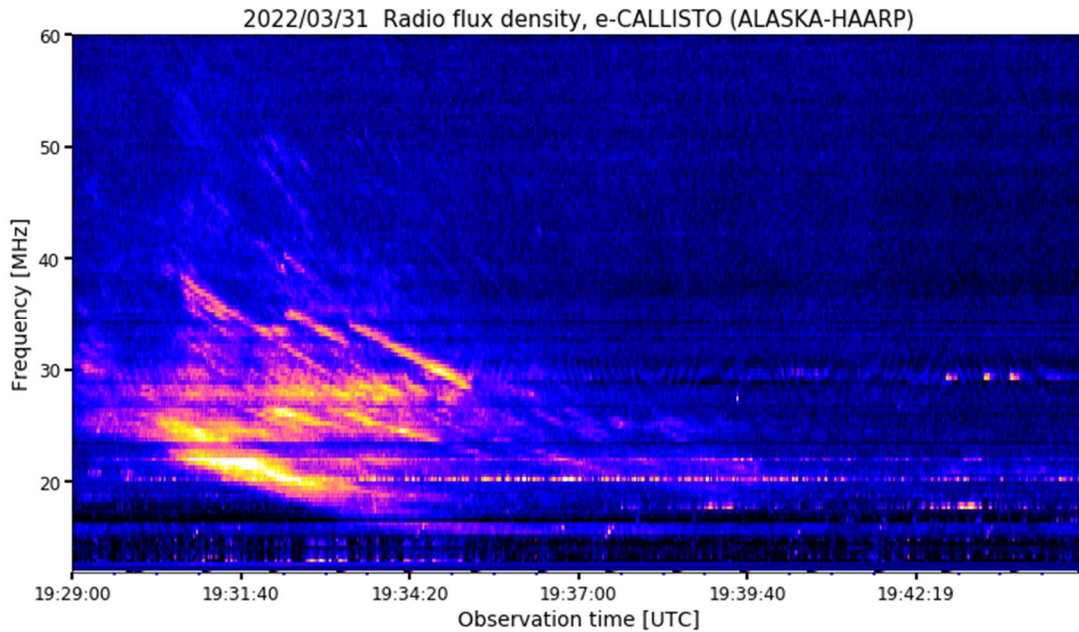


# Solar Radio Observations at Anchorage, Coho and HAARP Radio Observatories

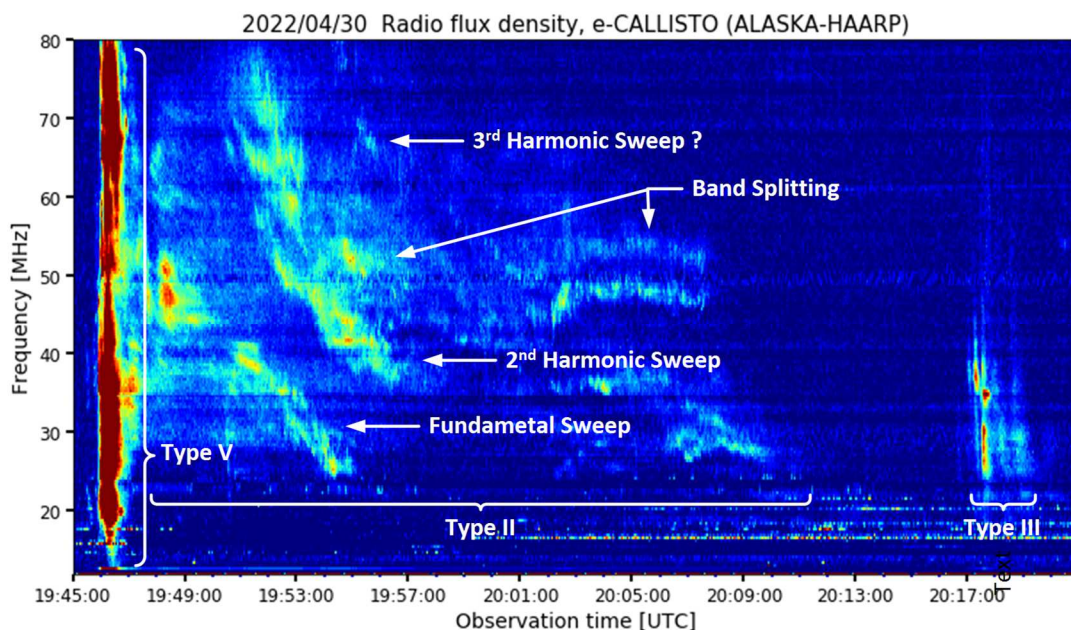
Whitham D. Reeve & Christian Monstein

Observations shown in chronological order. See Instrumentation section for additional details on the equipment, and Resources