Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

A cloud microphysical mechanism linking solar activity, atmospheric electricity, and climate[1] BRIAN TINSLEY, Physics, Space Science, UT-Dallas — The electrical current density from the ionosphere to the surface changes by tens of percent on the 11-year solar cycle and during transient solar events. This external forcing is accompanied by similar changes due to thunderstorm variability and atmospheric aerosols. The current density deposits space charge in gradients of conductivity associated with stratified clouds and aerosol layers. The space charge, which attaches to droplets and aerosol particles, can be carried deep into clouds by updrafts, and it affects collision rates between droplets and aerosol particles. The most important of these for cloud microphysics are collisions of cloud condensation nuclei (CCN) and ice forming nuclei (IFN) with droplets. These collision rate changes during in-cloud scavenging affect the concentrations of CCN and IFN and the rate of contact ice nucleation. Increases in CCN concentration in deep convective storms have recently been shown to decrease initial precipitation and invigorate the storm with extra release of latent heat of freezing from water not precipitated but carried above the freezing level. The changes in latent heat release account for several sets of correlations of storm vorticity changes with independent inputs that affect the current density. Such dynamical changes can result in regional climate change. A review of models of electrical effects on cloud microphysics, and of observed correlations which support the mechanism, will be presented.

[1]Supported by NSF AGS

Brian Tinsley
Physics, Space Science, UT Dallas

Date submitted: 19 Oct 2012 Electronic form version 1.4