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Evaluating Canopy Aerodynamic Resistance to heat transfer by means of a large eddy simulation (LES).

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The canopy aerodynamic resistance (CAR) for heat transfer is an important quantity necessary to parameterize different biosphere-atmosphere interaction processes such as canopy evapotranspiration, canopy water stress modeling, drought monitoring, and energy balance closure. The present work attempts to study the role of CAR in the context of 'canopy-convector effect' (Rotenberg E and Yakir D, Science, (2010)) observed in a semi-arid forest ecosystem. The hypothesis being that a significantly higher sensible heat flux observed over the canopy can be only explained by a reduced CAR since the surface to air temperature gradient is not sufficiently high. Hence an appropriate mechanistic description of CAR is necessary to describe the canopy convector effect. However, existing parameterizations for CAR do not generally take into account canopy leaf area index (LAI) and only account for a roughness length, although they account for different atmospheric stability conditions. In the present work, four semi-empirical and four empirical parameterizations are evaluated and compared with observed CAR by means of a Large Eddy Simulation (LES) in increasing order of complexity. Subsequently, the parameterizations are attempted to be modified by incorporating canopy LAI and these modifications are evaluated by means of the LES as well. The canopy convector effect is then interpreted with the help of this modified parameterization.