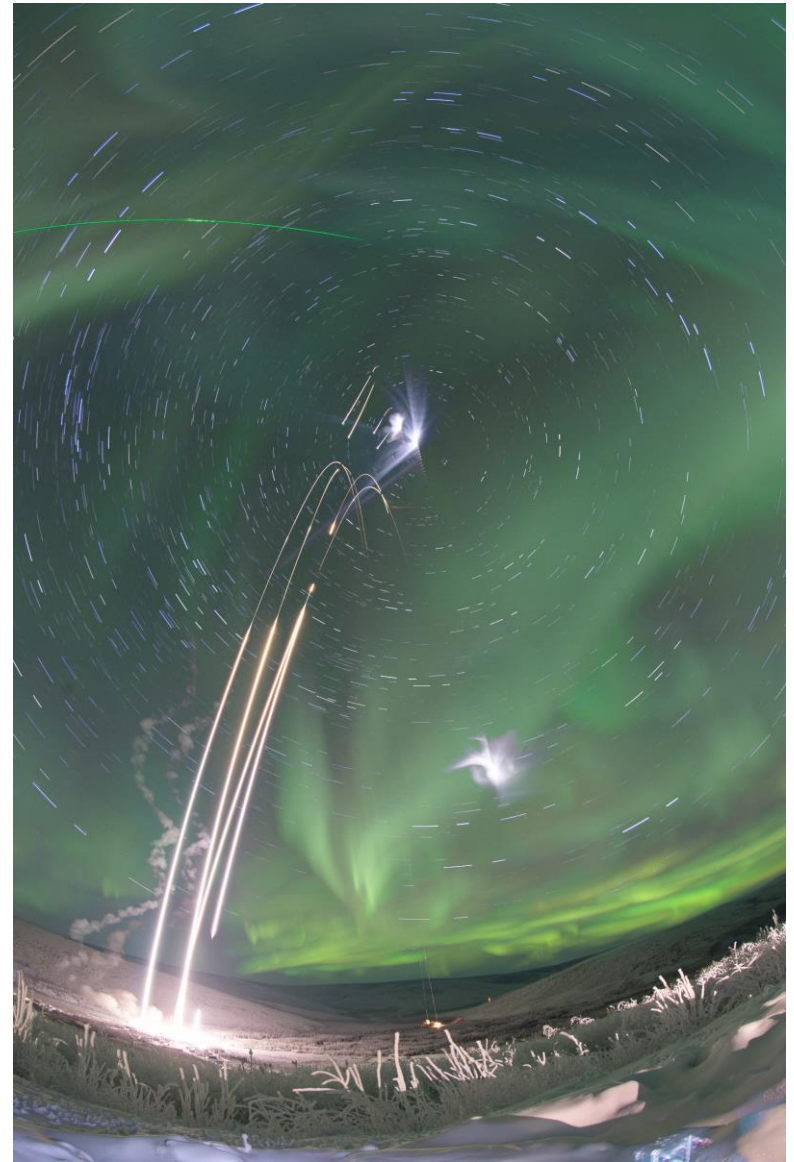


Poker Flat Research Range: combining ground- and rocket- based investigations

Richard Collins
with Katrina Bossert, William Bristow,
Mark Conde, Anthea Coster,
Christopher Fallen, Donald Hampton,
Miguel Larsen, Kristina Lynch, Michael
Stevens, Michael Taylor, Denise
Thorsen, Colin Triplett, Roger Varney,
Bifford Williams...

