

## **Lightning and Polarimetric Radar Behavior of Incipient Thunderstorms in CHUVA**

Earle Williams, MIT; Enrique Mattos, CPTEC; Luiz Machado, CPTEC; Antonio Saraiva, INPE

Movies of radar PPI scans made at 6-minute intervals with the X-band polarimetric radar at UNIVAP during the wet season of 2011-2012 have been used to identify 20 incipient isolated thunderstorms on five different storm days (November 10-13, March 13). A number of different lightning networks (BrazilDat, Lightning Mapping Array (LMA), Vaisala TLS200 and GLD360, LINET) have been used to characterize the lightning in each incipient storm. The 3D radar and lightning histories have been followed in each case from the initial radar echo to the first cloud-to-ground (CG) lightning flash. The sequence of events is remarkably reproducible and consistent with earlier studies in the Northern Hemisphere: initial radar echo, initial LMA radiation, initial intracloud (IC) flash, and initial CG flash (all negative polarity). The mean time interval from initial radar echo to first CG flash is 44 minutes, with a minimum time of 18 minutes and a maximum time of 78 minutes. The typical radar-measured storm diameter at the time of the initial CG flash is 15 km. In two storm cases, no CG flash was attained, but only IC flashes. In those cases, the maximum radar-measured diameter is only 7-8 km at the time of the lightning. These findings support the idea that a sufficiently extended charge reservoir is needed to enable a bridging of the nominal 5-7 km vertical distance between main negative charge center and ground by the initial CG flash. Of the 18 initial CG flashes, 16 of them (89%) are single-stroke flashes. This finding is consistent with the idea that when the main charge reservoir is compact, the positive leader intruding negative space charge is unable to continue its progression to stress the cutoff channel to ground and provide for a second stroke. Profiles of differential reflectivity are underway in the developing thunderstorms to distinguish negative ZDR values (associated with conical graupel) from positive ZDR values (associated with large raindrops below the freezing level and with supercooled drops above the freezing level.) The microphysical nature of the initial radar echo will also be diagnosed with this dual-pol method.