Multisensor Agile Adaptive Sampling (MAAS) of the Atmosphere

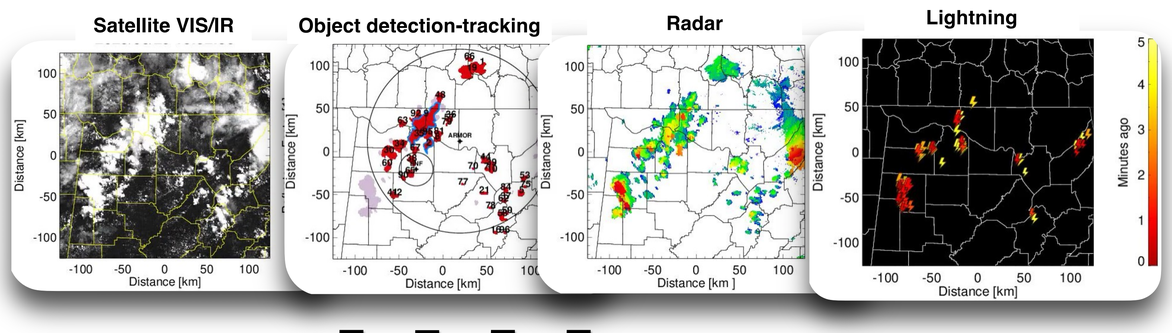
Nithin Allwayin[1], Oluwafemi Omitusa[1], Katherine McKeown[1] , Edward Luke[2], Mariko Oue[1],
Bernat Puigdomenech[3] and Pavlos Kollias[1,2]

[1]Stony Brook University, Stony Brook, NY, USA, [2]Brookhaven National Lab, Upton, NY, USA, [3]McGill University, Montreal, Canada

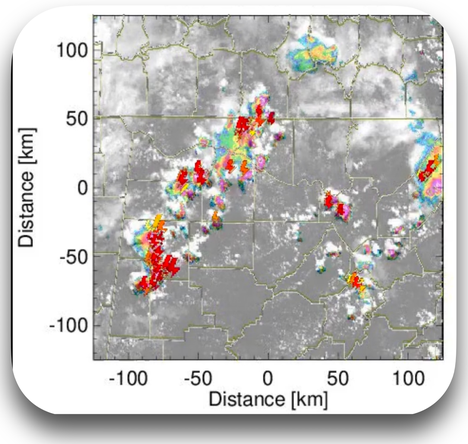
A new cyber-infrastructure remote sensing paradigm for smart atmospheric observations

Multisensor Agile Adaptive Sampling (MAAS) is an intelligent, collaborative, and adaptive cyber infrastructure platform for smart atmospheric experimentation. The primary goal of the MAAS CI is to significantly improve our ability to sample rapidly evolving atmospheric phenomena by enabling advanced control systems across multiple radar platforms. It aims to improve high-resolution simulations of extreme or high-impact weather events and to facilitate integration with emerging technologies such as unmanned aerial vehicles (UAVs) and phased-array radars (PARs).

Multisensor Agile Adaptive Sampling Workflow

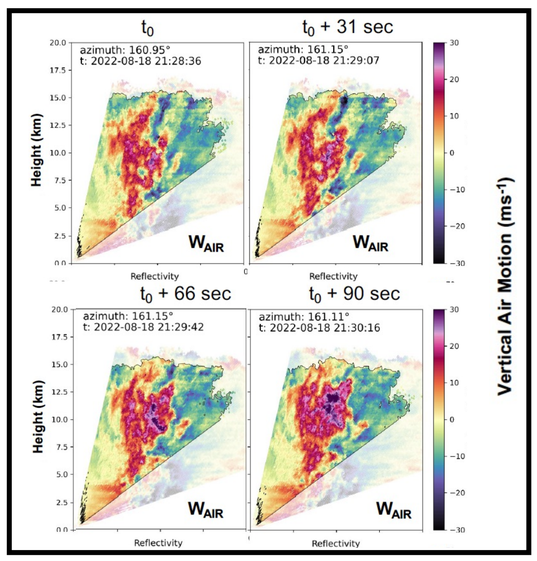


GOES-19 (ch 2 and 13)
SKYLER-II,NEXRAD, HRRR
Lightnings GLM and NALMA
NSSTC cooling rates



All products are sampled to a common grid and input to MAAS. MAAS implements real time sensor fusion and used edge-computing to create a product that will guide the real time operation and scan strategies of a network of radars

The radar network receives real-time scan instructions from MAAS. MAAS outputs drive rapid, high-resolution scanning of convective cells and are continuously communicated across the network. This enables effective tracking of rapidly evolving storms in real time.

