Satellites Help Understand Clouds’ Impact on Climate

Stratus clouds trapped in the subtropical atmospheric boundary layer greatly affect Earth’s radiation budget. The Special Sensor Microwave Imager attached to satellites is providing information to help simulate these complex clouds in global climate models. Analysis of cloud liquid water, or cloudiness, measured by the sensor reveals pronounced within-season variations over the subtropical Pacific off the coast of South America. Measurements taken at a buoy under this extensive low cloud deck confirm the frequent fluctuations (upper panel). QuikSCAT observations show that increased cloudiness (color, $10^{-2}$ mm) is associated with stronger southeast trades (vector) and a stronger cold advection due to advection of cold air from the coastal upwelling region (lower panel), which intensifies the turbulent heat flux at the ocean surface and strengthens the capping temperature inversion in the boundary layer. Not only does this finding help to clarify the processes leading to the clouds’ formation, but it also serves as a benchmark for testing atmospheric and coupled climate models. (For more detail, see next page.)