

Mitigation of Flow Blocking Effects at Colombo, Sri Lanka during DYNAMO

Paul E. Ciesielski and Richard H. Johnson

Abstract

During the DYNAMO field campaign, upper-air soundings were launched at Colombo, Sri Lanka as part of the enhanced sounding network of the experiment. The Colombo soundings were affected by flow blocking at low levels due to elevated terrain over 2 km high to the east of this site. Because of the large spacing between sounding sites, this local blocking effect is aliased onto larger scales impacting analyses and atmospheric budgets over the DYNAMO northern sounding array (NSA). To mitigate this blocking effect a procedure was designed which uses ECMWF-analyzed winds to estimate an unblocked flow, then merges the “unblocked” ECMWF winds at low-levels with observed Colombo soundings.

The impact of this procedure on the Colombo winds results in a mean increase in the low-level westerly winds of 2–3 m/s in westerly flow regimes and a similar increase of the low-level easterly winds in easterly flow regimes. The impact to the meridional winds at Colombo is somewhat smaller with a mean increase in the northerlies of ~ 1 m/s. In general, over the NSA the impact of the corrected Colombo winds results in more low-level divergence (convergence), more mid-level subsidence (rising motion) and reduced (increased) rainfall during the westerly (easterly) wind regimes over the NSA. In comparison to independent TRMM rainfall estimates, both the mean budget-derived rainfall and its temporal correlation are improved using the corrected winds. In addition, use of the “unblocked” winds result in a more realistic moisture budget analysis, particularly during the build-up phase of the November MJO when a gradual deepening of apparent drying was observed. Overall, the corrected winds at Colombo appear to have a beneficial impact on the NSA analyses and budgets.