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Air-trajectories around fast moving cyclones in the Mediterranean and southern Pacific

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Air-trajectories associated with the passages of moving cyclones are highly dependent on the relationship between the wind speed and the speed of the cyclone itself. This is especially emphasized in frontal cyclones within the warm sector, where the air-trajectories are expected to be curved anticyclonically (Holton 1992), in contrast with the cyclonic curvature of the streamlines surrounding the cyclone. The specific geometry of the air trajectory at that part of the cyclone indicates that the warm air that enters the cyclone originates from lower latitudes than those implied by the streamlines themselves.

The relationship between the air-trajectories, derived by the NOAA ARL HYSPLIT Model, and the streamlines were examined for two separate regions. One is the Mediterranean region and second - the southern part of the Pacific, between 45˚S-85˚S latitudes. It was found that the speed of the vast majority of the cyclones is smaller than the speed of the winds around them, so, they can be considered "slow moving cyclones". In addition, even in "slow moving cyclones", in warm sectors in which the local wind speed was smaller than that of the cyclone movement, the air-trajectories were found to be curved in the opposite sense of the streamlines, i.e., anticyclonically. This tendency was found to be enhanced when the cold front coincided with a sharp trough, so that the streamlines within the warm sector were almost straight. Hence, in such a case, even a small deflection of the trajectories from the streamlines made them anticyclonically curved.

This For example, we found an anticyclonically curved air-trajectory ahead of a frontal cyclone in the Mediterranean that originated at 31˚N latitude and reached the latitude

of 42˚N, within 48 hours.