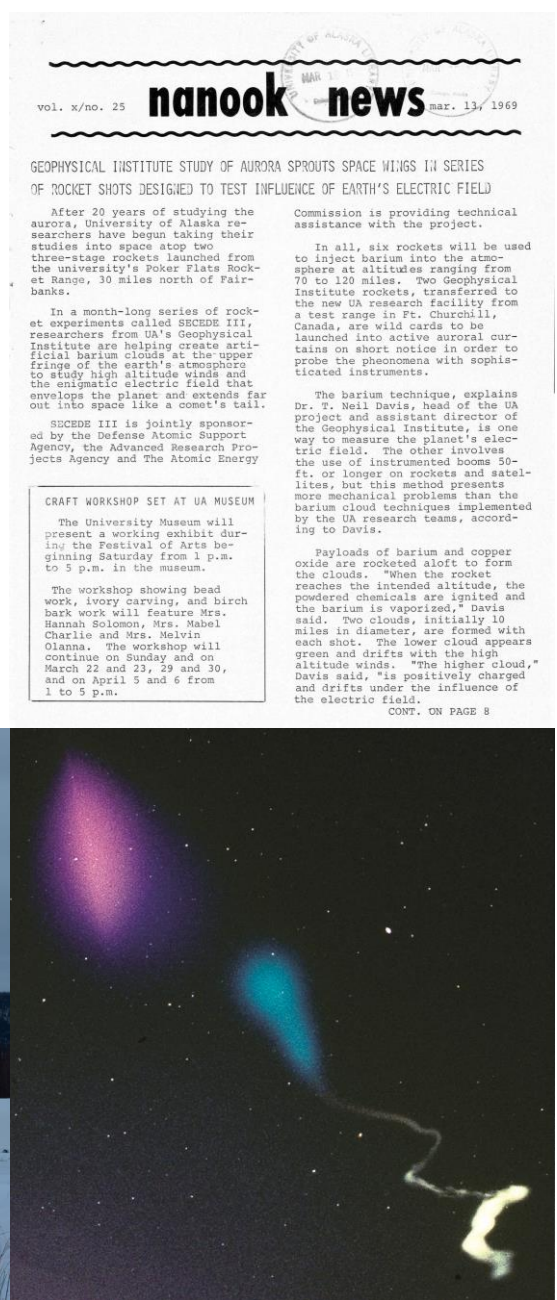


Poker Flat Research Range (PFRR)

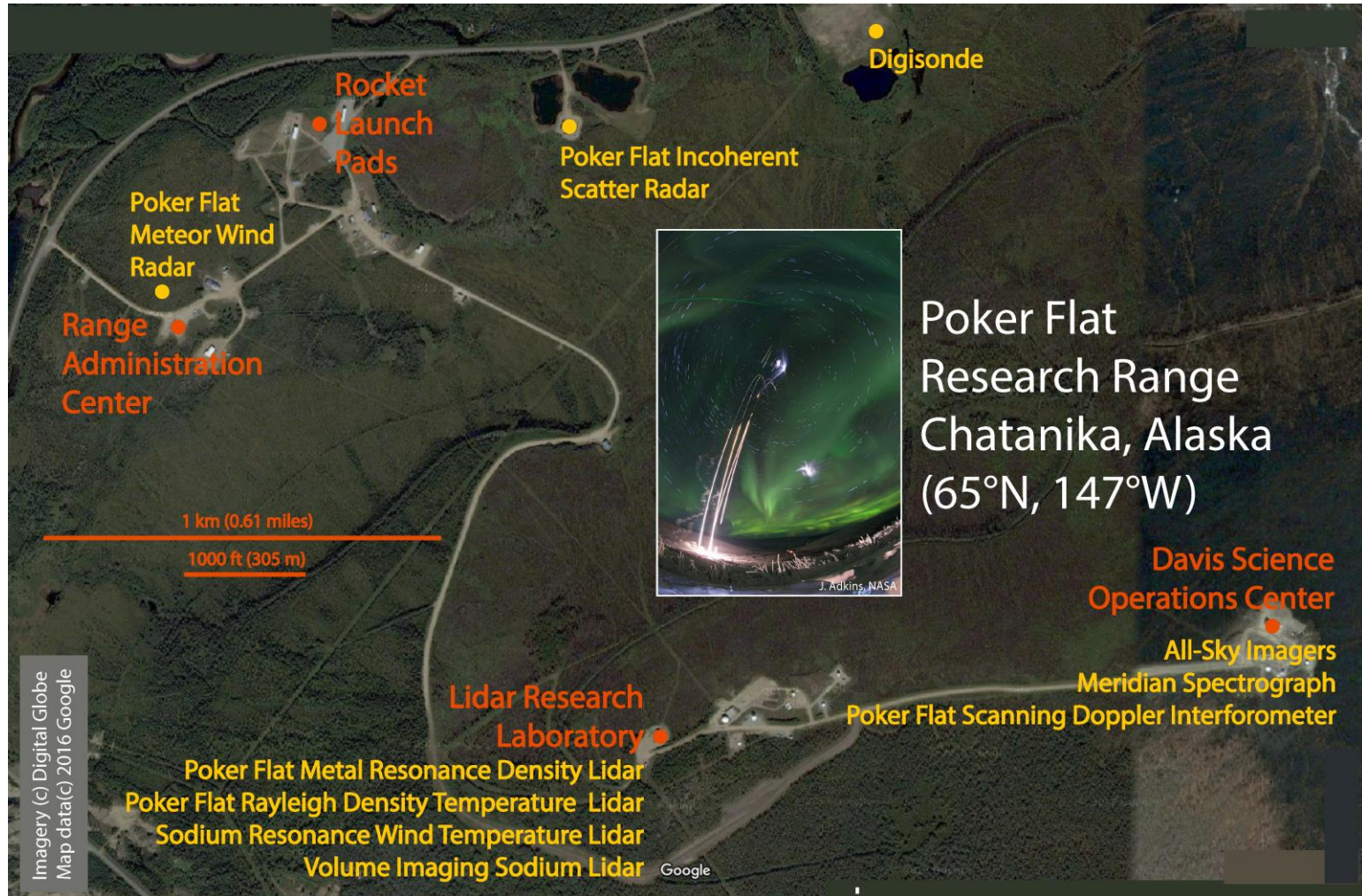
First launch on 5 March 1969 (50 this year).

