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Climatology of cloud overlap parameter

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Abstract

Cloud overlap parameter α was estimated on remote sensing data. This parameter is a measure of the relative weight of maximum (α = 1) and random (α = 0) overlap, and may be used to diagnose relative contribution of convective and stratiform cloudiness to total cloud fraction. Cloud overlap parameter α was calculated on passive satellite data MODIS and CERES for total cloud fraction; for both cases the vertical structure of cloud was assessed by using active satellite data CALIPSO. The global annual mean α is 0.36 (for CERES) and 0.26 (for MODIS), which points to the dominance of random overlap. Values of α are higher over land than over the ocean. The most prominent annual cycle of α is noted in the monsoon regions where α is close to 1 in winter and almost 0 in summer. The maximum cloud overlap is associated with small values of cloud fraction and occurs in subtropical highs over the ocean and in subtropical and polar deserts over land. The random cloud overlap occurs in regions with large values of cloud fraction (e.g., ITCZ and midlatitudinal storm tracks). Midlatitude oceanic lows are characterized by negative values of α, mostly in summer. Presumably, the assumption of the minimum overlap of cloud layers should be used in these regions due to strong baroclinic instability and horizontal shift of cloud layers.

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Keywords

Baroclinic instability, Cloud overlap, Cloud overlap parameter, Convective and stratiform cloudiness, Maximum overlap, Minimum overlap, Random overlap, Satellite data, Total cloudiness

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