Title: The turbulent Tayler-Spruit instability for the transport of angular momentum in stellar radiative zones: the importance of a careful implementation

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Abstract: Traditionally, the transport of angular momentum in stellar radiative zones (RZ) is modelled as the result of angular momentum advection by meridional circulation and diffusion of angular velocity through shear-induced turbulence. Clearly, the angular velocity (Omega) profiles obtained with this model do not agree with the observations. Indeed, the expected radial shear in the solar RZ is in complete contradiction with the results of helioseismic inversions, which show an almost rigid rotation. In more evolved stars, a radial differential rotation is inferred, but it is much smaller than that predicted by classical angular momentum transport. These discrepancies argue for the consideration of additional mechanisms that transport angular momentum. Diffusion of angular velocity induced by the Taylor-Spruit (TS) instability is one of the most promising candidates. Previous studies have shown that the TS instability is an efficient transport mechanism, but not sufficient to reproduce the observations. We study a recent prescription, based on 3D simulations that advocate for an additional source of diffusion coming from the Reynolds stress. We further discuss the implementation of such strong diffusive process in stellar evolution and the numerical issue they stress.