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On the validity of drift-reduced plasma fluid models JARROD LEDDY, BEN DUDSON, University of York, MICHELE ROMANELLI, Culham Centre for Fusion Energy — Fluid approximations are often used in the simulation of plasmas to reduce the dimensionality of the system from the full kinetic description. A further simplification can be made to reduce the full velocity vector field in the Braginskii equations to parallel velocity and parallel vorticity by taking the curl of the velocity equation. This so-called drift-reduced simplification assumes small drift velocities perpendicular to the magnetic field lines. The Hazeltine 4-field model makes use of this reduction and assumes an isothermal plasma minimising the full fluid equations to solve for pressure, poloidal flux, parallel velocity, and parallel vorticity. This model has been implemented using the BOUT++ framework and benchmarked against the full Braginskii code CENTORI. It was predicted that as gradients and drives were increased, the resulting increase in drift velocities would render the model inaccurate; however, initial results indicate that linear growth rates continue to match analytical values. Further study will reveal how the nonlinear behaviour is affected in this regime.

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