**New MRMS Cloud-to-Ground Probability in next 30 min**

- **Features:**
  - Reflectivity_-20C(dBZ)
  - LLReflectivity(dBZ)
  - MESH(mm)
  - MaxVIL(kg/m^2)
  - TotalVIL
  - Reflectivity_0C(dBZ)
  - MidLvlShear
  - MAXRef
  - Size(km2)
  - LapseRate_700to500mb(DegreeCPerKilometer)
  - TotalCGCount
  - SPEED
  - LifetimeMESH
  - SRHelicity0
  - SfcThetaE
  - SfcCIN(SquareMetersPerSquareSecond)
  - LapseRate_700to500mb
  - ENI_ICcount_15min(flashes)
  - IC_FlashesPerCellArea
  - CGCount_15min(flashes)
  - CGCount_2min(flashes)
  - VILAreaGT40(km^2)
  - MeanRef
  - MaxVIL
  - BRNShear(SquareMetersPerSquareSecond)
  - MESH
  - MeanRef
  - Reflectivity_0C
  - Reflectivity_-10C
  - Reflectivity_-20C
  - Reflectivity_0C(dBZ)

- **Importance:**
  - Reflectivity_-20C(dBZ)
  - LLReflectivity(dBZ)
  - MESH(mm)
  - MaxVIL(kg/m^2)
  - TotalVIL
  - Reflectivity_0C(dBZ)
  - MidLvlShear
  - MAXRef
  - Size(km2)
  - LapseRate_700to500mb

- **Performance:**
  - 0.070433
  - 0.077284
  - 0.13844

**DISCUSSION/FUTURE WORK**

- **New MRMS Cloud-to-Ground Probability in next 30 min:**
  - The current/NWS operational solution to CG Probability in the next 30 minutes is:
    - Uses all inputs for random forest and logistic regression calculations
    - Overall best Brier Score for both random forest and logistic regression solutions
    - Both solutions fit well with the perfect reliability line
    - Random forest has a slight under-forecasting above 25%
    - Logistic regression has slight over-forecasting in middle probabilities and under-forecasting towards the extremes
    - Table shows the most important inputs/features to the random forest solution
    - Most important features were all MRMS data-majority being Reflectivity products

- **New MRMS Cloud-to-Ground Probability in next 30 min:**
  - Uses only MRMS, NSE, and storm attribute inputs for random forest and logistic regression calculations
    - No MRMS or NSE inputs
    - Worst Brier Score for random forest
    - Both solutions fit well with the perfect reliability line
    - Table shows the most important inputs/features to the random forest solution
    - Most important features were all total lightning data-majority being Reflectivity products

- **New MRMS Cloud-to-Ground Probability in next 30 min:**
  - Uses only total lightning and storm attribute inputs for random forest and logistic regression calculations
  - No MRMS or NSE inputs
  - Worst Brier Score for logistic regression
  - Random forest time averaged around a lot
    - Due to small sample size
    - Logistic regression way over-forecasted for events lower than 25% and under-forecasted for events above 35%
  - Table shows the most important inputs/features to the random forest solution
  - Most important features were all total lightning products

- **Current/Operational:**
  - Has realistic probabilities with a good Brier Score
  - Uses new total lightning data as well as more MRMS and NSE data as inputs
  - Has realistic probabilities with a good Brier Score
  - In the future, need to:
    - Incorporate random forest decision trees into WDSSII CG probability algorithm-including pairing down the inputs
  - Test the new CG probability product in the 2016 Hazardous Weather Testbed (PHI Experiment)
  - Implement new CG probability product into operational MRMS (Version 127)

**Acknowledgments:** John Carbone, Ken Copsey, Chris Karstens, Darrel Kingfield, Amy McGovern, and Travis Smith.