Moving Towards a Network of Autonomous UAS Atmospheric Profiling Stations for Observations in the Earth’s Lower Atmosphere: The 3D Mesonet Concept

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The deployment of small unmanned aircraft to collect in-situ vertical measurements of the atmospheric state in conjunction with other meteorological observations has the potential to significantly expand our weather observation capabilities. 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 sites deemed suitable for this application. The system must be able to operate unattended, which necessitates the inclusion of risk mitigation measures such as 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, 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 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.