Improving the parametrization of transport and mixing processes in stellar interiors and planetary atmospheres and oceans: the importance of implementing the full Coriolis acceleration

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The radiative region of star's interior is composed of rotating and stratified fluid in a similar fashion as planetary atmospheres and oceans. With the ongoing efforts of characterisation and modelling for these environments, it becomes necessary to build coherent models able to treat dynamical processes in any regime of thickness, stratification and rotation. However, many stellar, atmospheric and oceanic models only partially include the Coriolis acceleration with only taking into account the local vertical projection of the rotation vector (which is called the “traditional approximation of rotation”) and do not treat the effect of the rotation when it dominates the stratification.

In this contribution, we will report the efforts developed to take into account the full Coriolis acceleration for the transport of momentum and the mixing of chemicals. First, we will show how the interaction between waves and zonal winds can be drastically altered because of the modification of the wave damping or breaking when taking into account the complete Coriolis acceleration. Next, we will show how the horizontal local component of the rotation vector can deeply modifies the instabilities of horizontal sheared flows and the turbulence they can trigger. These works are devoted to improve the parameterization of waves and turbulent processes in global circulation and evolution models.