The value of airborne science to my water and energy cycle research area.

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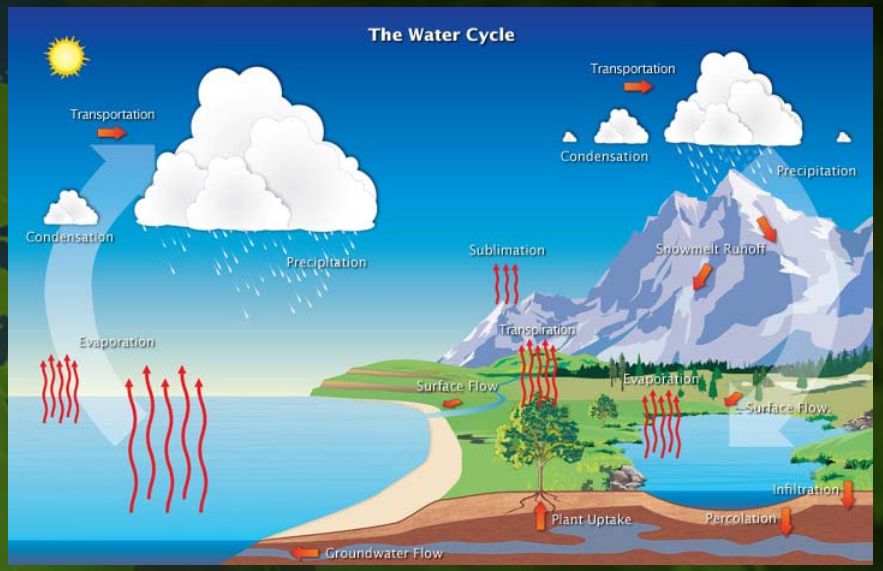
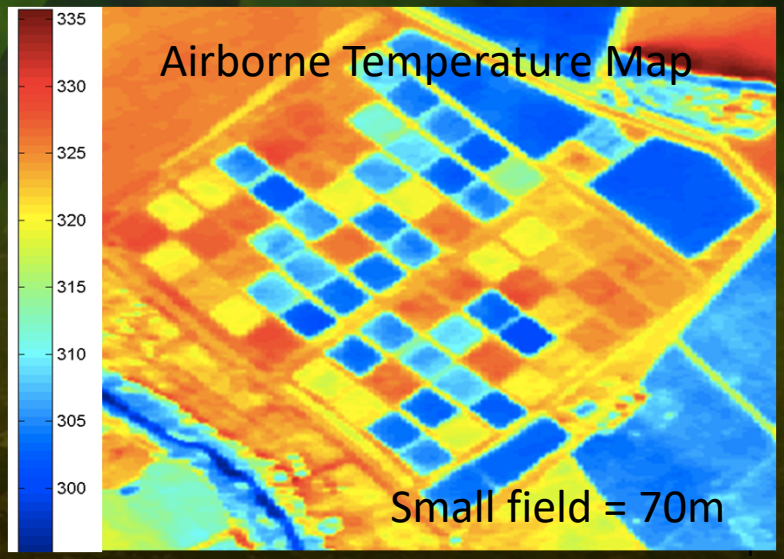
- Research focused on Plant Physiology and Functional Types Key measurements provided by remote sensing: type (traits), structure and function.
- Key Benefits of Airborne Data for ET Science:
  - High spatial resolution. Airborne data can be very high resolution looking at individual trees or variation within a field.
  - High temporal resolution. Airborne data can look over the diurnal cycle by repeat overpasses, very difficult to obtain from satellite data.
  - High spectral resolution: Airborne instruments provide higher spectral resolution allowing mapping of type and gas exchange, including evapotranspiration (ET), how water flows between atmosphere and land.



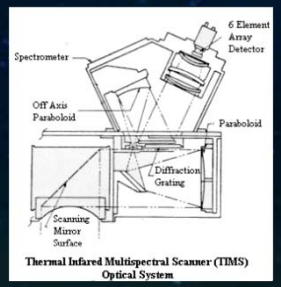
(Image courtesy NOAA National Weather Service)

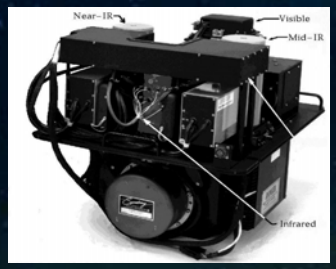


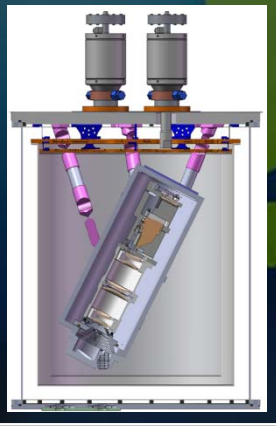
How airborne science has been used in my research area

- **Technology development** Ho
- **Calibration and validation**
- **Algorithm development**
- **Local to regional science studies**

Airborne Instruments







Airborne Name	TIMS	MASTER	QWEST	HyTES
First Year of Operation	1980	1998	2008	2012
Number of TIR Bands	6	10	56	256

Spaceborne Name	ASTER	Landsat 8	ECOSTRESS	SBG-TIR
First Year of Operation	1999	2013	2018	2026
Number of TIR Bands	5	2	8	8
Pixel Size	90m	100 m	60 m	60 m

Perspectives and Future Directions

Lessons Learned:

- Airborne platforms/instruments provide a valuable proving ground for science and technology
- Airborne platforms need to provide a range of altitudes, speeds and durations to maximize usefulness of data. We have used a wide range of aircraft: Beachcraft B200, Cessna Caravan, DC-8, ER-2, Twin Otter. Some are NASA aircraft and some commercial. Commercial often lower cost and more flexible but new NASA rules make this route increasingly difficult.
- Airborne campaigns need to include for resources for subsequent analysis of data.
- Instruments should fit in a standard camera box for maximum flexibility but NASA planes often lack such standard fittings causing expensive customization.

Future Directions for large payload, prolonged duration aircraft

- Develop airborne observatories. Observatories would include a suite of instruments for addressing a particular problem, e.g. optical (type, function, AV-NG/HyTES) lidar/radar (structure), passive microwave (soil moisture). Observatories would typically be a single large platform with a large range e.g. DC-8, Gulfstream, ER-2. These would be supplemented by smaller aircraft with single instrument. Want to go as low and slow as possible to maximize signal and spatial resolution. A combination of a single platform observatory with supporting smaller aircraft maximizes the science return. Greater thought is needed to provide a compatible space on range of platforms.