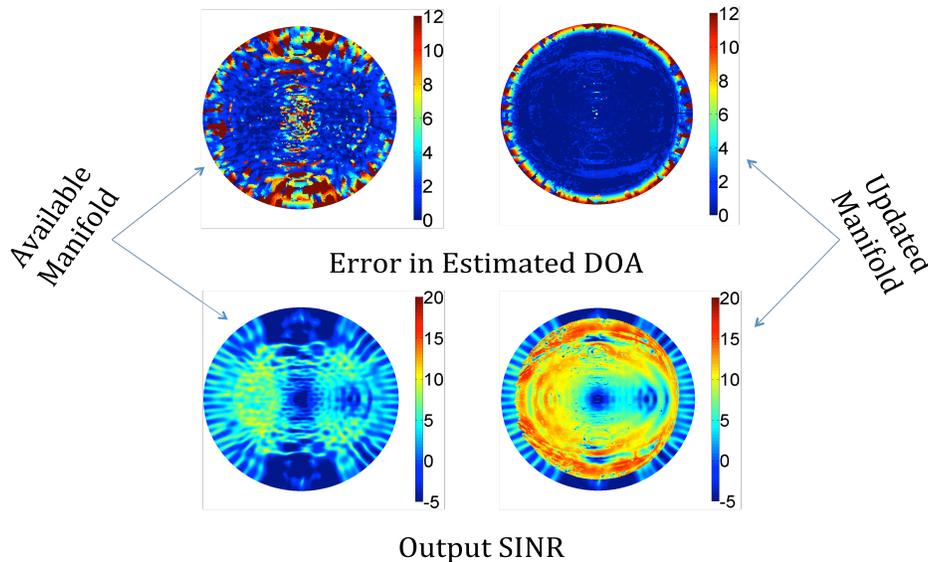


Calibration of Airborne Antenna Arrays using Signals of Opportunity

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There is an increasing interest in airborne antenna arrays for applications such as communications, radars, and angle of arrival estimation. However, the spatial processing algorithms utilized require accurate knowledge of the relative responses of the antenna elements as a function of angle and frequency – the so called *antenna manifold* – in order to obtain optimal performance. With angle of arrival (AoA) estimation in particular, differences between the stored antenna manifold and the true, in-situ antenna manifold can lead to severe degradations in performance. This situation is commonly referred to as *manifold mismatch*.

Due to the difficulty of obtaining precise, in-situ measurements of individual arrays on individual platforms, the ideal solution would be for an antenna array to measure its own response to any signal of opportunity during normal operations. Such a solution, however, brings with it several new problems. The locations of the sources of signals of opportunity are not known to the system, and must be found. However, with manifold mismatch, individual AoA estimates are unreliable. Therefore, in the presence of multiple incident signals, it is hard to locate the emitters with desired accuracy. Additionally, the array manifold in the directions of the individual signals must be measured. Finally, if the array response to a signal and the associated angle of arrival has been found, there must be a means for incorporating the new information into the existing manifold. This last requirement is complicated by the fact that signals will generally be observed from angles between the points where the antenna manifold is tabulated. We are developing techniques to overcome all these problems.

Further Reading:

- [1] A. Kintz and I.J. Gupta, "RF Emitter Location Estimation in the Presence of Antenna Array Manifold Mismatch," *IEEE International Symposium on Antenna and Propagation*, Chicago, IL, July 2012.
- [2] Andrew Kintz and I.J. Gupta, "Airborne Antenna Array Calibration with Signals of Opportunity," *IEEE International Symposium on Antennas and Propagation*, Lake Buena, FL, July 2013.