

Abstract Submitted  
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**Non-linear interactions of Rossby waves in astrophysical fluid dynamics** ARAKEL PETROSYAN, DMITRY KLIMACHKOV, Space Research Institute of the Russian Academy of Sciences — We have obtained extended set of rotating magnetohydrodynamic shallow water equations in external magnetic field. The MHD shallow water equations are revised by supplementing them with the equations that are consequences of the magnetic field divergence-free conditions and reveal the existence of vertical component of the magnetic field in such approximation providing its relation with the horizontal magnetic field. It is shown that the presence of a vertical magnetic field significantly changes the dynamics of the wave processes in astrophysical plasma compared to the neutral fluid. We have investigated the interaction of magneto-Rossby waves in the MHD shallow water flows in external vertical magnetic field and in horizontal (toroidal and poloidal) magnetic field on a  $\beta$ -plane. Using the asymptotic multiscale method we obtained the non-linear interaction equations for the waves amplitudes. The analysis of the amplitudes equations shows that on  $\beta$ -plane there are two types of instabilities: one magneto-Rossby wave decays into two magneto-Rossby waves and magneto-Rossby wave amplifies in field of two magneto-Rossby waves. These instabilities occur in the external vertical magnetic field and in the horizontal magnetic field. For all types of instabilities the growth rates are found..

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