Barium cloud released near altitude of 100 miles.

Since 1969 there have been 339 rocket launches from the range, with four launches in January 2018.



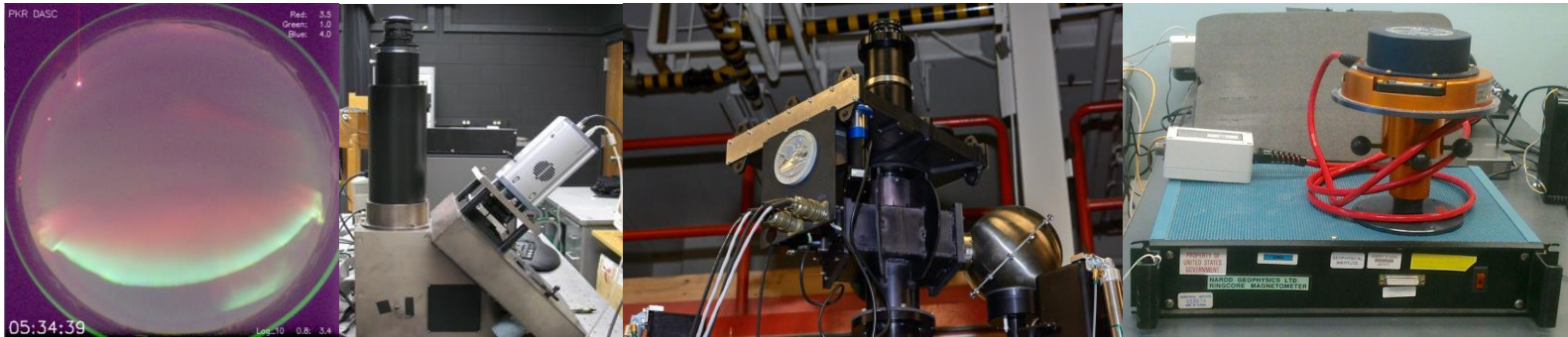
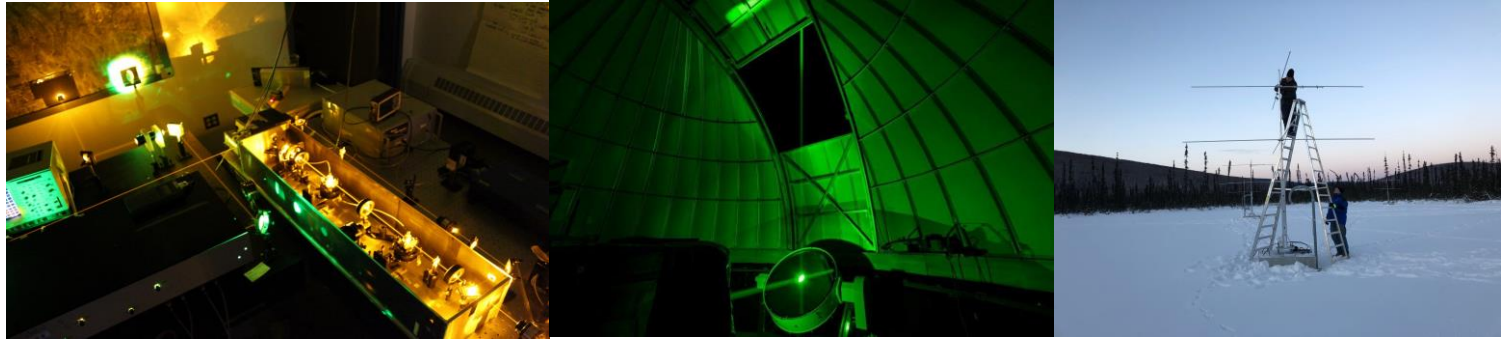
PFRR Ground-Based Instrumentation



