

VOCALS/Southeast Pacific science: Factorial analysis of mechanisms governing the diurnal cycle in southeast Pacific stratocumulus

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The marine boundary layer over the southeast Pacific (SEP) exhibits a pronounced diurnal cycle, as observed during the VOCALS field campaign. Nighttime longwave cooling at cloud top drives turbulent boundary layer flow, and shortwave radiation during daylight hours suppresses turbulent moisture transports and drizzle production. The large-scale vertical motion field over the SEP is more complicated than in other stratocumulus regions and strongly modulated by a periodic vertical velocity oscillation termed the "upsidence wave." Because of the upsidence wave, the large-scale vertical motion field over the SEP is a function of longitude and time of day. The large-scale vertical motion directly impacts boundary layer depth, which in turn affects liquid water content and thus precipitation production. The diurnal cycle of radiation and large-scale vertical motion are sometimes additive and sometimes canceling. We employ the factorial method to isolate the relative effects of these two mechanisms in determining outcomes of cloud and turbulence properties.