Using oblique, bistatic receptions of SuperDARN signals to measure HF propagation in the auroral and polar cap region

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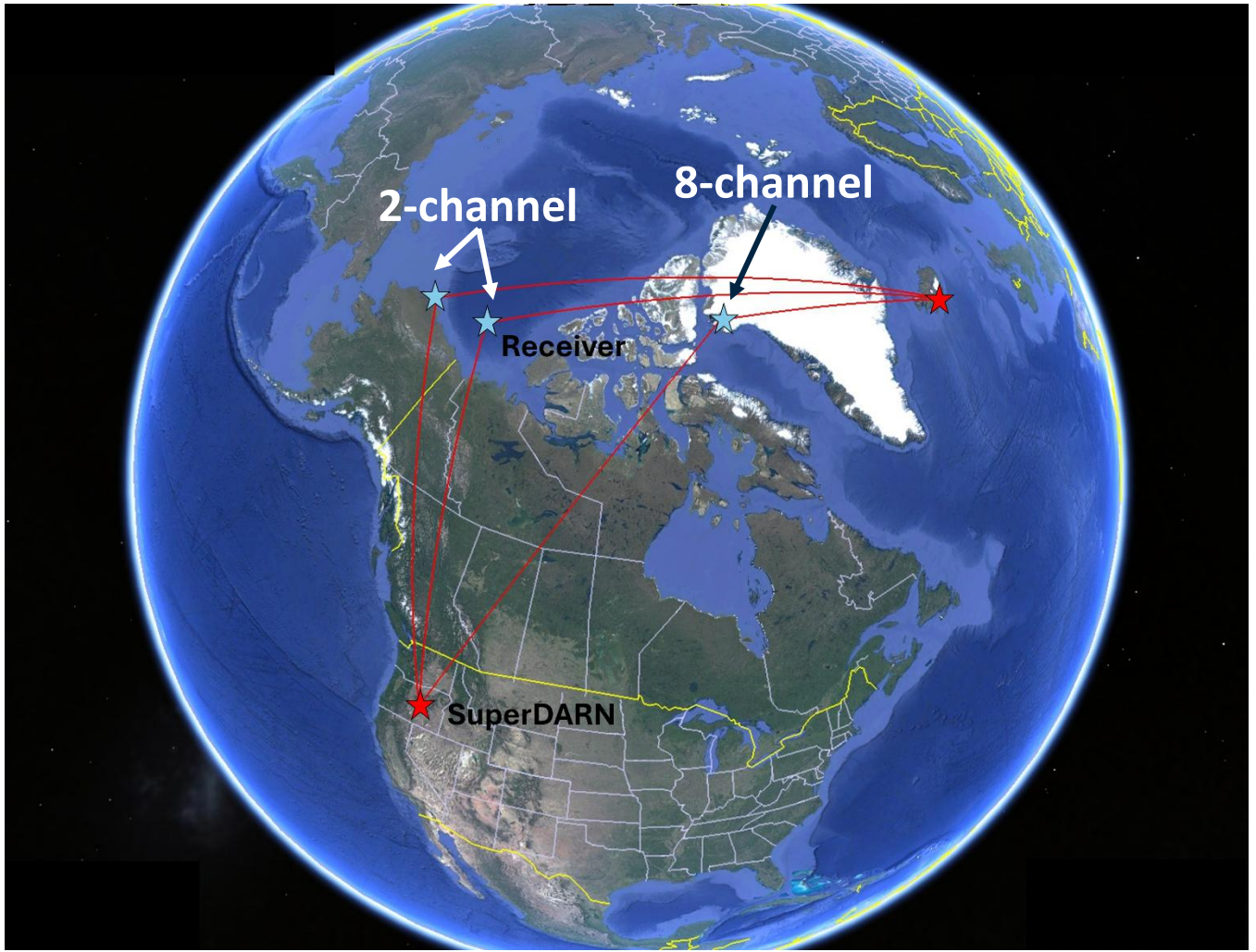
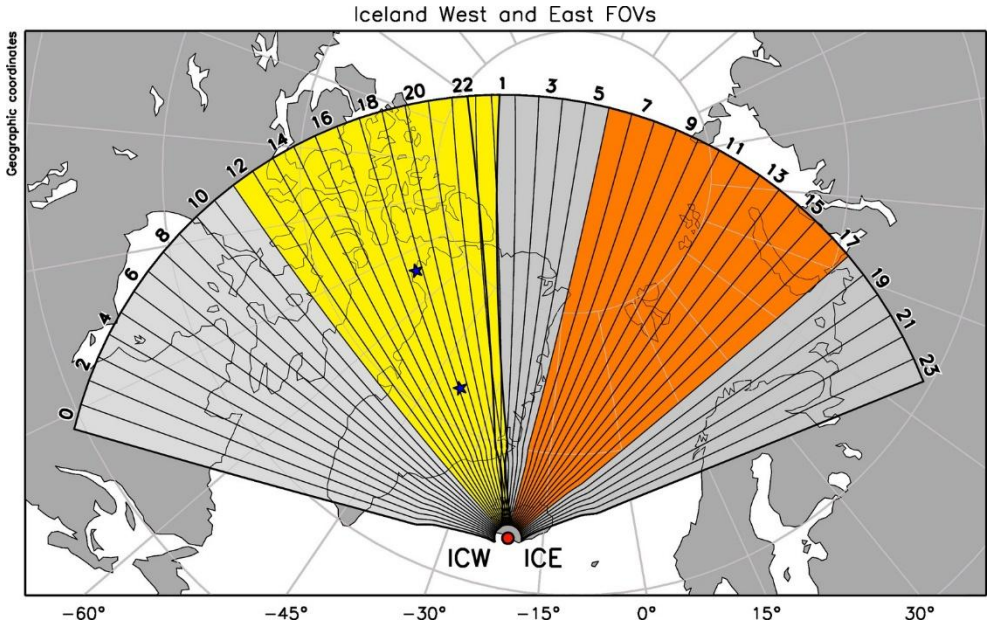
Experiment Geometry