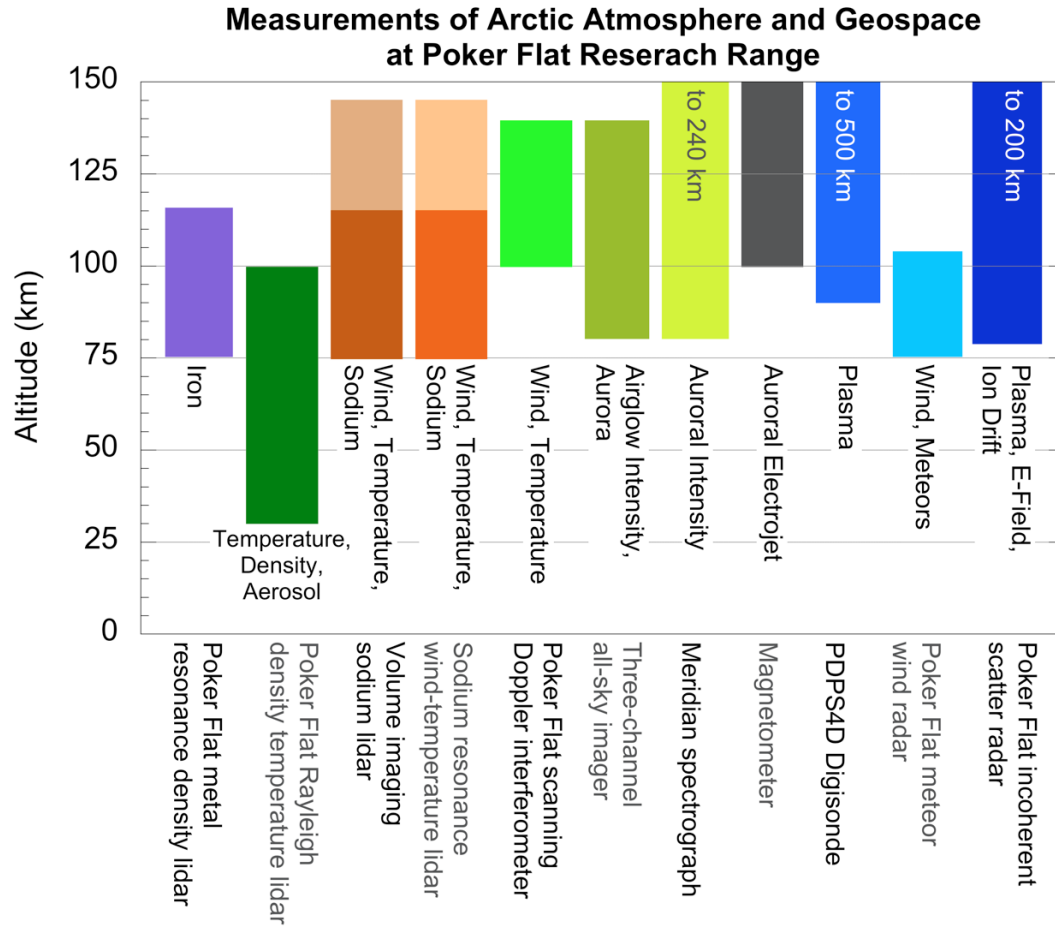
A Regional Natural Laboratory



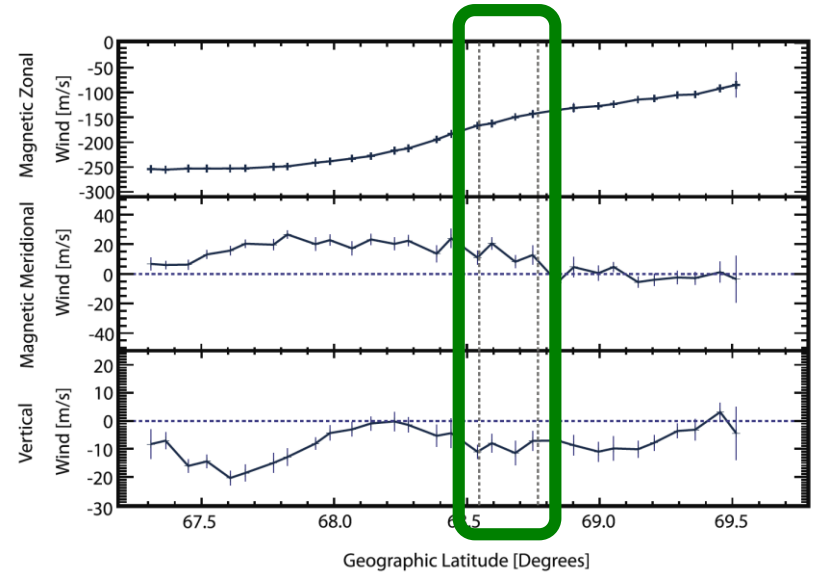
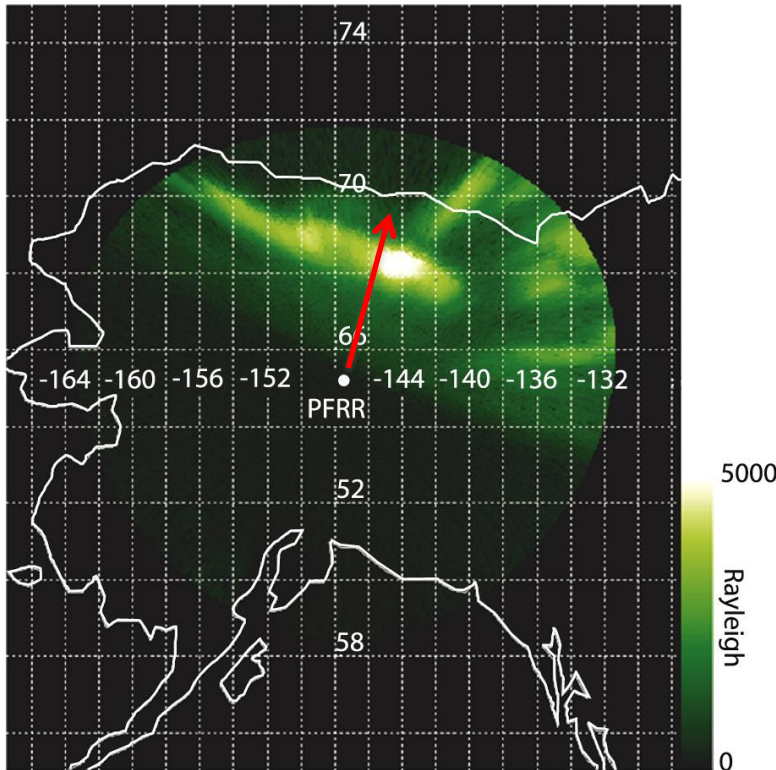
PFRR Ground-Based Instrumentation



