***Magnetic Flux Transport Modeling***

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Upon emergence from the solar interior, the Sun's magnetic field is moved about within the photosphere by a combination of flows, including the (super-)granular convection, the differential rotation, and the slow meridional advection towards the poles. On time scales up to a few years, the solar magnetic field disperses much like model runs for a randomly-walking, signed scalar that adds to like-signed concentrations or cancels against concentrations of the opposite sign. On time scales from years to centuries, however, inconsistencies show up that suggest that other processes also play a role. These may imply modulations of the global transport processes across the solar surface or a failure of the 2-dimensional description. I will review the successes and problems of the transport modeling for the surface magnetic field and for the heliospheric field resulting from it.