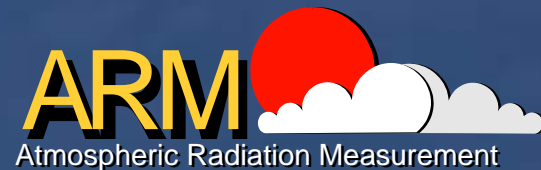


Ice Experiments in ARM

Tom Ackerman
Chief Scientist

Pacific Northwest
National Laboratory



ARM Research Sites



Southern Great Plains Region



ARM Ice Cloud Studies – A Sample

- Cirrus climatologies (Sassen, Comstock, Mace, Ackerman)
- Ice property retrievals (Mace, Matrosov, Comstock, Turner, Sassen, Mitchell, Stephens, Evans, Wang)
- In situ observations (Heymsfield, Poellet, Mace, McFarquhar, Lawson)
- Radiation (Vogelmann, Fu, Liou, Curry, Stephens)
- Physical modeling (Sassen, Lin, Boehm)
- Cloud resolving models (Krueger, Randall, Xu)

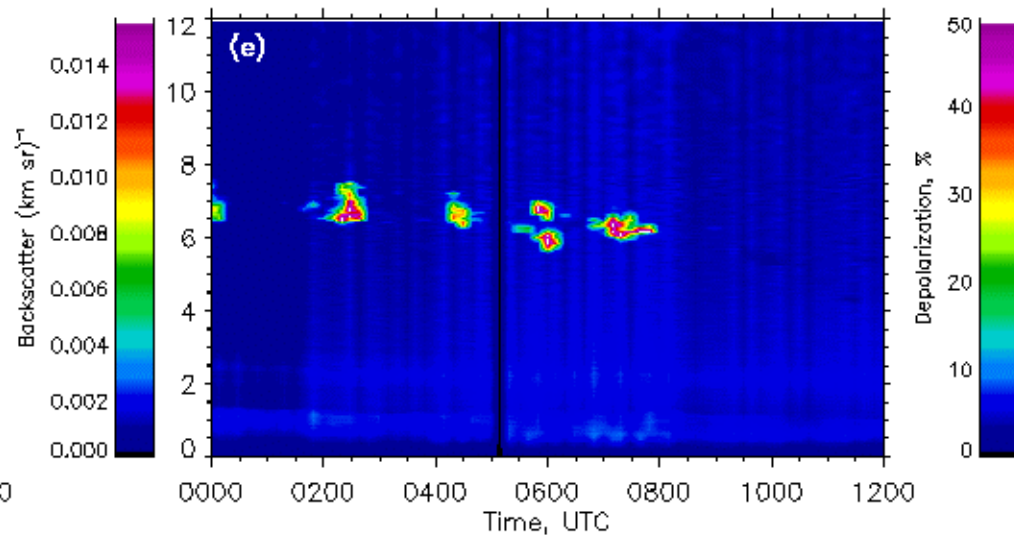
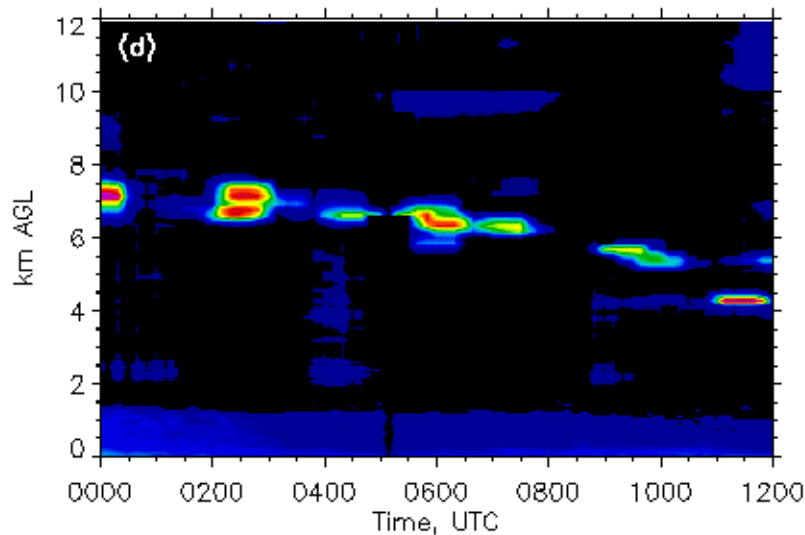
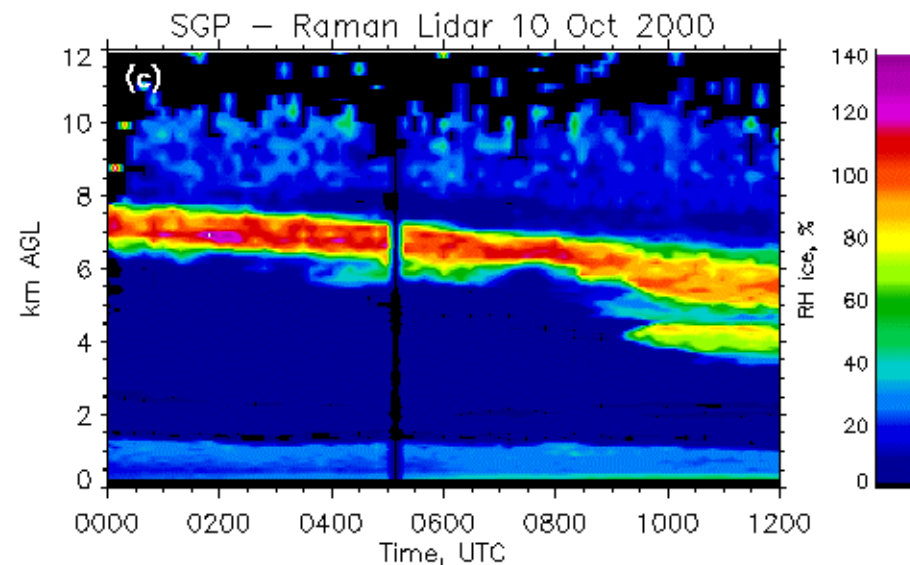
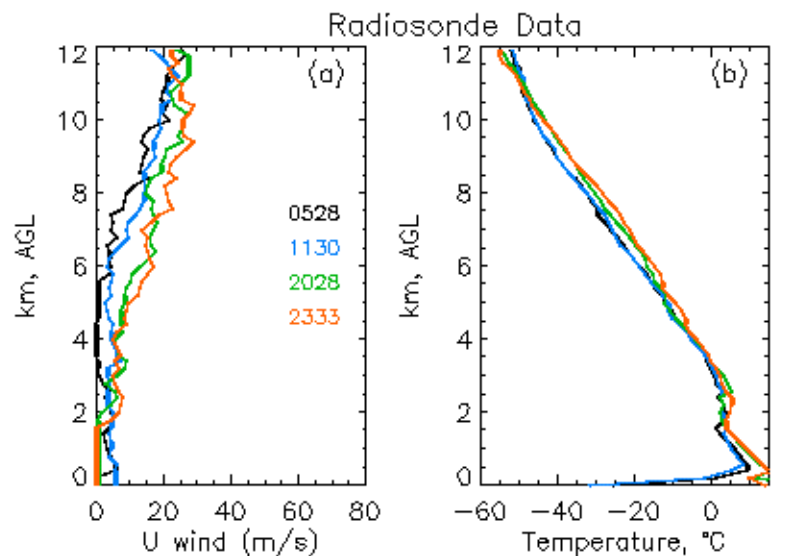
• Parameterizations / CCM (McFarquhar

