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Atmospheric Turbulence

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TURBULENCE IN DIFFERENT AIR MASSES

Fresh polar air masses which rapidly invade a warmer region whether land or sea, and hence are intrinsically colder than the underlying surface, quickly become unstable by heating at the surface. Turbulence in such air masses is quite severe and thunderstorms develop especially if the underlying terrain is quite moist. Before this development takes place, it is necessary for convection from the surface to penetrate any inversions which exist at low and moderate levels in the cold air mass, so that the freezing level may be reached and sufficient energy be liberated for strong upward transport of moisture. Polar air masses of the type mentioned are generally very gusty at the surface.

Polar air masses which are warmer than the underlying surface, exhibit comparatively little turbulence in the free air and little gustiness, for inversion both near the surface and at the upper boundary of the air mass hinder convection.

Tropical maritime air masses which are colder than the surface beneath them, as sometimes happen on land areas near the Gulf of Mexico, are characterized by extremely strong turbulence. Thunderstorms and other convective type clouds are prevalent, while rough flying weather is the rule. Surface winds are moderately gusty except near the thunderstorms where marked gustiness occurs.

Tropical air masses which are warmer than the underlying surface exhibit only mild to moderate turbulence and surface gustiness. Clouds may form at high levels

and these are usually attended by moderate turbulence unless they are the cumulonimbus type in which case severe turbulence can be expected.

TURBULENCE OVER DIFFERENT TYPES OF TERRAIN

This depends greatly upon the type of air mass involved, and the moisture conditions at the surface.

Thus when a polar air mass rapidly passes over a warmer ocean area, convection both below and within the clouds formed reaches considerable strength. Thunderstorms may develop under these circumstances, even in winter. High waves are produced on the ocean surface so that the sweep of polar air over them creates mechanical turbulence which may be very choppy. Passage of an air mass over land after modification by such a maritime traversal causes it to become turbulent to an even greater degree, particularly if the ground is warmer than the ocean surface.

On the other hand, when an air mass passes over a colder ocean area, turbulence is likely to be mild (but visibility conditions become very poor at low levels because of fog formation especially if the air mass is quite moist).

Over land surfaces, turbulence is greatly influenced by the roughness of the terrain, its surface character and slope relative to the sun. During the daytime, exposed inclined surfaces which are most nearly perpendicular to the sun's rays receive relatively greater amounts of radiant energy from the sun than surfaces in the shade or inclined at small angles to the rays. There is, therefore, a tendency for greater warmth to be