Breakout Session #2 - Logistics Needs for Arctic Domains
Monday p.m., 7 October 2013
Atmosphere Group

Different atmospheric challenges:
- Harder to get a handle on, measure.
- OPP funding not very invested in atmosphere (10-15% science grants); feedback from NSF is that they are not getting the proposals.

What's needed in the long term to do best science?

- Soundings (radio or drop) over the central arctic. Need to define: How high? How accurate? Key parameters?
- Gap of observations between sea ice and bottom of the cloud (ground-based, active sensors). Boundary layer is important.
- Atmospheric observations over the sea ice.
- Sustained (seasonal, inter-annual) observations and spatially broad.
- New generation of sensors to go on buoys. Technology to deal with LIDAR riming for these types of platforms.
- Do you really need something on the ground? Can UAV use be more widely considered? Addresses vertical and horizontal heterogeneity.
- Size of UAV will drive the complexity of payload. Large system can go out and deploy smaller systems (expendable like a drop sonde, but yielding multiple profiles). To make the small UAV work, you must have a facility to launch from.
- Cold hardening technologies. De-icing technologies. Broad applications for that technology – wind turbines have this issue as well. Intra-agency in NSF there is technology development. Needs to be a mechanism to fund tech dev. Untested technologies like nano-coatings. SBIR is a potential mechanism.
- Polar engineering: engineers don't want anything to do with it because it isn't a big enough market. Maybe industry is looking at this.
- Measurements can be leveraged: flying into an ice cloud, use LIDAR or RADAR to improve the flight paths.
- Pristine atmosphere free of local contaminants from local power requirements. Clean energy integration will be extra important for atmospheric sampling. Atmospheric groups will have limitations using industry platforms because of the contamination footprint.
- Data transfer issues (e.g. 20 Hz-LIDAR at Summit is 2 MB down from 50 MB), but if LIDAR was on a buoy. General need to get smarter about large data bundles if platforms become autonomous. Will also have impacts for power.
- Need to be simultaneously looking at the aerosols to really understand.
- Stratosphere is even more sparsely sampled.
- $500/day to launch 2 sondes at summit (just materials). How many UAVs could you buy? One year of an icebreaker = $$MMM. How many UAV's could you buy?

Logistics limitations/opportunities?

- NO intensive measurements over the central arctic.

Satellite limitations of clouds, contrast, resolution of key parameters near the ground, strong inversions, etc.

UAVS

- Become iceballs in the clouds
- Regulatory standpoint: FAA is opening up to UAVs, targeted 3 areas in Arctic (Beaufort, Aluetians, Anchorage). MIZOPEX study launched out Iloqtok. "Blessed" two platforms.
- UAVs need launch facilities.

- Communication as we are currently operating is not always a limitation, but more autonomous, low-energy communication will be a challenge. Science can potentially leverage industry infrastructure. At MIZOPEX it was a problem.
- Access to central Arctic is further complicated by changes in sea ice thickness for supporting large, year-round ice camps.
- What about mounting things on cargo ships that are planning to traverse the Arctic regularly?
- Is there an opportunity to expand and coordinate community-based observing of Arctic atmosphere?
- Example of AVOS from low latitudes.

Limited by international agreements?
If you wanted to go out on the sea ice, where could you go?
Winter access to the Russian arctic is the most difficult. There's no logistics there to help out.

Opportunity – AGU presentation on a dirigible platform that can carry up to 2 c-tainers. $250k to do a flight.

Air-drop-able O-buoy.

Training is an issue. We will create a different type of professional who will not deploy, but will just analyze the data. There is not a lot of early career development for training the next generation of field students. Example from ICECAPS at Summit is that experiments are run by professional techs; student techs are not helping with logistics around the station as much because they are learning.

Regulations?

Interdisciplinary?
From an agency standpoint: best way to drive interdisciplinary is to have scientific questions that are interdisciplinary.

You need to train people to work together.

Disconnect between some of the major interdisciplinary cryospheric science questions (Greenland melt, glacier/marine/fjord, sea ice melt) and where the most

intensive atmospheric observations are being made (dry center of Greenland ice sheet, coastal Barrow observatory). If these questions drive where logistics infrastructure will go, the atmospheric community must be at the table.

Look for the areas of opportunity (e.g. Barrow) and utilize them for interdisciplinary science (e.g. terrestrial-atmosphere).

NCAR is a special place for interdisciplinary science well integrated with atmosphere.

If there is a push both from the community and the funders to consolidate research locations it would enable more interdisciplinary work.

Summary

What's needed to do the best atmospheric science. We need a strategy for filling atmospheric observing gaps:

- Extensive sounding of the atmosphere
- Central arctic over sea ice
- Comprehensive atmospheric profiling (cloud, aerosol, BL)
- Greenland melt hot spots (e.g. marine glaciers)
- Pristine atmosphere free of local contaminants from local power requirements. Clean energy integration will be extra important for atmospheric sampling. Atmospheric groups will have limitations using industry platforms because of the contamination footprint.

Technology research:
Identify the funding mechanism for developing polar technology (may be synergistic with industry, SBIRs, Where to go in NSF to get funding for a new generation of sensors? Role of CRESIS ?etc.).
Technology need to:

- Develop UAVs at a range of scales, larger to miniaturized
- Ground based robots
- Next generation of atmo instruments: LIDARS on buoys (EU is doing it)
- Cold hardening, de-icing technologies
- Blimp airlift capability for deploying heavy things inexpensively
- Power system development, renewables. Need low-power broad, routine measurements; managing bandwidth requirements or improving communications technology
- Intra-agency, interagency funding coordination to support
- Develop mechanism to coordinate with industry for platforms of opportunity. Identify what the technology needs would be to modified instruments to operational functioning.

Strategy for increasing interdisciplinary:

- From agency perspective: The scientists need to pose the interdisciplinary questions to the agencies
- Offer place-based awards connected to existing or desire locations that focus on interdisciplinary questions (e.g. Barrow or key fjord in Greenland); community should focus on defining these hot spots.
- NCAR can play a role.
- You need to specifically train people to be interdisciplinary.