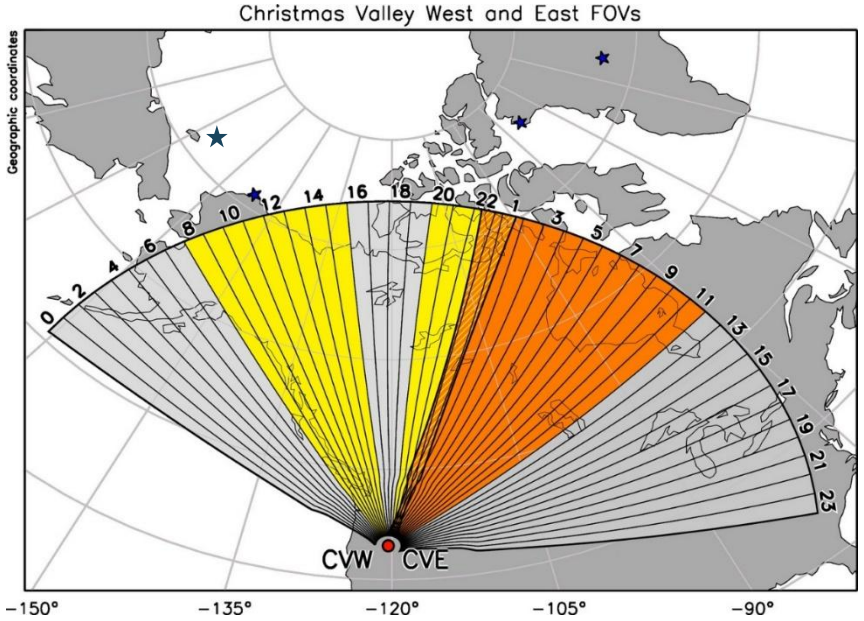
- Save ~1-7 days of 2-22MHz IQ
- Local processing capablilites



Transmit over fewer beams and between 9 and 17 MHz on each for 2 experiment days

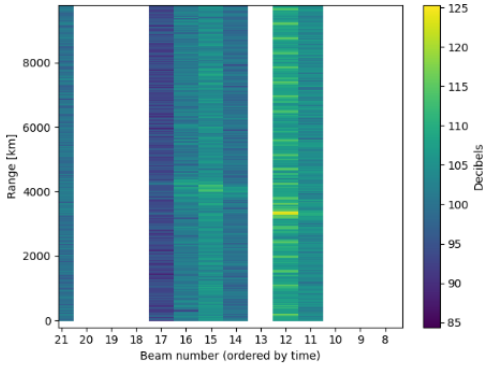
- Experiment 1: 4 beams (1 min sweep)
- Experiment 2: 12 beams (3 min sweep)



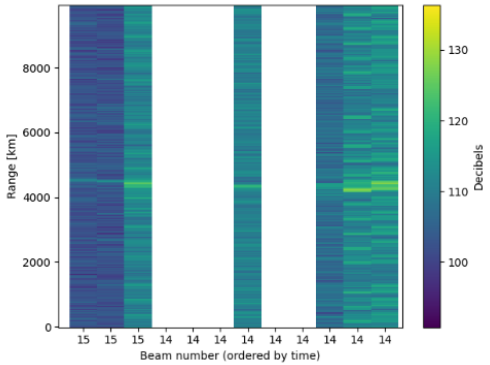


We can detect both Tx from all three Rx and recorded a full day on two separate occasions