PFRR Ground-Based Instrumentation



The Horizontal E-Region Experiment (HEX)

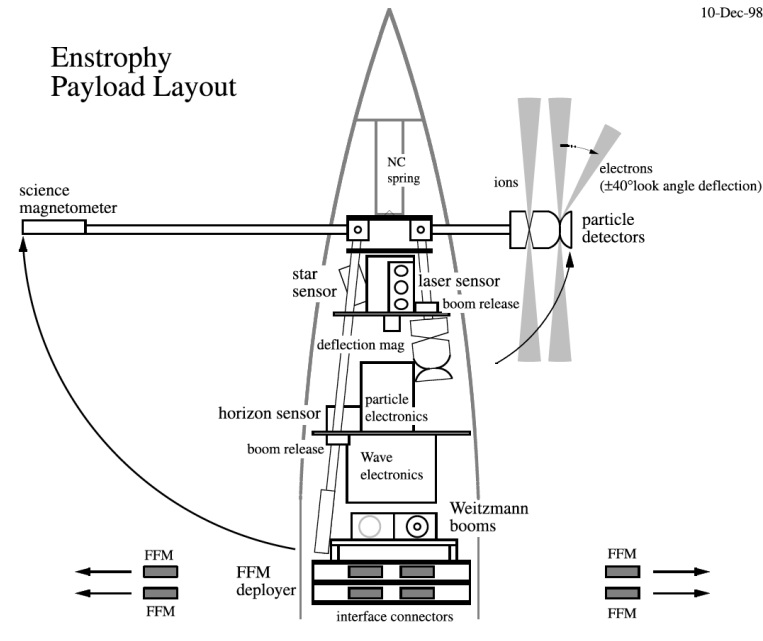
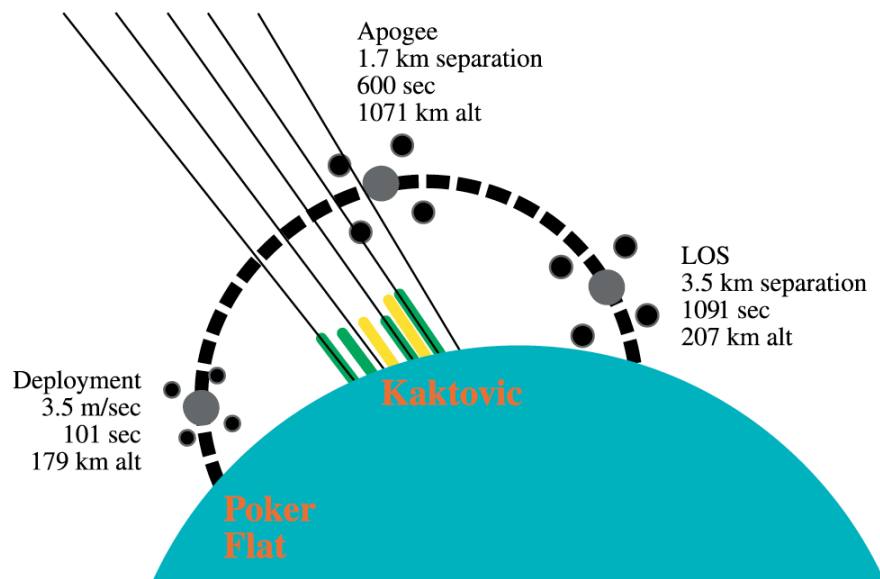


Arc

HEX measured the winds around an auroral arc using puffs of TMA.

