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Improving stellar models with 3D atmospheres

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One of the key ingredients when determining the ages of stars is one-dimensional numerical models of stellar structure and evolution. However, many of today's stellar models share common shortcomings. To address this, we have consistently implemented results from 3D simulations of stellar atmospheres into the stellar evolution codes: GARSTEC, ASTEC, and MESA. Our implementation substitutes the non-physical atmosphere with a more appropriate T-tau-relation – which depends on the physical properties of the star – to set up more realistic outer boundary conditions. Furthermore, to refine the treatment of convection, the mixing-length parameter is calibrated from the 3D simulations and changes as the star moves in the HR-diagram. We investigate the impact of our implementation on low-mass stars by examining their evolution, structure, and stellar oscillation characteristics. Furthermore, we analyse the impact on the temperature during evolution on the red giant branch.

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