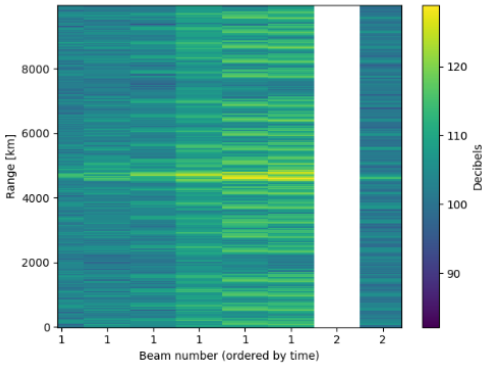
Oregon to Utqiagvik



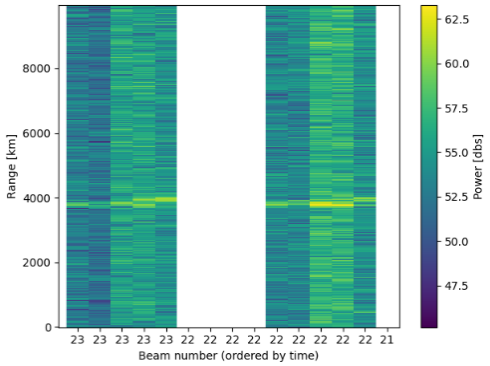
Oregon to Healy



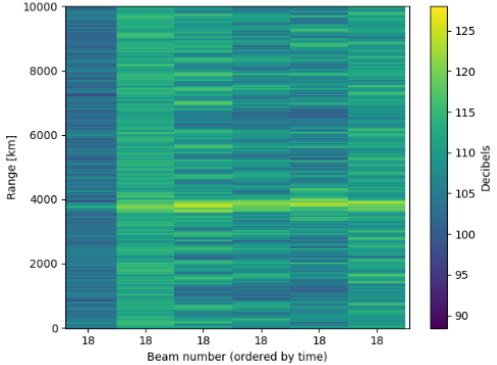
Oregon to Pituffik



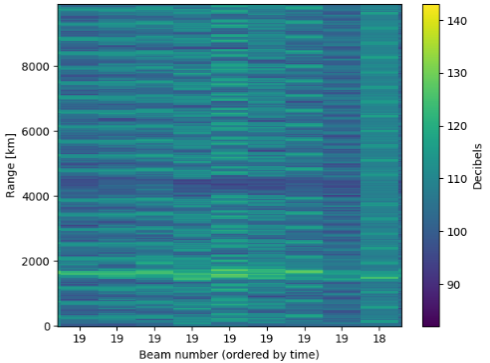
Iceland to Utqiagvik



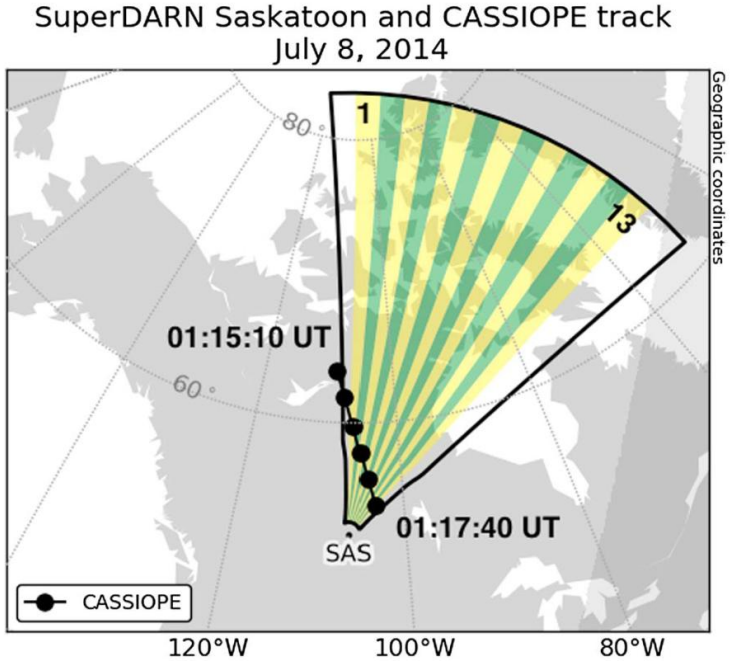
Iceland to Healy



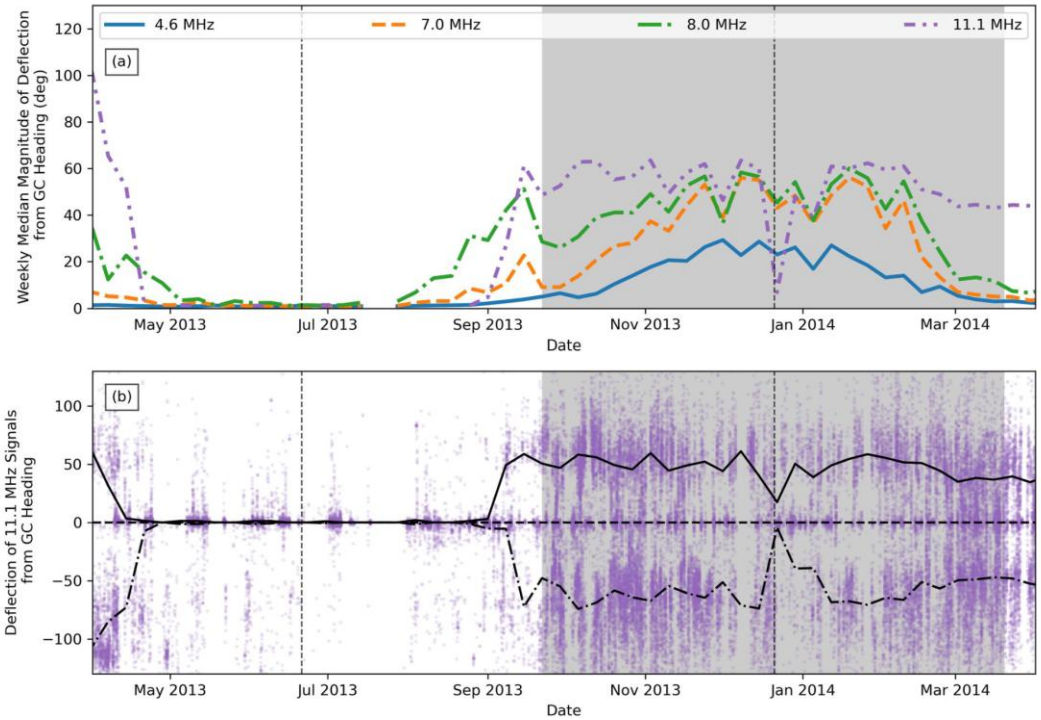
Iceland to Pituffik



Interested in this setup to measure auroral and polar cap HF propagation – it appears this has only been done a few times

