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Forecasting the weather
- ensemble techniques
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Aircraft Icing Conditions Determined From Satellite Imager Data in Single-layer and Overlapped Cloud Conditions

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The presence of super-cooled liquid water in clouds poses a serious icing hazard to aircraft. Currently, model forecasts and pilot reports (PIREPS) constitute much of the database available to pilots for assessing the potential for icing conditions in a particular area. Such data are often uncertain or sparsely available. The severity of aircraft icing depends on meteorological factors, as well as characteristics of the airframe and flight parameters. Meteorological factors include the cloud temperature, super-cooled liquid water content (LWC) and droplet size distribution. Various methods have been developed to quantify closely related cloud parameters from satellite data using theoretically based techniques. This paper describes an algorithm to determine the flight icing threat to aircraft based on satellite estimates of cloud top temperature, thermodynamic phase, cloud water path, and effective droplet size. The technique is applicable in single-layer and some multi-layer conditions when high thin ice clouds overlap lower level liquid water clouds. During the daytime, the satellite product includes a crude estimate of icing severity. Aircraft pilot reports (PIREPS) over the contiguous U.S. provide direct observations of icing and are used extensively in algorithm development and validation. Results from recent verification studies using PIREPS, Tropospheric Airborne Meteorological Data Reporting (TAMDAR), and NASA Icing Remote Sensing System (NIRSS) data indicate that the satellite algorithm performs reasonably well in a variety of cloud conditions. Recent advances in the technique, results from the verification studies, and future plans to improve the accuracy and utility of the product will be presented. The algorithm is currently being run routinely using data taken from a variety of satellites across the globe and is providing useful information on icing conditions at high spatial and temporal resolution that are unavailable from any other source.