Enstrophy

10-Dec-98

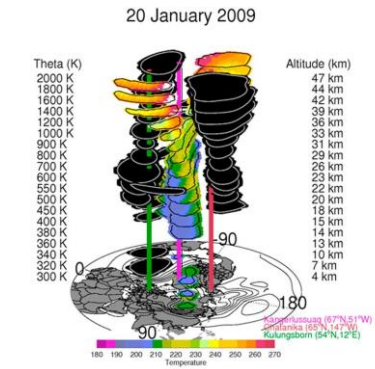
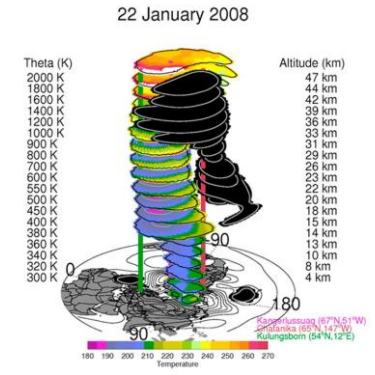
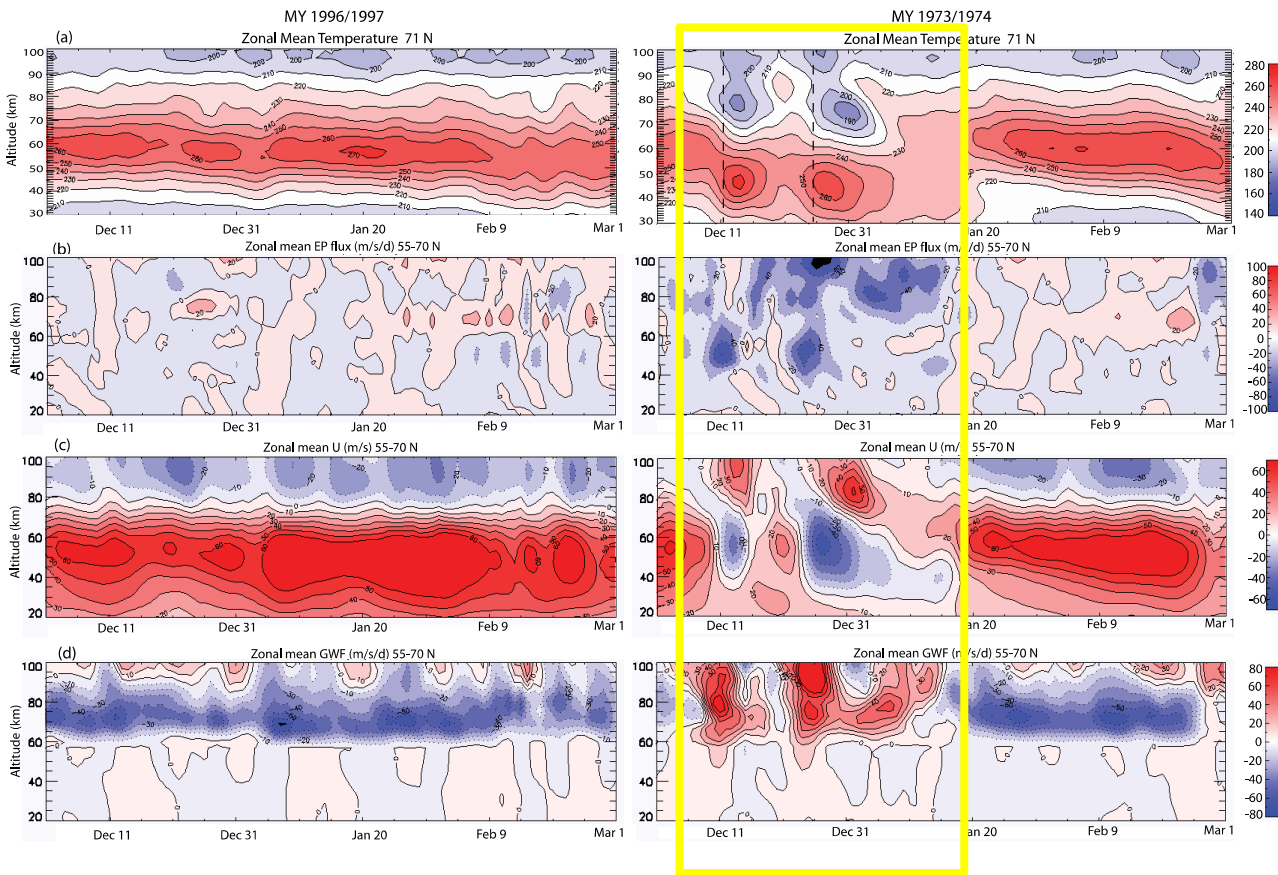


Enstrophy flew across an auroral arc over Kaktovic with a cluster of “hockey puck” magnetometers.

