

音速抑制法を用いた太陽内部熱対流数値計算

Numerical calculation of solar thermal convection with the Reduced Speed of Sound Technique

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We suggest the new technique to calculate solar internal convection efficiently. It is important to understand the solar internal convection. This issue is deeply related to investigation of the solar global flow and the solar dynamo problem. There is a difficulty to solve the solar internal convection numerically, i.e. the speed of sound. The speed of sound is about 200 km/s, whereas the speed of convection is about 50 m/s at the base of the convection zone. The time step is significantly short with this high speed of sound. The anelastic approximation is often adopted to avoid this difficulty and there are many works with this approximation. This approximation, however, requires the frequent global communication in parallel computing and the efficiency becomes bad with large number of CPUs. A larger resolution with larger number of CPUs is essential to solve the proper angular momentum transport by turbulence. Therefore, we are looking for another way, i.e. RSST(Reduced Sound Speed Technique). The speed of sound is artificially reduced with the transformed equation of continuity and the time step can be took large. This technique does not require the global communication. We investigate the validity of this technique to describe the convection. 3D simulations of the convection shows that the characteristic features does not change with RSST when Mach number is smaller than 0.7.

キーワード: 太陽, 対流, 数値計算

Keywords: sun, convection, numerical calculation