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On the limits of the quasilinear evolution of ions interacting with Alfvén waves in a magnetised plasma

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We analyse the transport properties of ions in the presence of a spectrum of Alfvén waves. Assuming that the ambient magnetic field is $B = B_0 e_z$ and the amplitude of the waves is small ($\delta B/B_0 \ll 1$, weak turbulence), we attempt to estimate the transport in energy space of an initial thermal distribution inside the turbulent spectrum of MHD waves by presuming that the Fokker Planck equation is valid and by using the Quasilinear approximation to estimate the transport coefficients. We repeat the above experiment using test particle simulations and try to confirm the analytical results. Keeping the above setup, we gradually increase the amplitude of the waves till the strong turbulent regime is reached ($\delta B/B_0 = 1$). Our goal is to search for the breakdown of the Quasilinear theory and, correspondingly, the inability of the Fokker Planck transport equation in energy space to reproduce the results derived from our numerical simulations.