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Parametric study of torus instability threshold

Jun Chen (1,2), Bernhard Kliem (2), and Rui Liu (1)

(1) University of Science and Technology of China, School of Earth and Space Sciences, China (el2718@mail.ustc.edu.cn),
(2) University of Potsdam, Institute of Physics and Astronomy

Utilizing the analytical model of Titov & Demomulin (1999) to set a toroidal current channel in force-free equilibrium, partially submerged under the solar photosphere to model a solar prominence, we studied the threshold of torus instability for a range of different geometries and external toroidal field strengths. Four parameters of the equilibrium have been varied: minor radius and footpoint distance of the current channel, strength of the external toroidal field, and sunspot distance. The sunspot distance determines the height profile of the external poloidal field's decay index, thus, determines the torus-unstable height range. We found that the critical decay index at the torus instability threshold increases (corresponding to a more stable situation) when the strength of the external toroidal field or the radius of the current channel increase. For given apex height, the threshold does not depend significantly on the footpoint distance of the current channel.