section for more detailed explanations of the phenomena. See also Acknowledgements section.

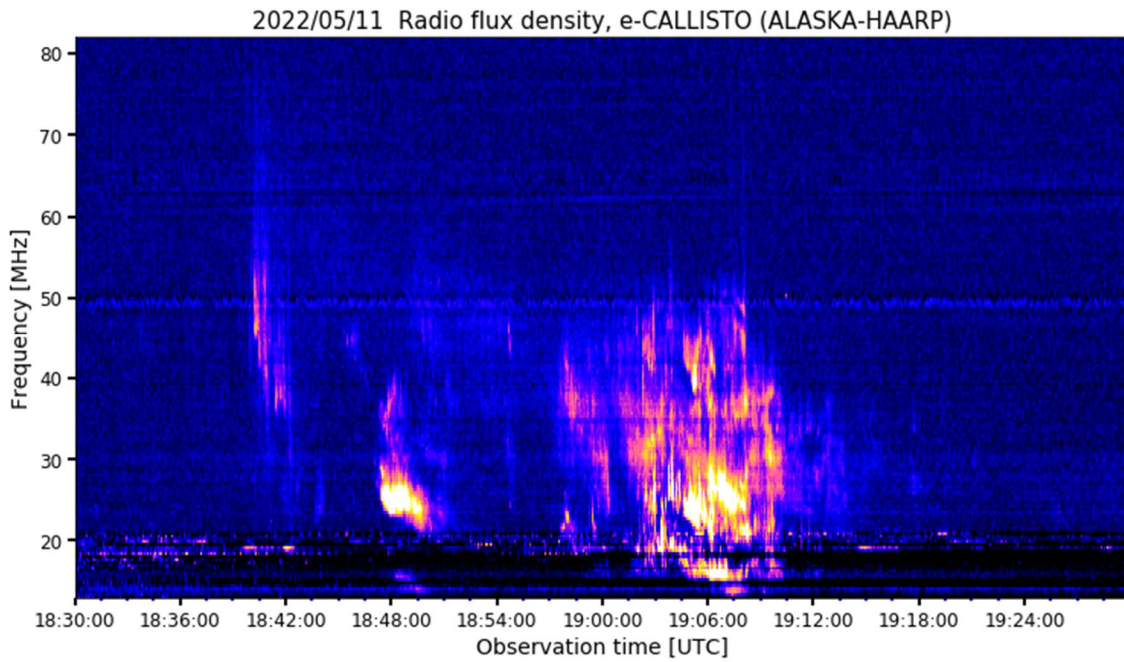


31 March 2022 (left) ~ HAARP Radio Observatory, Gakona, Alaska: Type II slow sweep radio bursts caused by solar active region 2981 and may be related to a C5.4 x-ray flare as reported by SWPC.