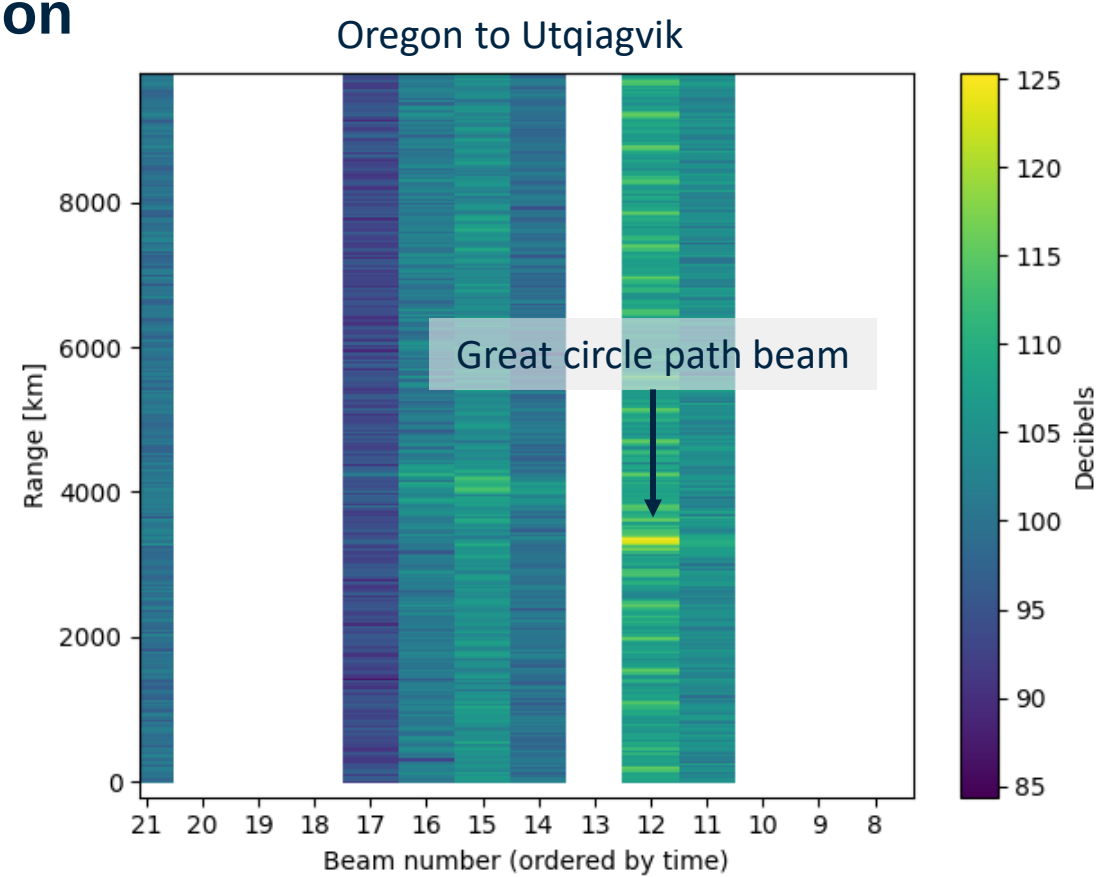


Perry+ 2024 - 10.1002/2016RS006142

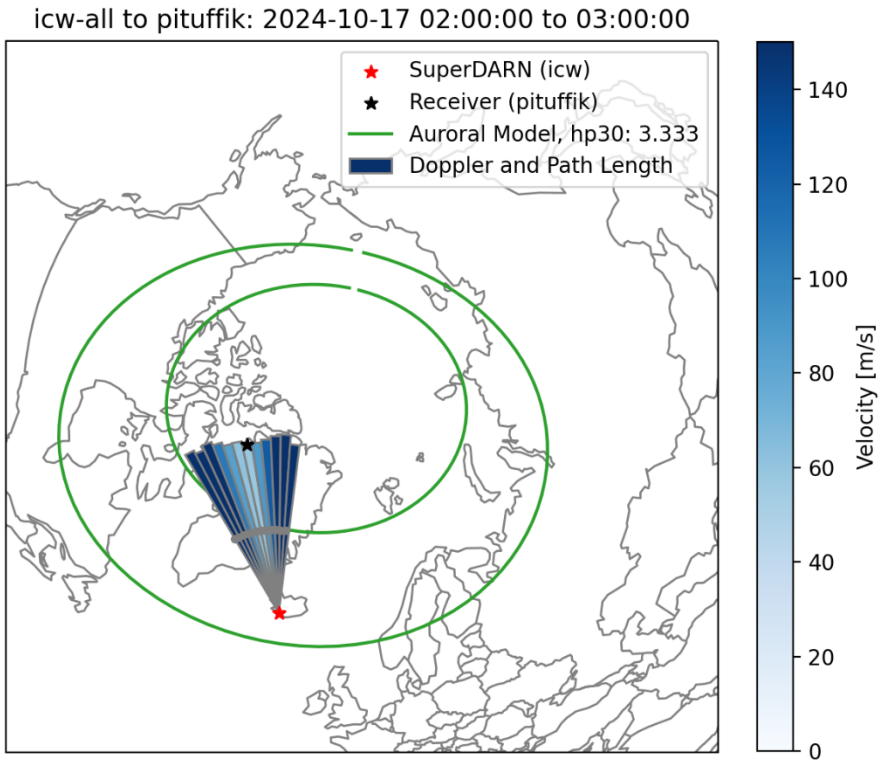


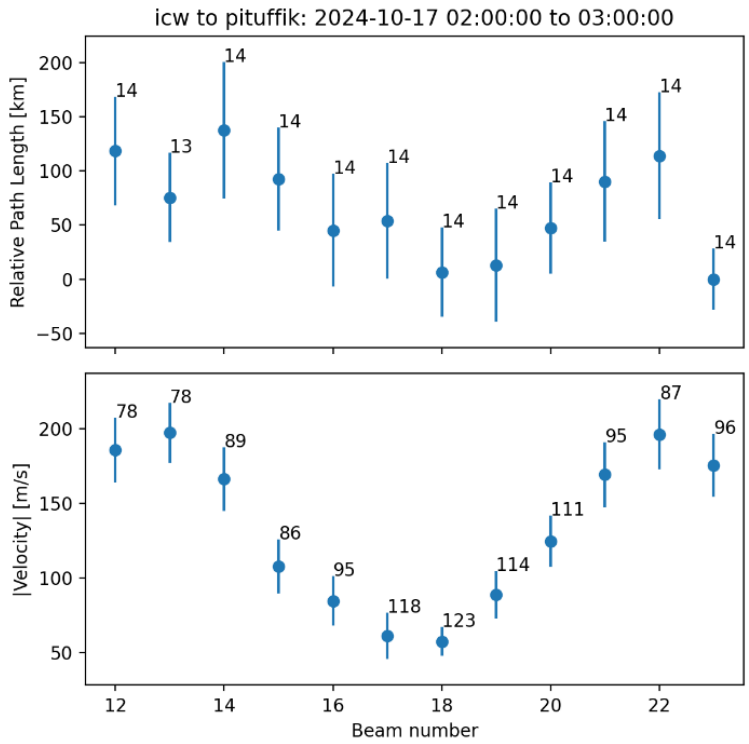
Cameron+ 2024 - 10.1029/2023RS007897

