A New Parametarization Scheme for Surface Fluxes at Low Wind Convective Conditions using MONTBLEX and JASMINE Measurements.

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Accurate representation of surface heat, moisture and momentum transports in General Circulation Models is an important issue and the method widely used for their estimation till today is based on Bulk Aerodynamic formulae.

An analysis of atmospheric observational data archived during the 'Monsoon Trough Boundary Layer Experiment (MONTBLEX)' indicates that the conventionally defined drag and heat transfer coefficients increase rapidly as wind speed falls. It is shown here that, at low winds, there is a linear increase of drag with wind speed and the observed heat flux is independent of wind speed. These findings are not consistent with the so-called free-convection limit of Monin-Obukhov (M-O) theory. At low wind convective conditions, M-O theory is unable to capture the observed linear dependence of drag on wind speed, unlike during forced convection. They are instead best seen as the result of a new regime of 'weakly forced convection', in which the heat flux is determined solely by temperature differentials as in free convection, and the momentum flux by a perturbation linear in wind on free convection.

It is proposed here that this weakly forced convection regime is governed by a new velocity scale determined by the heat flux (rather than by friction velocity as in classical turbulent boundary layer theory). Novel definitions of the drag and heat exchange coefficients, based on appropriate heat-flux velocity scales, are found to be independent of wind speed up to values of at least 18 times the preferred heat-flux velocity scale.

With a view to extend the scheme to oceans, the above proposed scheme for land region has been examined using unique measurements, made over Bay of Bengal during JASMINE (Joint Air-sea Monsoon Interaction Experiment) which represented all the three wind (low, high and transition) and stability regimes. Analysis of JASMINE measurements indicate that minimum latent heat flux at low wind speeds observed over Bay of Bengal is at least twice in magnitude higher than that over Western Pacific. A remarkable inference is that the surface flux scaling laws for oceans are similar to the ones observed for land region and the new flux scheme is valid for measurements over oceans also and hence, it suggests, that the velocity scales may be universal.