P2.10 INCORPORATING LIGHTNING DATA INTO A REAL-TIME INFRARED/MICROWAVE SATELLITE PRECIPITATION ALGORITHM

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1. BACKGROUND AND MOTIVATION

Remote sensing of precipitation has attracted interest from a wide variety of users due to its ability to offer information at much higher spatial and temporal resolutions, and over much larger areas, than would be possible using in situ measurements such as rain gauges. However, accuracy problems continue to plague both radar- and satellite-based estimates of precipitation, and consequently much work has focused on blending information from multiple remote senging platforms, such as satellite-based infrared and ground-based radar (e.g., Gourley et al. 2002) and satellite-based infrared (IR) and microwave (e.g.,Sorooshian et al., 2000; Huffman et al. 2001; Todd et al. 2001; Turk et al. 2003;Miller et al 2001).

Lightning data represent another source of useful information for remote sensing of precipitation Numerous authors have already demonstrated the utility of these data for a wide range of a range of space-time scales, from Mohr et al. (1996) and Toracinta et al.'s (1996) studies of mesoscale convective systems using lightning, radar, and Special Sensor Microwave/Imager (SSM/I) data, to Sheridan et al. (1996) and Petersen and Rutledge's (1998) analysis of large-scale relationships between lightning and precipitation. A number of retrieval techniques have also been developed, ranging from lightning-alone approaches (Tapia et al. 1998) to approaches that use infrared and lightning data together (Grecu et al. 2000; Morales and Anagnostou 2003).

In this work, lightning data are being incorporated into the Self-Calibrating Multivariate Precipitation Retrieval (ScaMPR) algorithm, which is a flexible precipitation estimation framework that uses microwave data (but could also use radar data) to modify its calibration in real time..

As described in Kuligowski (2002), the objective of SCaMPR is to produce precipitation estimates with the accuracy of microwave-based estimates (which are generally agreed to be superior in accuracy to infrared estimates at the instantaneous time scale) with the frequency of infrared-based estimates (since microwave-based estimates are available only several times a day with a data latency time of several hours). ScaMPR uses microwave-based estimates of precipitation from the SSM/I based on the Ferraro (1997) algorithm (and now also the Advanced Microwave Sounding Unit (AMSU) based on the Ferraro et al. (2004) algorithm) as the target precipitation fields.

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After aggregating the GOES-based predictors to the SSM/I or AMSU-B footprint size and location, the SCaMPR algorithm operates in two phases:

1. Rain/no rain discrimination. Discriminant analysis is used to select and calibrate the best predictor variables for discriminating raining from non-raining pixels. The target values are those microwave pixels with rain rates exceeding 1 mm/h.
2. Rain rate estimation. Forward screening multiple linear regression is used to select and calibrate the best predictor variables for estimating rain rate for raining pixels. Logarithmically transformed variables are included, since the relationship between IR window brightness temperature and rainfall rate is typically exponential (e.g., Vicente et al. 1998).

SCaMPR presently runs over the continental United States and nearby regions, producing estimates every 15 min at 4-km resolution that are available over the Internet at http://www.orbit.nesdis.noaa.gof/smcd/emb/ff.

2. METHODOLOGY AND ONGOING WORK

Lightning data from the National Lightning Detection Network (NLDN; Cummins et al. 1996) covering the continental United States are being received in real-time and archived at NESDIS. These data, which are point data at discrete times, have been converted to gridded, time-integrated predictors compatible with the spatial scales of the satellite data (15 km for the SSM/I and AMSU-B; 4 km for GOES).

The resulting parameters have been added to the set of predictors from which SCaMPR is allowed to select for both rain/no rain classification. The impacts of these data on SCaMPR performance are still under study at the time of this writing.

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