We may be able to use these bistatic links to detect off great-circle-path propagation



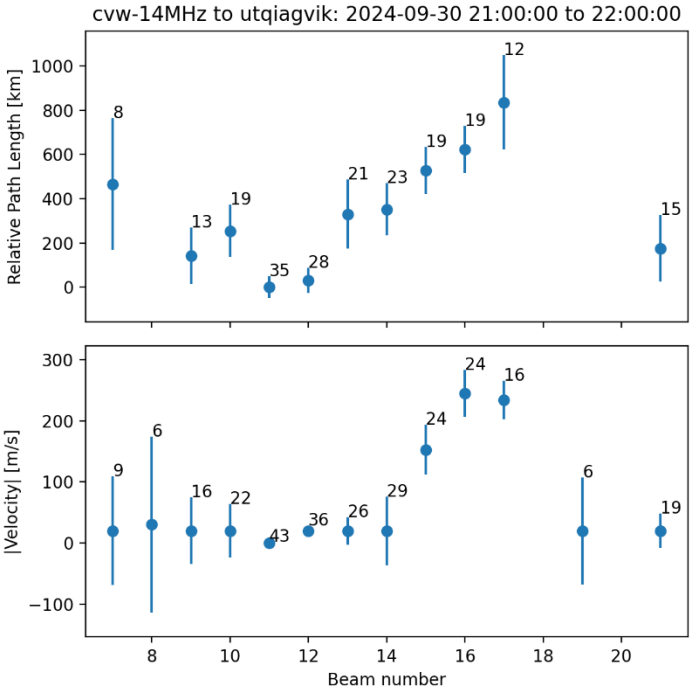
Integrate doppler and relative range over 1 hour for each beam

