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Forecasting the weather
- ensemble techniques
in probabilistic weather prediction

Trade-wind Cumulus vertical structure observed from ship during RICO: Mesoscale Organization along Cold Pool Boundaries

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Shallow, precipitating, trade-wind cumuli are investigated using ship-board measurements placed within a larger spatial context by scanning S-Pol radar data and visible satellite imagery. We find, similar to previous studies, that most precipitation occurs within moist (high water vapor path) environments, from arc clouds organized around the boundaries of cloud-free cold-pool areas speculated to reflect previous convection. Surface air measurements of the cold pools, though limited to a few case studies, show relatively cool, moist air at the upwind (west) side of the cold pools where the more developed convection occurs, and relatively warm, dry air at the downwind (east) side. While dynamical lifting can explain initial cloud development at the upwind side, buoyancy generated by positive moisture anomalies appears necessary for the development of the deeper (4-5 km) convective cells. We also discuss an observed bimodal cloud distribution, with a cloudiness minimum existing at 3 km even for clouds reaching 4-5 km, consistent with radiosonde moisture/temperature inversions at both 2 and 4 km. We relate this to penetrative precipitation-driven downdrafts that do not reach the surface, but instead create new, lower, capping inversions. These discourage the vertical development of subsequent convection even though higher altitudes have been moistened. This negative feedback then provides another mechanism for maintaining trade-wind inversions and for limiting cloud fraction in the trade-wind regime.