Enstrophy provided measurements of the spatial structure of the currents around the arc.

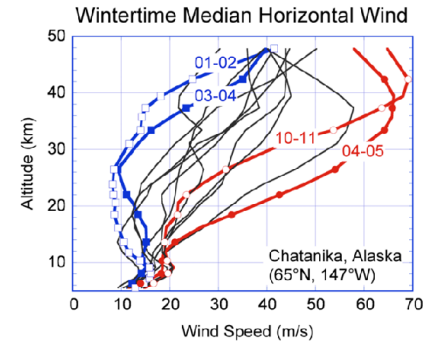
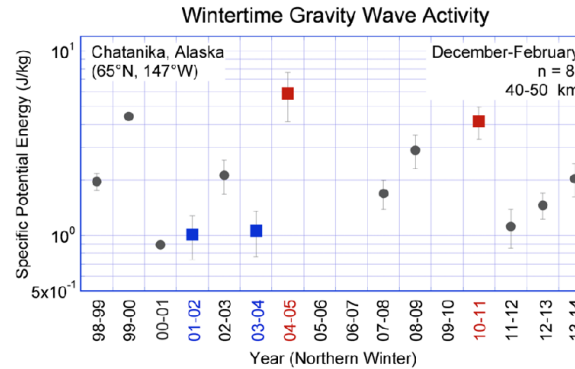
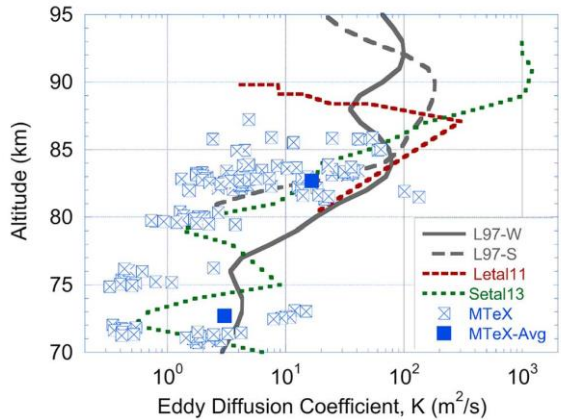
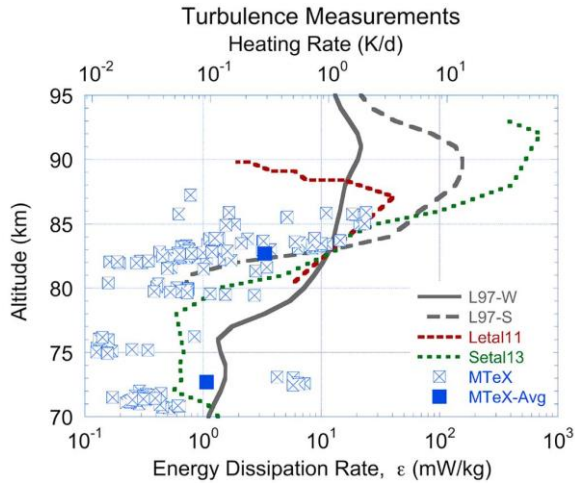


Wave Coupling in the Arctic



Planetary waves drive sudden stratospheric warming events with systematic reversals of the circulation and gravity wave forcing.

The Mesosphere Lower Thermosphere Turbulence Experiment (MTeX)



MTeX measured turbulence in the upper mesosphere while lidar measured gravity wave activity.

Low levels of turbulence are associated with low levels of gravity wave activity.

Super Soaker

The goal of the Super Soaker experiment was to study upper atmospheric response to locally concentrated water vapor