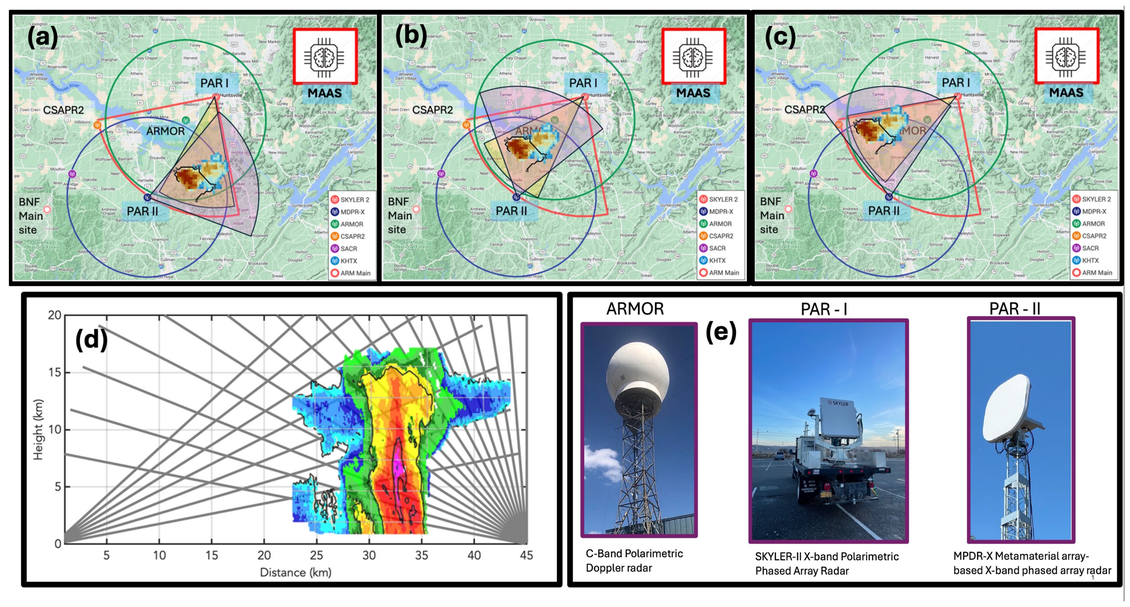


The MAAS testbed in Huntsville AL brings together scientists and engineers from several research institutions

Why MAAS ?

The need for improved weather and climate predictions calls for transformational shifts in the observational infrastructures used to inform understanding and guide model predictions. Data-driven, adaptive observations enabled by MAAS can lead to a substantial increase in spatiotemporal resolution of convective cloud systems. Such a can for the first time provide new insights into rapidly evolving atmospheric phenomena.

Testbed: Bankhead National Forest (BNF) observatory



As part of a multi-agency field campaign, we deployed a hybrid radar network near the Bankhead National Forest Atmospheric Observatory in Huntsville, Alabama. The network integrates traditional reflector-based radars with next-generation phased array systems. This effort is supported by the DOE Atmospheric Radiation Measurement (ARM) user facility and NASA's INCUS Cal/Val program.

Broader Impacts

- The Huntsville deployment and MAAS CI offers hands-on experience for professionals and students on advanced sensor technologies and on autonomous optimized experiments.
- The MAAS CI will provide real-time, multisensor situational awareness to support data-driven decision-making during atmospheric field campaigns. These capabilities—and the underlying data—will be shared with the broader research community to promote collaboration, gather feedback, and inform future development.
- Designed as a flexible, open-source platform, MAAS CI invites community-driven contributions to enhance its functionality. Through expert engagement and open access, this initiative aims to advance real-time experimentation and accelerate innovation in atmospheric science.
- The unique data collected by MAAS can lead to improve predictions of extreme weather phenomena at high spatiotemporal resolution through their application to NWP and AI-based models

This award (#2411114) is supported by the Office of Advanced Cyberinfrastructure (OAC) and the Directorate for Computer and Information Science and Engineering