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Effective stratification associated with the Madden-Julian Oscillation during TOGA-COARE

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The effective stratification, which is obtained when diabatic heating is treated as a part of vertical advection in the thermodynamic equation, is determined for the active phase of the Madden-Julian Oscillation during TOGA-COARE. The projection of the effective stratification onto vertical normal modes leads to a direct estimation of the effective equivalent depth. Spectral analysis carried out by Wheeler and Kiladis (1999) shows that a variety of convectively coupled equatorial waves satisfy linear dry equatorial-wave dispersion relations for an effective equivalent depth of around 25m. If similar linear wave theory is to be applicable to the Madden-Julian Oscillation, the effective equivalent depth of all vertical modes should be constant in time and space. The effective equivalent depth as estimated using the present method is relatively uniform with a value of around 10m, but it also contains a substantial imaginary component. This imaginary component, due to the phase relationship between geopotential and divergence perturbations, implies that there is no simple interpretation of the Madden-Julian Oscillation as a linear equatorial wave.