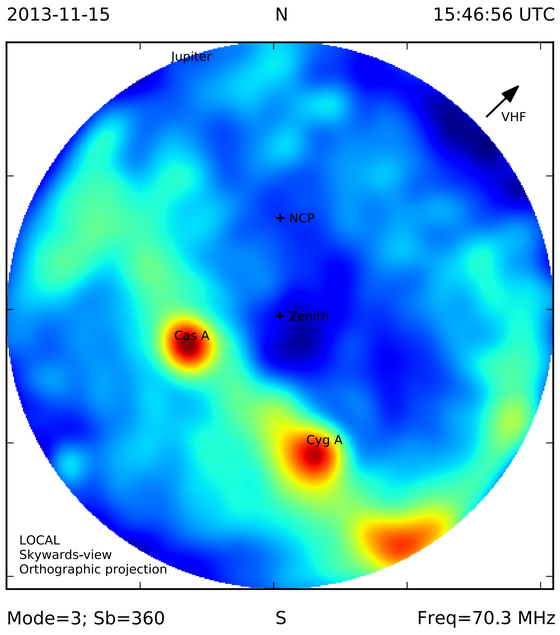
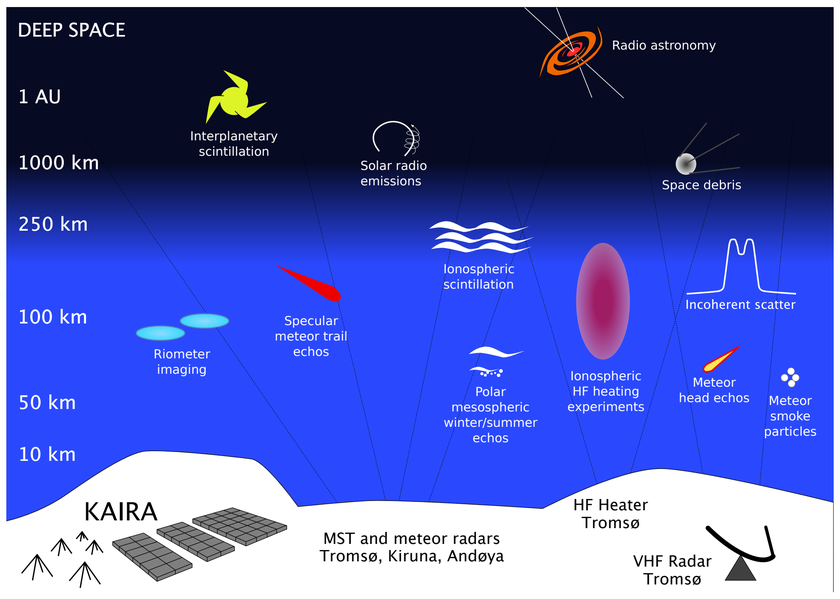
KAIRA

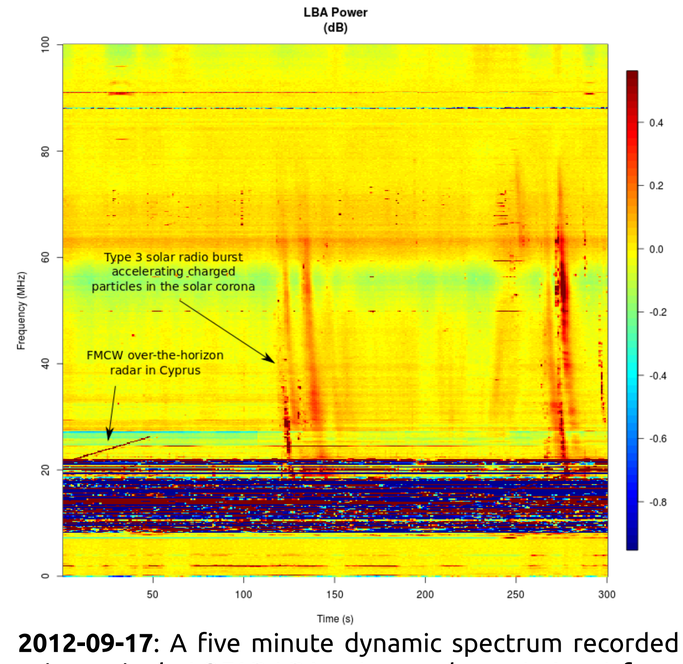
Kilpisjärvi Atmospheric Imaging Receiver Array



