

Shorter contribution

Vorticity and divergence in a cyclone field

An example of the occurrence of high turbulent winds in nature is the hurricane field. These hurricanes or tropical cyclones form and move over oceans and weaken on crossing the coast. The analysis of divergence and vorticity in such severe cyclonic conditions is an important aspect of wind field dynamics. However, to get enough observations of surface wind and weather around cyclones is difficult as ships try to avoid them because of the dangers involved for life and property.

The Gopnath cyclone of May/June 1976 — in the Arabian Sea-passed through Bombay High area off Bombay harbour in India. The jacked-up oil rigs of the Oil and Natural Gas Commission of India took wind and weather observations every hour. Mukherjee and Sivaramakrishnan (1977) have reported an analysis of wind and wave observations forming the composites. The divergence and vorticity at points 20 km apart around the centre of the cyclone were evaluated.

Figure 1 presents the divergence field. The direction of motion of the cyclone was towards northeast. The strongest convergence (12.3×10^{-4}) is seen just near the centre of the cyclone. The regions of divergence protrude well inside from the left rear side. In general the regions of divergence in the

cyclone field are more in the rear than in the front quadrants.

Hughes (1952) has computed the divergence for the Pacific cyclones from a number of reconnaissance flights' data. In his model the region of divergence is in the front quadrant. But the area considered by him was very large (about 8° in lat. diameter around the centre) while the length of the mesh for the field here is only 160 km (about 1.5° latitudinal length).

Figure 2 represents the vorticity distribution around the cyclone centre. The maximum value was at the centre with an extension to the right rear. A significant point to note is that there are regions of negative vorticity also in the field. Comparing again with Hughes' distribution, his model is rather uniform up to about 2° distance from the centre. Isolines of vorticity are near circular with respect to the centre of the cyclone and no negative vorticity is seen in the distribution. It may be mentioned that the micro-structure of individual storms and variations between storms are almost averaged out when we consider the data from different storms and arrive at a generalised model like the one by Hughes.

Fig. 1 Divergence field. Box indicates centre. Decimal points of the figures indicate the grid points.

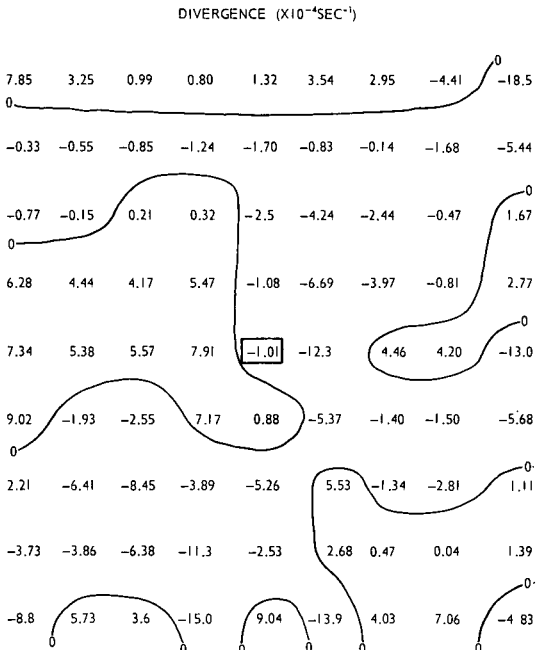
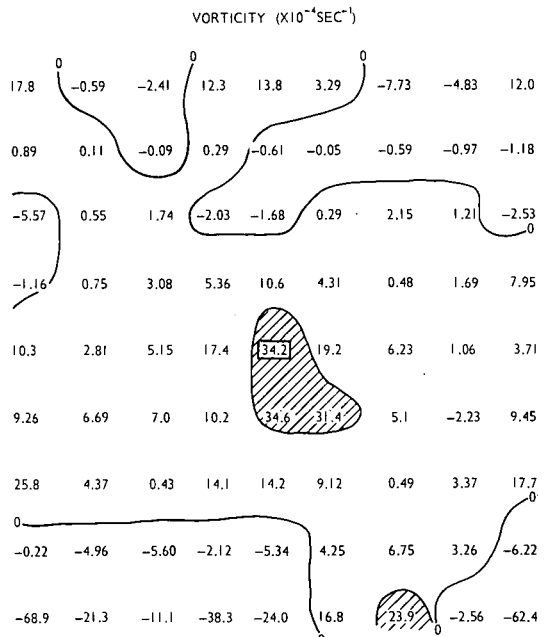


Fig. 2 Vorticity distribution. Box indicates centre. Decimal points of the figures indicate the grid points. Hatched areas indicate high cyclonic vorticity.



Hence any specific storm may vary considerably.

The author is thankful to the Oil and Natural Gas Commission for the observations, to Dr A. K. Mukherjee (India) and Prof. Goyal of Washington for the fruitful discussions on the analysis.

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References

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