Abstract SF2A

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

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With the ongoing characterisation of the atmospheres of exoplanets and the observational potential unlocked by telescopes like the JWST, we expect to unveil a large diversity of planetary atmospheres, both in terms of composition and dynamics. As such, it is necessary to build coherent atmospheric models for exoplanets able to treat dynamical processes in any regime of thickness, stratification and rotation. However, many atmospheric 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 ongoing efforts 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 modified 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 atmospheric models.