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The structure of deeply seated high latitude jets in numerical models of giant planets

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The surface winds of Jupiter and Saturn exhibit a dominant equatorial jet of prograde zonal flow and weaker but well-defined bands of zonal flow at higher latitudes. Boussinesq numerical models of rotating convection in spherical shells have reproduced this general surface flow structure, and have shown that equatorial and high latitude jets can plunge deep into the molecular envelopes of the giant planets. Furthermore, numerical dynamo models with radially variable electrical conductivity have shown that the maximum depth of fast equatorial zonal flow is limited by Lorentz forces that increase strongly with depth. Here we use numerical models of rotating convection, as well as variable conductivity dynamo models, to investigate the structure of zonal flow with depth. We focus on the effect of the outer thermal boundary condition for dynamo models, and both the thermal and velocity boundary conditions on rotating convection models. In contrast to some previous studies we show that high latitude jets can form in rotating convection models with a no-slip bottom boundary condition. A preliminary finding is that, while solar heating may not be a requirement for the development of high latitude jets, thermal boundary conditions with latitudinal variation tend to favour the development of strong high latitude zonal flows.