Warm and Cold Conveyor Belts: Which Is the Main Rainfall Contributor in the Mediterranean?

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The conveyor belt approach of extra-tropical cyclones regards the warm conveyor belt (WCB) as the main rainfall contributor. This is attributed to the high moisture content of the warm air and its considerable ascent while approaching the cyclone. In contrast, the cold conveyor belt (CCB) has only minor rainfall contribution, due to the small moisture content of the cold, and typically continental, air mass and the absence of upward motion within this conveyor belt. Satellite imagery indicates that over the Mediterranean, the cloudiness associated with WCBs is less extensive and thinner than is common, and that thick convective clouds are typical for the CCBs and within the cyclones' cores.

A 3-D thermodynamic analysis of the Mediterranean Cyclones was done in order to evaluate the potential rainfall contribution of these two types of conveyor belts. The analysis is based on vertical cross-sections of relative humidity, potential temperature (θ) and equivalent potential temperature (θ_e). In order to investigate the source and evolution of the air-masses involved we incorporated air trajectories, derived by the HYSPLIT Model of NOAA.

The results show that the WCBs contains dry air, originating from the Sahara, which points at low rainfall expected in this belt over the Mediterranean. This contradicts the classical conveyor belt model. As for the CCB, while the air-stream flows over the Mediterranean Sea it becomes warmer (along-stream increase in θ) and moist near the surface and becomes unstable, till it develops convection of several kilometers deep, expressed in vertically homogeneous θ_e.