ON TURBULENT RECONNECTION EUN-JIN KIM and P. H. DIAMOND Department of Physics, University of California at San Diego, La Jolla, CA 92093, USA

abstract We examine the dynamics of turbulent reconnection in 2D and 3D reduced MHD by calculating the effective dissipation due to coupling between small–scale fluctuations and large–scale magnetic fields. Sweet–Parker type balance relations are then used to calculate the global reconnection rate. Two approaches are employed — quasi–linear closure and an eddy-damped fluid model. Results indicate that despite the presence of turbulence, the reconnection rate remains inversely proportional to $\sqrt{R_m}$, as in the Sweet–Parker analysis. In 2D, the global reconnection rate is shown to be enhanced over the Sweet–Parker result by a factor of magnetic Mach number. These results are the consequences of the constraint imposed on the global reconnection rate by the requirement of mean square magnetic potential balance. The incompatibility of turbulent fluid–magnetic energy equipartition and stationarity of mean square magnetic potential is demonstrated.

Subject headings: MHD — magnetic fields — turbulence