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Lightning Flash Initiation Locations in Four Storms over Land and Ocean

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This study examines initiation locations of intracloud (IC) and cloud-to-ground (CG) lightning in four storms that occurred near Kennedy Space Center, Florida, on one day. One unicellular and two multicellular thunderstorms occurred over land, and one multicellular storm was 30 km offshore. The storm over ocean was visible on radar 47-51 minutes before its first flash (of 17 total); first radar echoes in the storms over land were just 23, 12, and 16 minutes prior to their first flashes (of 34, 16, and 9 total). Initiation points of 66 flashes were identified using the first initial breakdown (IB) pulse location from electric field change measurements or a VHF source coincident with the first IB pulse; the other ten flashes occurred without enough data to similarly locate the initiation. Most of the IC initiations were above the echo core and above 7.5 km altitude, while nearly all the CG initiations were beside or atop the core and below 6.8 km. The off-shore storm had similar lightning duration, IC:CG ratio, and initiation altitudes as the storms over land, but it took that storm much longer to get from first radar echo to first flash and from first flash to first CG. In both regions, early and mature stage flash initiation locations were tightly clustered in small horizontal areas covering just 10-30% of the entire radar reflectivity areas in these small storms. In this presentation, we focus on comparison of temporal trends in the flash initiation altitudes among the storms and the radar reflectivity structure near the initiation locations.