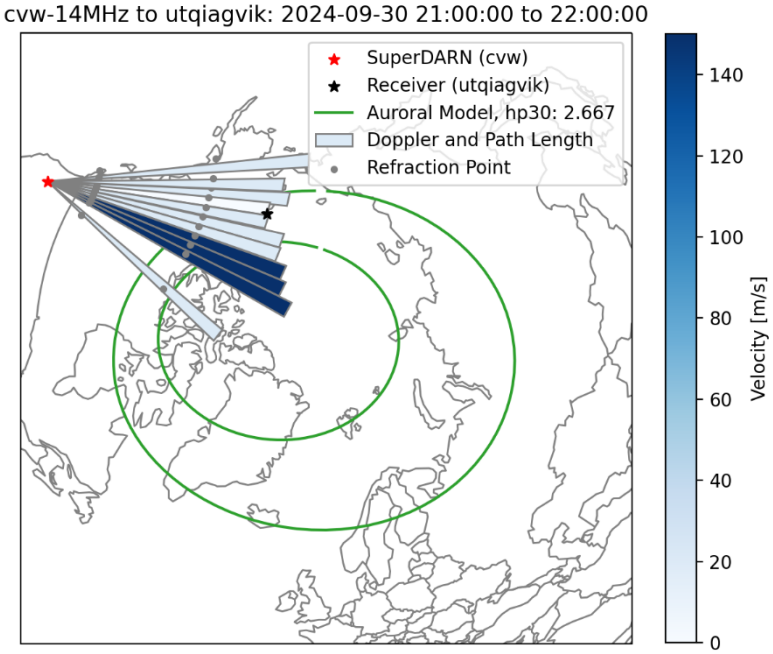




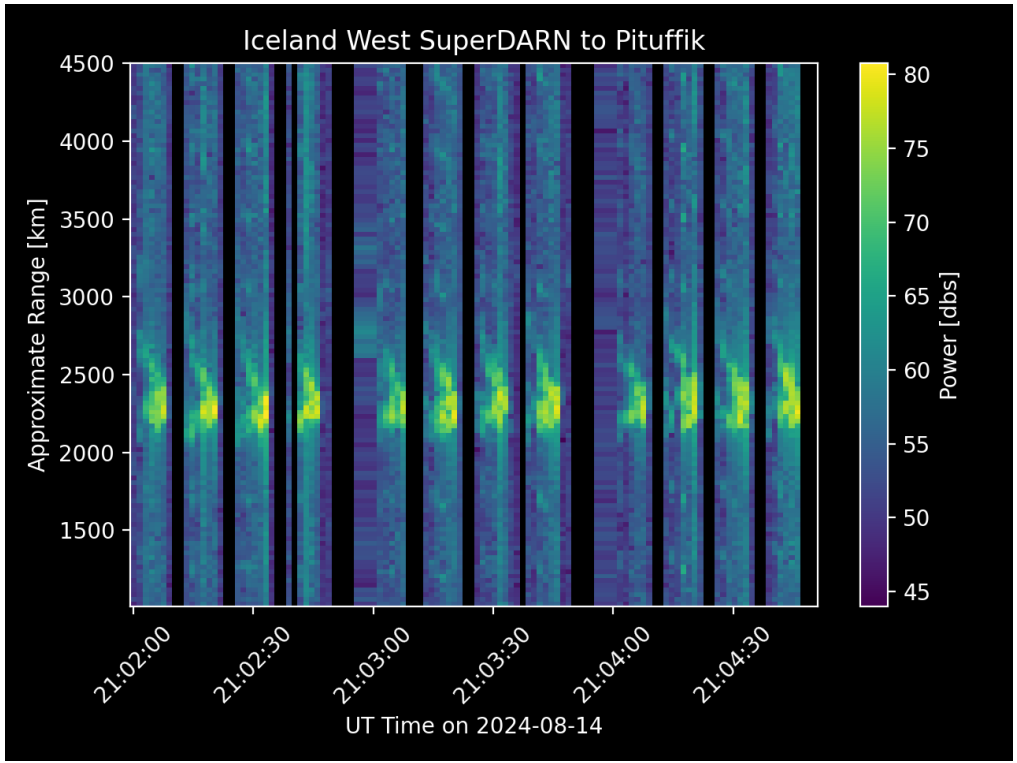
Auroral model from Troyer et al. (2025)

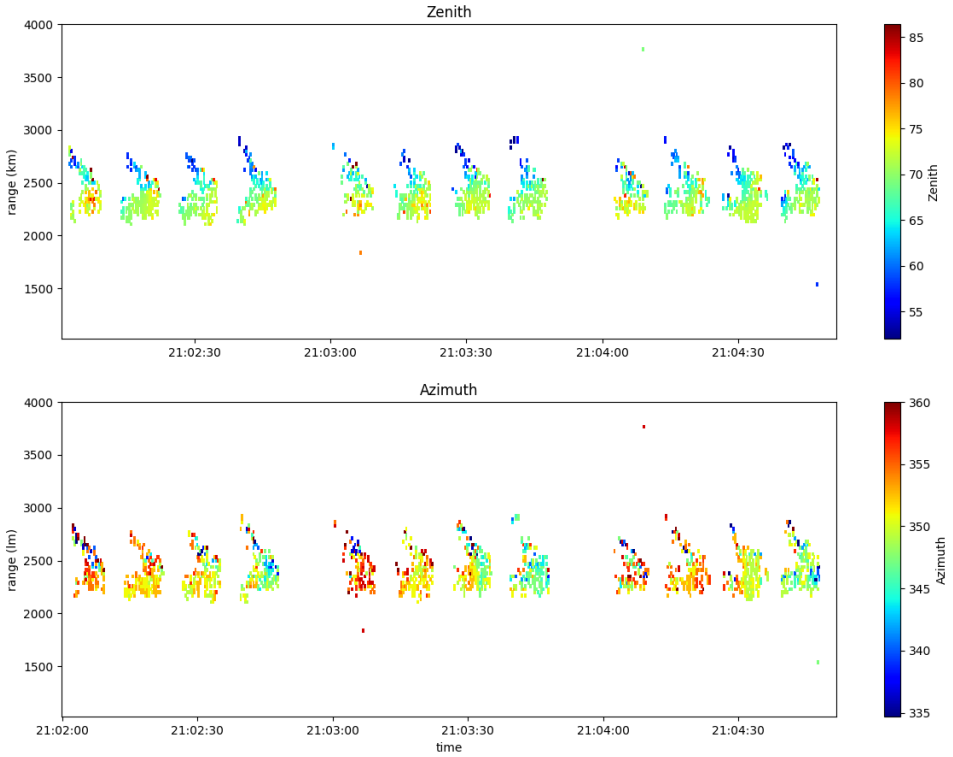
Integrate doppler and relative range over 1 hour for each beam



