adjacent interacting typhoons.



. Figure 3. The numerical results confirming the possibility of occurrence of small eddies, for the situation presented in Figure 2.

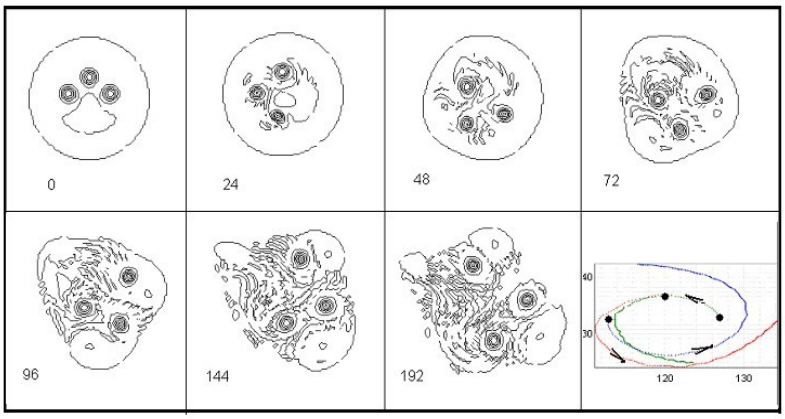


Figure 4. Dynamics of three vortexes and their trajectories of movement, derived with the model research. The integration time (in hours) is given in the left bottom corner.