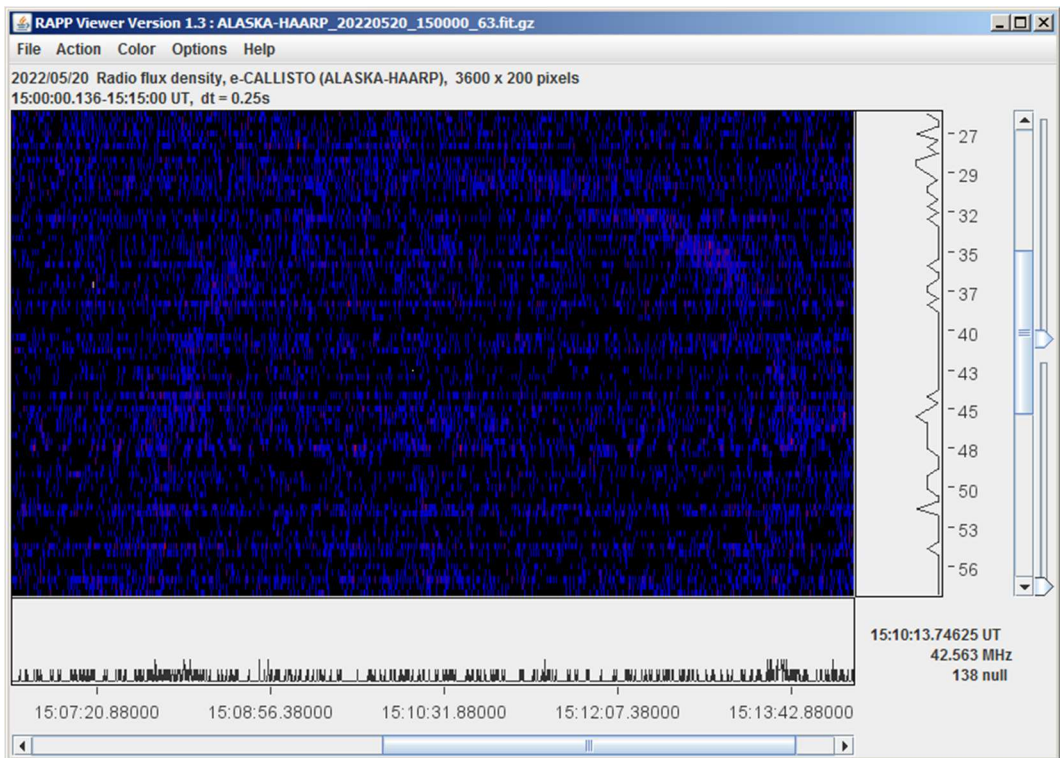
30 April 2022 (below) ~ HAARP Radio Observatory, Gakona, Alaska: Annotated image. Type V continuum, Type II slow sweep, and Type III fast sweep radio bursts caused by M1.9 x-ray flare at solar active region 2994 as reported by SWPC. Note that the Type V burst extends down to 12 MHz, which is the low frequency limit of this spectrogram, and that the Type II burst may have a 3<sup>rd</sup> harmonic in addition to the fundamental and 2<sup>nd</sup> harmonic.