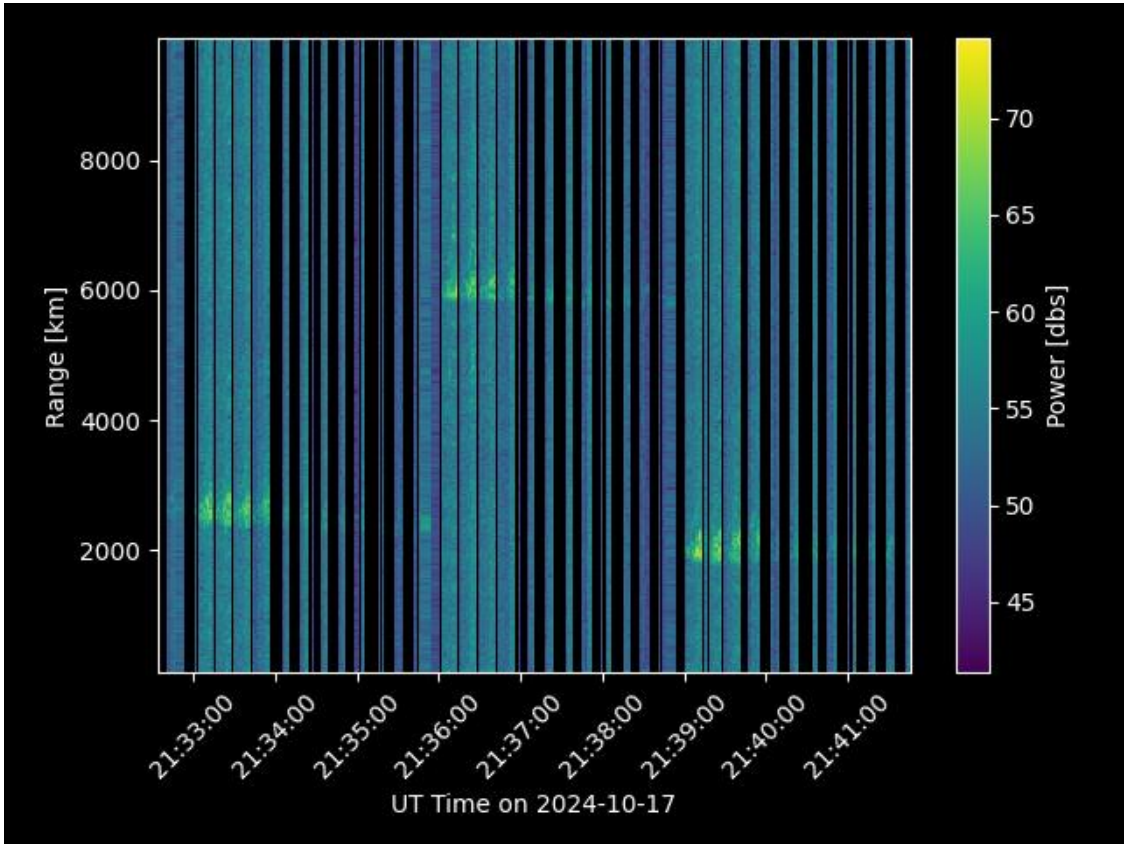


Frequency sweeps allow us to produce high cadence, low resolution ionograms and derive angle of arrival using 8-channel system

