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## Simulating vortices and jets in deep atmospheres of gas giant planets

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Decades of observations have painted a dynamic and rich picture of the atmosphere on Saturn and Jupiter. Both planets have a dominant prograde equatorial jet, and strong zonal flows that alternate in direction at higher latitudes, with Saturn also having a mysterious hexagon shape embedded in one of the polar jets. Both planets also have numerous vortices or storms of different sizes scattered on their surface. All these features are striking examples of turbulent self-organization. While observations abound, the physics behind the formation of these dynamical features is still uncertain. Two interpretations have emerged over time: In one, the surface features are shallow, extending to depths ranging from 10s to 100s of kilometers, while, in the other, they extend to 1000s of kilometers. Here we utilize the deep interpretation and investigate the properties of rotating convection in deep spherical shells. We present three cases: In the first case a giant polar cyclone, alternating zonal flows, and a high latitude eastward jet having polygonal patterns form simultaneously; The second case generates alternating zonal flows as well as numerous cyclones and anticyclones on various latitudes; And, the third case exclusively generates anticyclones with few being as large as Jupiter's great red spot. We discuss what drives these features in these turbulent simulations, and what can we learn from these cases about the interior and surface dynamics of Saturn and Jupiter.