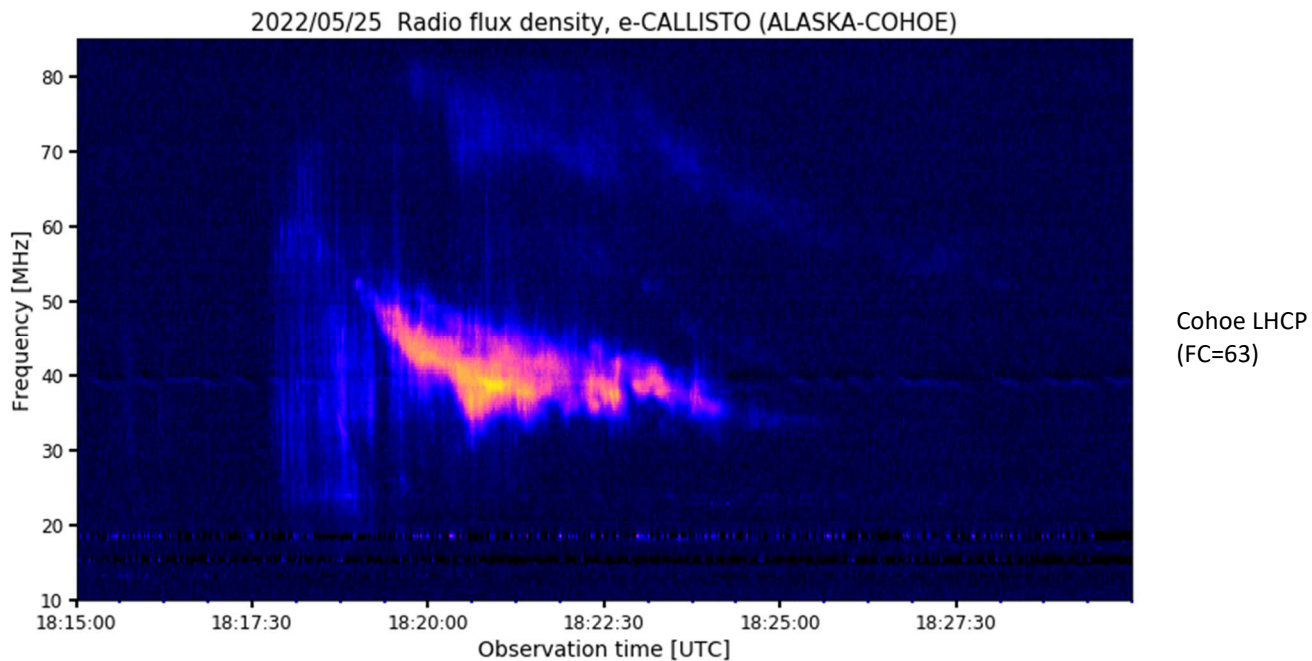
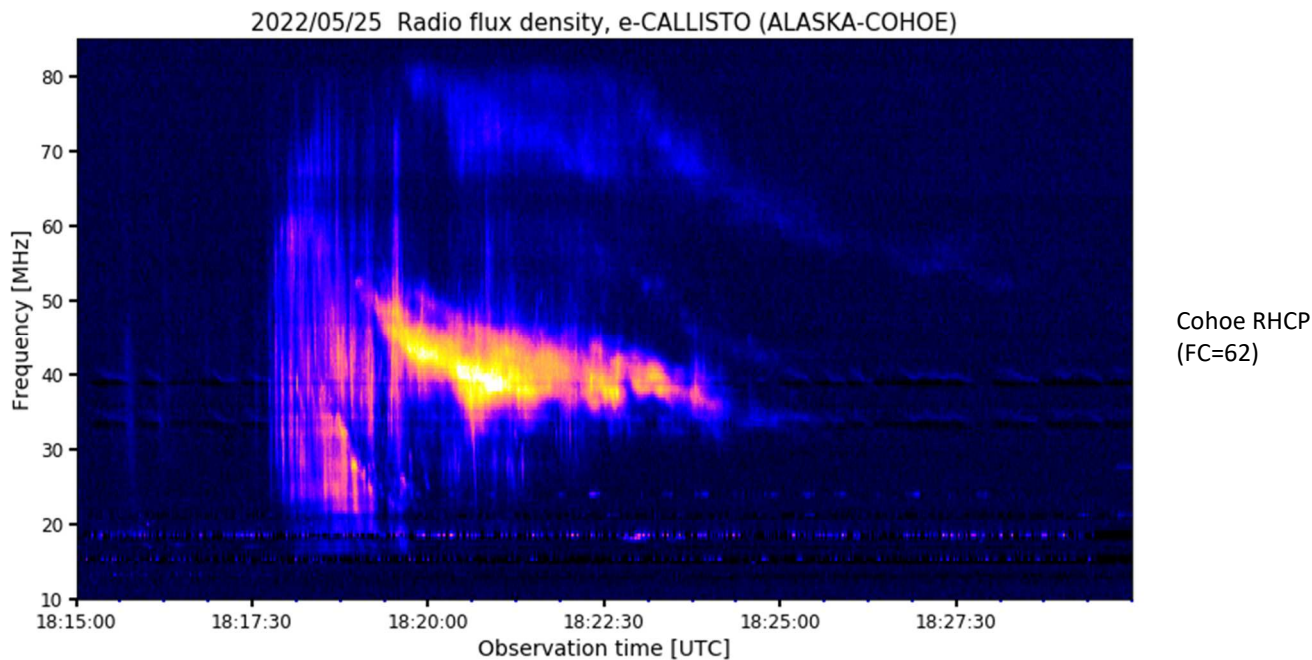
11 May 2022 (below) ~ HAARP Radio Observatory, Gakona, Alaska: Type II slow sweep radio burst caused by M2.6 flare at solar active region 3007 as reported by SWPC. The activity between 1900 and 1910 may be a second burst overlapping the first one or corruption of the first burst. Note that the spectra around 1906 extends down to 13 MHz, the lower limit of this spectrogram.



