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Degree-one convection and the origin of Enceladus' dichotomy

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Recently, the Cassini spacecraft has detected ongoing geologic activity near the south pole of Saturn's moon Enceladus. In contrast, its north-polar region is heavily cratered and appears to have been geologically inactive for a long time. We propose that this hemispheric dichotomy is caused by the satellite's interior dynamics and that a degree-one convection pattern is driving the south-polar activity. We investigate a number of core sizes and internal heating rates for which degree-one convection occurs. The numerical simulations imply that a core radius of 100 ± 20 km and an energy input at a rate of 3.0 to 5.5 GW would be required for degree-one convection to prevail. This is within the range of the observed thermal power release near Enceladus' south pole. Provided that Enceladus is not fully differentiated, degree-one convection is found to be a viable mechanism to explain Enceladus' hemispheric dichotomy.