1135-39-388 **James Walsh*** (jawalsh@oberlin.edu). *Nonsmooth invariant manifolds in a conceptual climate model.*

There is widespread agreement that ice sheets flowed into the ocean at sea level in tropical latitudes during the Earth's past. Whether these extreme ice ages were snowball Earth events, with the entire surface covered in ice, or whether ocean water remained ice free in regions about the equator, continues to be controversial. For the latter situation to occur, the effect of positive ice albedo feedback would have to be damped to stabilize an advancing ice sheet shy of the equator. We analyze a system of difference equations modeling the cold world of these great glacial episodes and derived from the coupling of zonally averaged surface temperature to a dynamic ice line. The analysis leads to a nonsmooth singular perturbation problem, for which we prove the persistence of an invariant manifold, thereby gaining insight into model behavior. In particular, a stable climate state with the ice line resting in tropical latitudes, but with open water about the equator, is shown to exist. We also present local smooth and nonsmooth bifurcations as the efficiency of meridional heat transport is varied. (Received August 30, 2017)