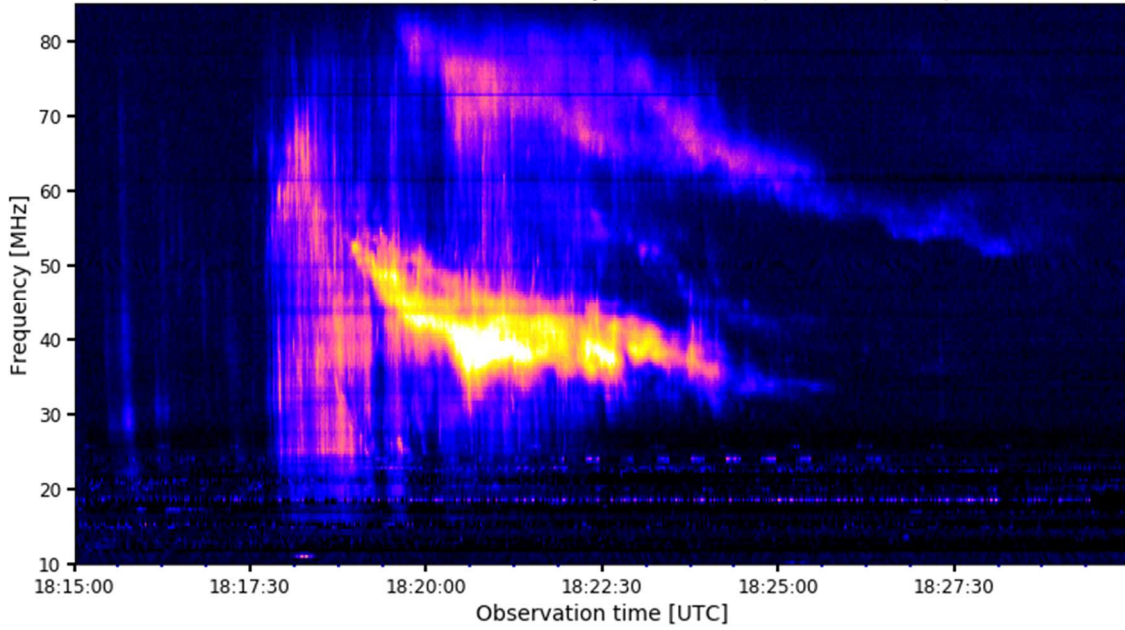
20 May 2022 (below) ~ HAARP Radio Observatory, Gakona, Alaska: Very weak u-shaped spectral indication of unknown origin. This may be an inverted-U solar radio burst or spectral caustics. Note that the frequency scale (right side of image) is reversed compared to other spectrograms in this report.



25 May 2022 (below) ~ HAARP Radio Observatory, Gakona, Alaska and Cohoe Radio Observatory, Cohoe, Alaska: Type II slow sweep radio bursts observed simultaneously at Cohoe and HAARP in right-hand and left-hand circular polarizations caused by M1.3 x-ray flare at solar active region 3016 as reported by SWPC. The first is from about 1818 to 1819 with a 2<sup>nd</sup> harmonic. The second burst overlaps the first slightly and also shows a 2<sup>nd</sup> harmonic.

