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Magnetic reconnection driven via forced fluctuations in stable, sheared magnetic configurations

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We investigate reconnection of magnetic field lines in sheared magnetic field configurations due to fluctuations driven by random forcing by means of numerical simulations. The simulations are performed with an incompressible, pseudo-spectral MHD code in 2D where we take thick, resistively decaying, current-sheet like sheared magnetic configurations which do not reconnect spontaneously. We describe and test the forcing that is introduced in the momentum equation to drive fluctuations. We observe that such a forcing can induce magnetic reconnection due to field line wandering leading to the formation of magnetic islands and O-points. These reconnecting field lines spread out as the current sheet decays with time. A semi-empirical formula is derived which reasonably explains the formation and spread of O-points. We find that reconnection spreads faster with stronger forcing and longer correlation time of forcing, while the wavenumber of forcing does not have a significant effect. When the field line wandering becomes large enough that neighboring current sheets with opposite polarity start interacting, then the magnetic field is rapidly annihilated. This work is useful to understand how forced fluctuations can drive reconnection in large scale current structures in the solar environment that are not susceptible to reconnection.