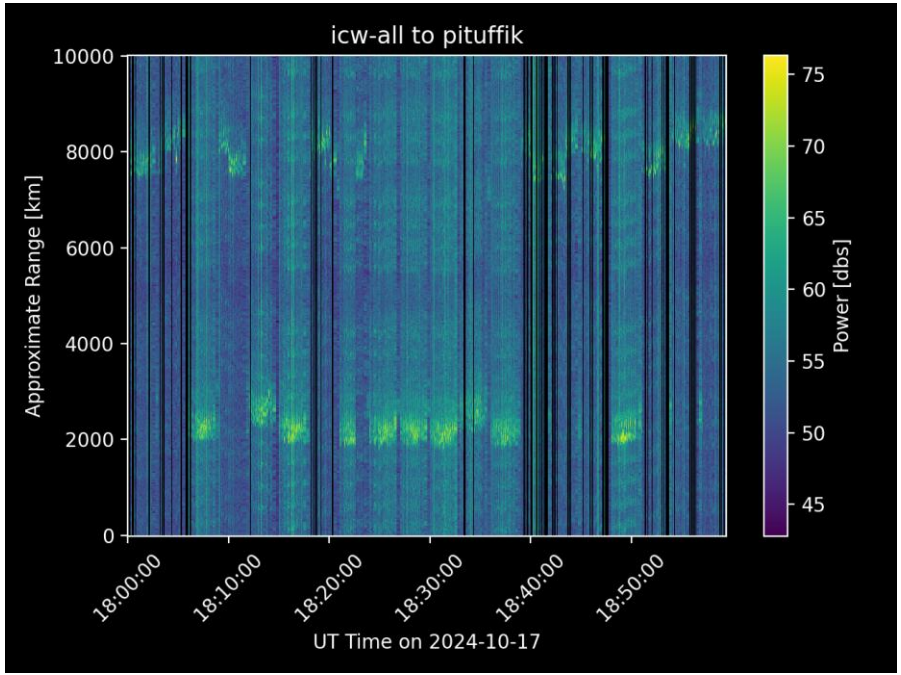




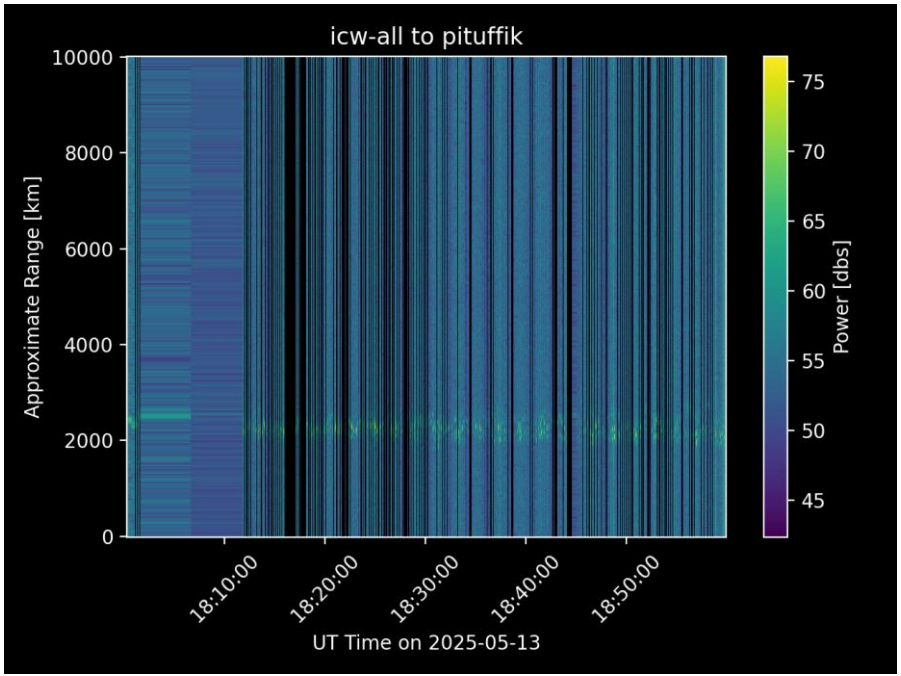
A bistatic setup allows us to identify timing offsets and issues



An updated USRP in Iceland appears to have improved the timing problems



Before



After

Will be running many more experiments in 2025-2026 with another receiver at Summit Station in Greenland

Do you have ideas for interesting science we can do with these measurements?

Interested in other radar. Require precise timing and frequency

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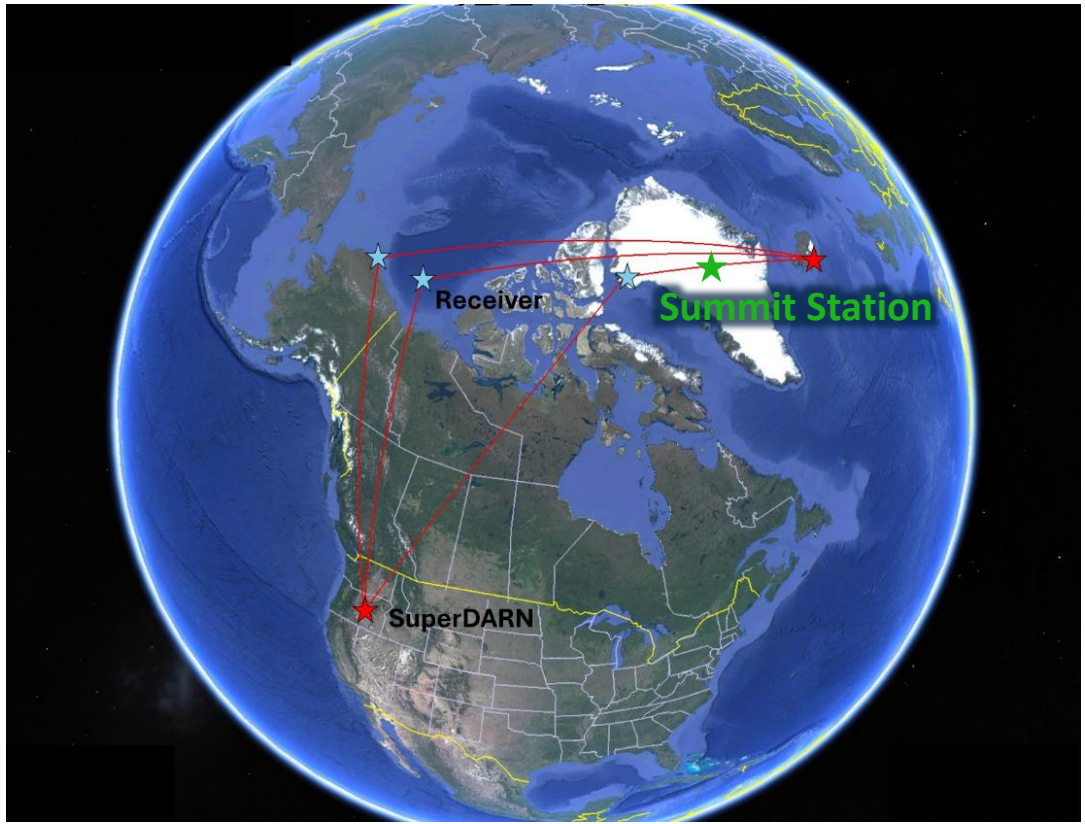

We process Farley pulse sequence via a full Fourier transform instead of autocorrelation function fitting