But not direct ice nucleation, because ...

- **Lack of aerosol (CCN, IN) information – only have aerosol backscatter, extinction**
- **Single column measurements – don't know upstream conditions**
- **Difficult to get high resolution measurements of relative humidity and vertical velocity**

We can make inferences about nucleation using a combination of modeling and observations

Warm Case (mixed phase)



Planned ARM cloud experiments

- **Mixed-Phase Arctic Cloud Experiment (M-PACE)**
- **Tropical Warm Pool International Cloud Experiment (TWP-ICE)**

Mixed-Phase Arctic Cloud Experiment

M-PACE

October 2004

Hans Verlinde

With contributions from

Jerry Harrington, Greg McFarquhar, Eugene
Clothiaux,

Scott Richardson, and Chad Bahrmann



TWP ICE: The Darwin 2006 IOP Tropical Warm Pool International Cloud Experiment

Peter May

Jim Mather

Christian Jakob (BMRC)

Chuck Long (PNNL)

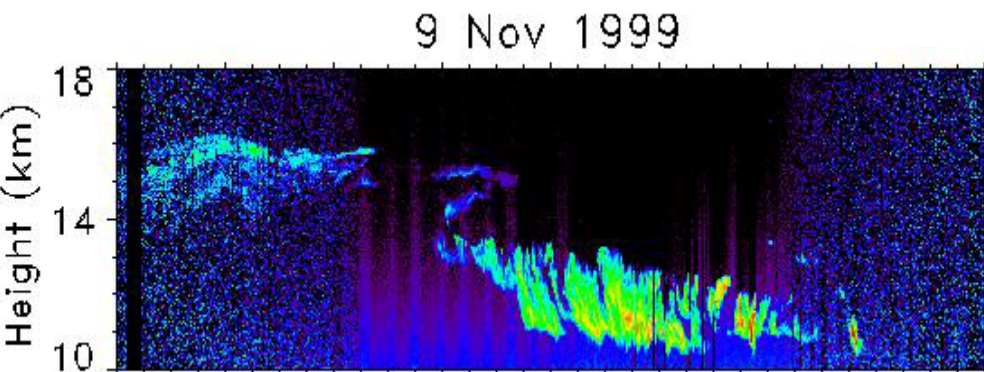


Aerosol in TWP ICE

- Realize that aerosol measurements are largely missing
- Have suggested list of measurements
- No volunteers yet to fund measurements
- Talking with European SCOUT group about participation

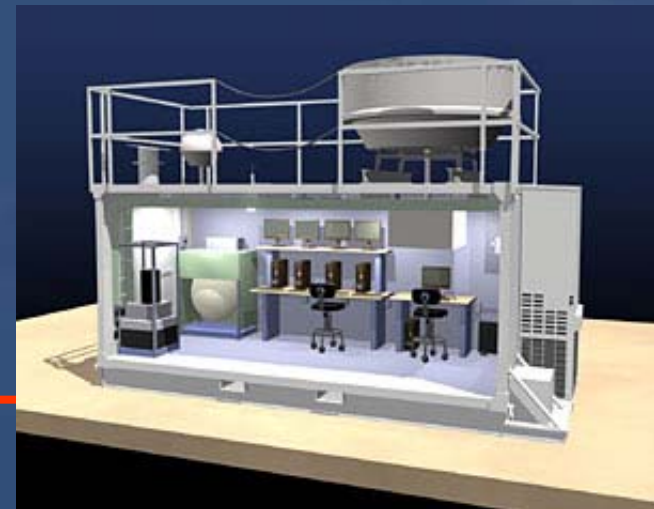
TWP ICE Transit flight

- Fly Proteus across the equatorial channel from Nauru to Manus to Darwin
- Add another lidar – upward pointing
- Measure occurrence and characteristics of tropopause cirrus



ARM Mobile Facility

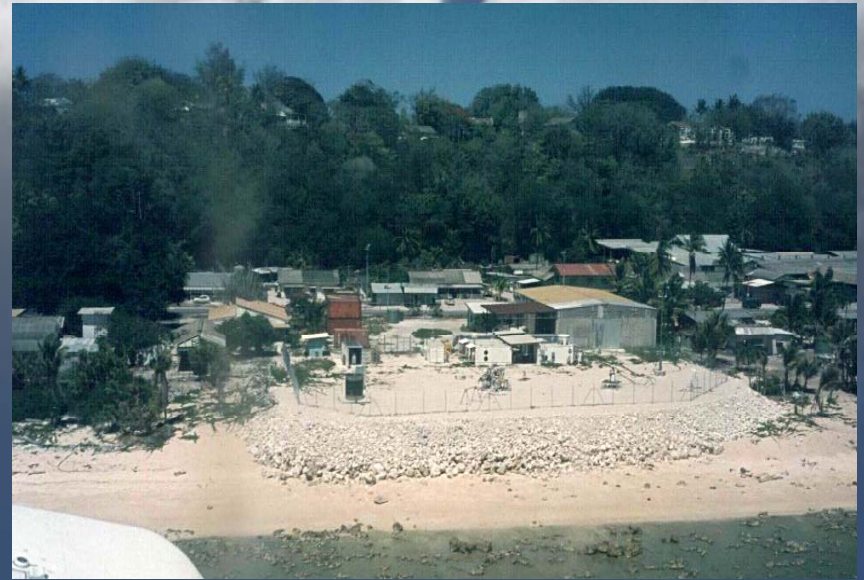
- Deployable ARM instrument suite
- Under construction
- First deployment expected in 2005
- Deployments selected by peer-reviewed proposals (www.arm.gov)



Closing thought

- Nucleation experiments require aircraft, probably more than one
- Remote sensing is a critical component because of the small sample volume of in situ probes
- Remote sensing can be done from aircraft (Wyoming radar)
- However, ground based systems provide much more complete measurements of cloud and aerosol properties and thus a better context in which to place the experiments

*Thanks for your
attention!*



Tropical Western Pacific

Southern Great Plains



North Slope of Alaska

