

A PLANETARY BOUNDARY LAYER HEIGHT CLIMATOLOGY DERIVED FROM ECMWF RE-ANALYSIS DATA

A. von Engelⁿ*(1) and J. Teixeira (2)

(1) Meteorological Division, EUMETSAT, Darmstadt, Germany (2) Jet Propulsion Laboratory, California, USA

A Planetary Boundary Layer (PBL) height climatology from 20 years of ECMWF re-analysis data is generated and analyzed in detail. Several different methods are first compared to derive the PBL height from atmospheric temperature, pressure, and humidity profiles, which mostly make use of identifying vertical gradients in atmospheric profiles such as relative humidity, refractivity, or virtual potential temperature. The method based on the vertical gradient of relative humidity was selected for the climatology generation, since it appears to capture in a more realistic manner the inversion that caps the convective boundary layer due to its dependence on both the temperature and humidity structure. A validation of the re-analysis fields with co-located radio sonde data shows good agreement between the data in terms of PBL height mean and standard deviation. The ECMWF based PBL height climatology shows many of the expected climatological features such as a fairly low PBL height near the west coast of continents where stratus clouds are found, and the growth of the PBL as the boundary layer air is advected over warmer waters towards the tropics along the trade winds. Large seasonal and diurnal variations are primarily found over land. The PBL height can exceed 3 km, mostly over desert areas during the day, although large values can also be found in other areas such as the ITCZ. Trends in PBL height over the investigated time span are estimated and some significant trends are found.