5.5: Development of an Autonomous Uav Atmospheric Profiling System: Initial Implementation and First Results

Tuesday, 9 January 2018
11:30 AM - 11:45 AM
Austin, Texas - Room 13AB (ACC)

Fixed monitoring sites, such as those in the US National Weather Service Automated Surface Observing System (ASOS) and the Oklahoma Mesonet provide valuable, high temporal resolution information about the atmosphere to forecasters and the general public. The Oklahoma Mesonet is comprised of a network of 120 surface sites providing a wide array of atmospheric measurements up to a height of 10 m with an update time of five minutes. The deployment of small unmanned aircraft to collect in-situ vertical measurements of the atmospheric state in conjunction with surface conditions has a potential to significantly expand weather observation capabilities. This concept can enhance the safety of individuals and support commerce through improved observations and short-term forecasts of the weather and other environmental variables in the lower atmosphere. We briefly report on a concept of adding the capability of collecting vertical atmospheric measurements (profiles) through the use of unmanned aerial systems (UAS) at remote Oklahoma sites deemed suitable for this application. While there are a number of other technologies currently available that can provide measurements of one or a few variables, the proposed UAS concept will be expandable and modular to accommodate several different sensor packages and provide accurate in-situ measurements in virtually all weather conditions. Such a system would facilitate off-site maintenance and calibration and would provide the ability to add new sensors as they are developed or as new requirements are identified. The small UAS must be capable of accommodating the weight of all sensor packages and have lighting, communication, and aircraft avoidance systems necessary to meet existing or future FAA regulations. Moreover, the system must be able to operate unattended, which necessitates the inclusion of risk mitigation measures such as a detect and avoid radar and the ability to transmit and receive transponder signals. It is also necessary for the system to be capable of assessing local weather conditions (visibility, surface winds, and cloud height) and the integrity of the vehicle (system diagnostics, fuel level) before takeoff. We begin by providing a notional concept of operations for a 3D Mesonet and a description of the technical configuration for one such station in the network. We then report on progress being made at OU to develop and test a prototype 3D Mesonet station and show preliminary measurements and discuss how such measurements from an operational network could be utilized to better characterize the atmospheric boundary layer, improve weather forecasts, and help to identify threats of severe weather.

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