Turbulence model of the atmospheric boundary layer by G. I. Taylor's statistical theory applied to the global model BAM-INPE

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Abstract

A turbulent parameterization based on the Geoffrey Ingram Taylor's statistical theory is employed to the global model Brazilian Atmospheric Global Model (BAM). The BAM is the code used by the INPE for operational weather and climate predictions to the Brazil. The parameterization is developed for all stability conditions of the planetary boundary layer (PBL): convective, neutral, and stable layers. For each PBL condition, an analytical formulation for the turbulent spectra is derived. In addition, a counter-gradient term is also developed using the Taylor's theory. The new parameterization for the BAM-INPE model was compared with other e turbulent parameterizations already codified in the BAM (first-order: Holtslag-Boville, Bretherton-Park, second and half order: Mellor-Yamada). The ERA-5 data was used for performance evaluation of the different parameterizations. Our results show that the new parameterization is competitive with other approaches. However, results for precipitation prediction over de Amazon region presented better performance using the Taylor parameterization. The results were even better for precipitation forecasting for the cited region applying the counter-gradient term. Finally, the mixing length derived by Taylor's theory was applied to the Mellor-Yamada approach with similar results produced by the standard scheme used for this parameter.

Keywords: Turbulence, Parameterization, G. I. Taylor, Atmospheric Model, BAM

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