Included 3 sounding rockets

1 with 220 kg H₂O (~1 bathtub) explosively released at 85 km

2 rockets with chemical tracers (TMA) for wind measurements

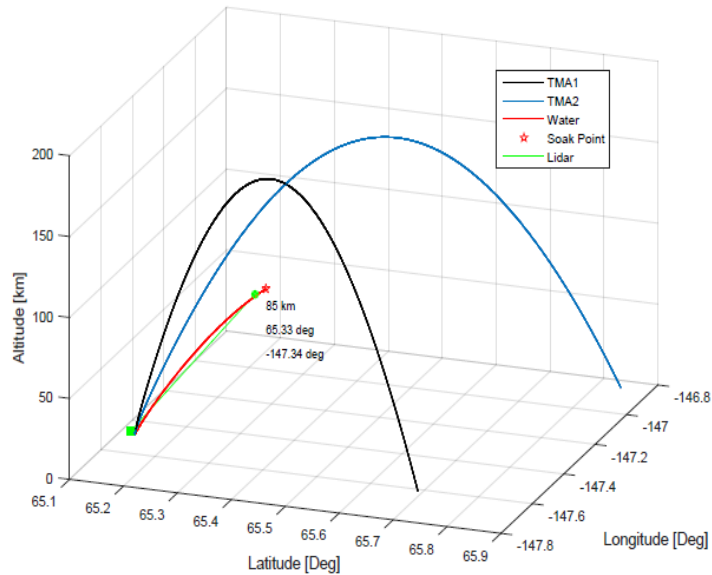
Use TMA trails and coordinated ground-based measurement from lidars and a temperature mapper to observe the formation of ice clouds and any changes in temperature and winds at water release altitude



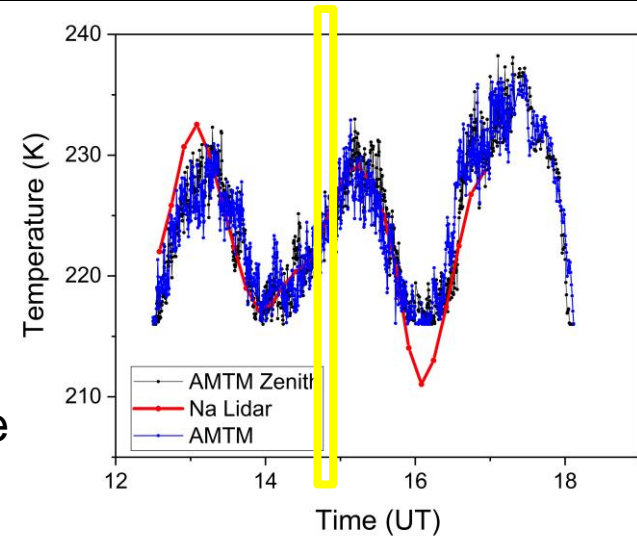
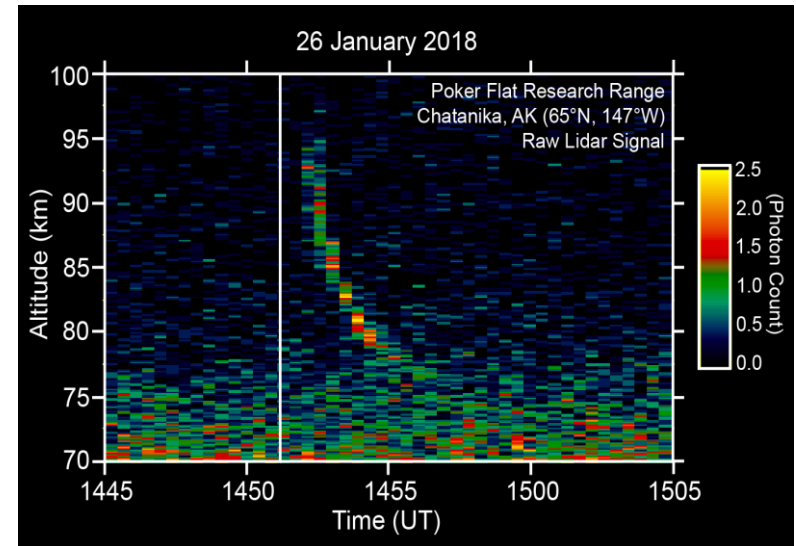
Super Soaker - Release



Super Soaker – Cloud Formation



Cloud formed 18s after release in high temperatures (~ 225 K).
Model analysis indicates rapid cooling by water vapor.
Rapid cooling depends on spatial structure of water.



Key PFRR Features

- Extensive on-range and downrange observatory capabilities to support science missions from PFRR. UAF scientists have instruments across Alaska and routinely support NASA sounding rocket Principal Investigators when formulating launch decisions.
- UAF faculty frequently called upon to help candidate PIs formulate their mission proposals.
- PFRR launches have synergy with NSF-funded instruments; PFISR, SuperDARN, meteor radar, lidars, imagers.
- Fairbanks, GI and UAF offer extensive support capabilities – machine and electrical shops, university laboratories, local vendors, and extensive logistics options.

Closing Thoughts

- Use facility at Kodiak to launch CubeSats that orbit over Alaska to study auroral substorms.
- Use US Array to host dense array of GPS-GNSS receivers to map ionosphere.
- Mesospheric Grand Challenge.
- Invite researchers who wish to develop rocket proposals as PIs to work with UAF faculty who have experience with rocket proposals.
- Invite students to consider graduate student and post-doctoral opportunities at University of Alaska Fairbanks.
- Acknowledge support from NSF, NASA and DoD.