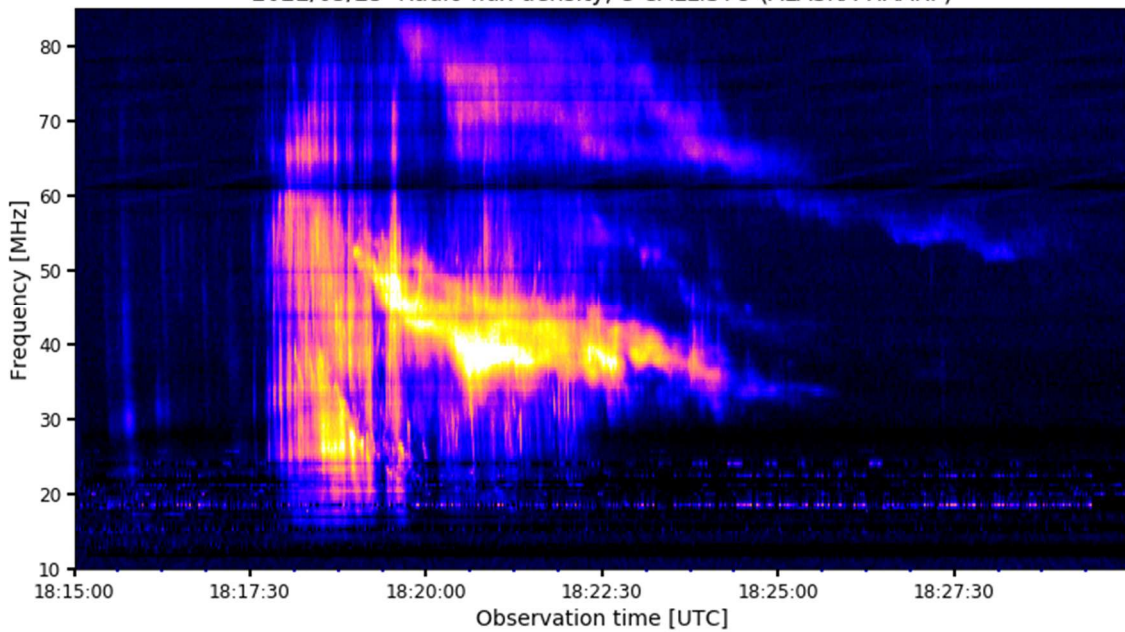


2022/05/25 Radio flux density, e-CALLISTO (ALASKA-HAARP)



HAARP  
RHCP  
(FC=62)

2022/05/25 Radio flux density, e-CALLISTO (ALASKA-HAARP)



HAARP  
LHCP  
(FC=63)



HAARP Radio Observatory, Gakona, Alaska. LWA Antenna buried in the snow with a background of black spruce trees on 29 March 2022. The HRO equipment is collocated on the science pad with the Modular UHF Incoherent Radar (MUIR). Image courtesy of HAARP staff.

#### Instrumentation:

- ⚙ Anchorage Radio Observatory: 8-element log periodic dipole array and three Icom R-8600 wideband receivers with audio output connected through an analog audio mixer to a PC soundcard, SAM-III Magnetometer;
- ⚙ Coho Radio Observatory: LWA Antenna connected to two Callisto instruments through a quadrature coupler;
- ⚙ HAARP Radio Observatory: LWA Antenna connected to two Callisto instruments through a quadrature coupler.

#### Resources:

Solar radio burst types: <https://reeve.com/Solar/Solar.htm>

Type II Slow Sweep Radio Bursts: [https://www.reeve.com/Documents/CALLISTO/Reeve\\_TypeII-Burst.pdf](https://www.reeve.com/Documents/CALLISTO/Reeve_TypeII-Burst.pdf)

Sudden Frequency Deviations:

[https://www.reeve.com/Documents/Articles%20Papers/Propagation%20Anomalies/Reeve\\_SuddenFreqDevConcepts\\_P1.pdf](https://www.reeve.com/Documents/Articles%20Papers/Propagation%20Anomalies/Reeve_SuddenFreqDevConcepts_P1.pdf)

U-Burst: [https://www.reeve.com/Documents/Articles%20Papers/ReeveMonstein\\_U-Burst.pdf](https://www.reeve.com/Documents/Articles%20Papers/ReeveMonstein_U-Burst.pdf)

Space Weather Prediction Center: <https://www.swpc.noaa.gov/>

#### Acknowledgements:

Callisto FITS files, credit: FHNW Brugg/Windisch and IRSOL Locarno, Switzerland, {[Callisto](#)}