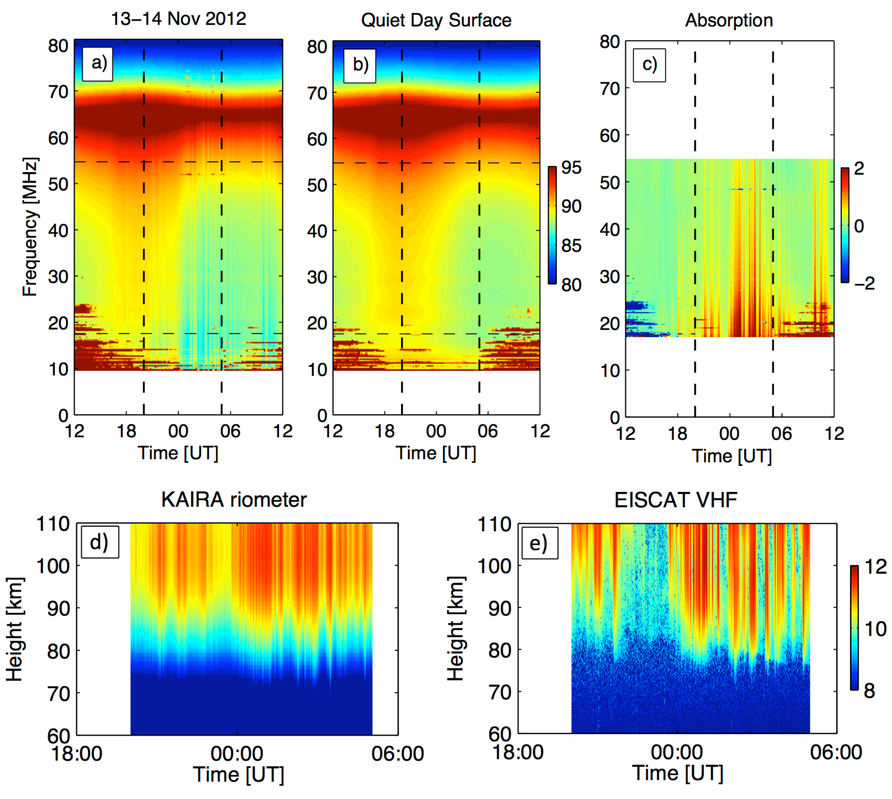
2012-10-12: First all-sky image. Here a recent example at 70.3 MHz. The three red areas are (bottom to top) the galactic plane, Cyg A and Cas A.



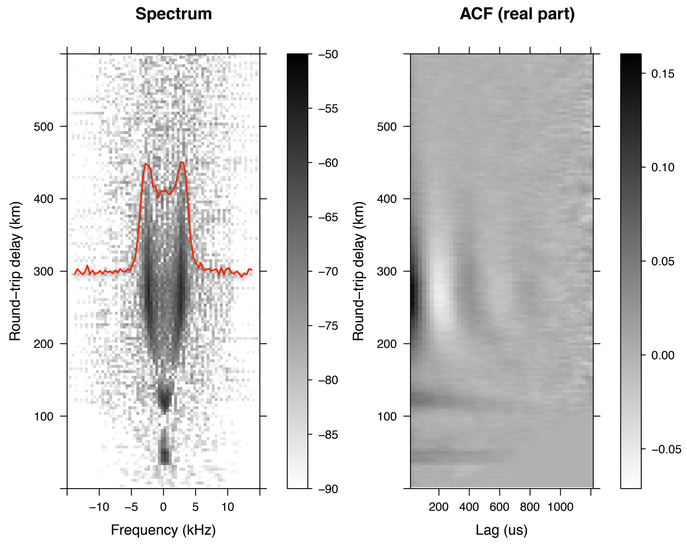
KAIRA Science Diagram – an overview of what can be done with the Kilpisjärvi Atmospheric Imaging Receiver Array. Distance to EISCAT Tromsø 80 km, Anderes 180 km, Kiruna 140 km, Sodankylä 310 km, Hankasalmi 800 km. Collaboration welcome, contact details below.



2012-09-17: A five minute dynamic spectrum recorded using a single LOFAR LBA antenna element. Apart from the HF radio band, the most prominent features are several type 3 solar radio bursts and the FMCW over-the-horizon radar signal transmitted from Cyprus.

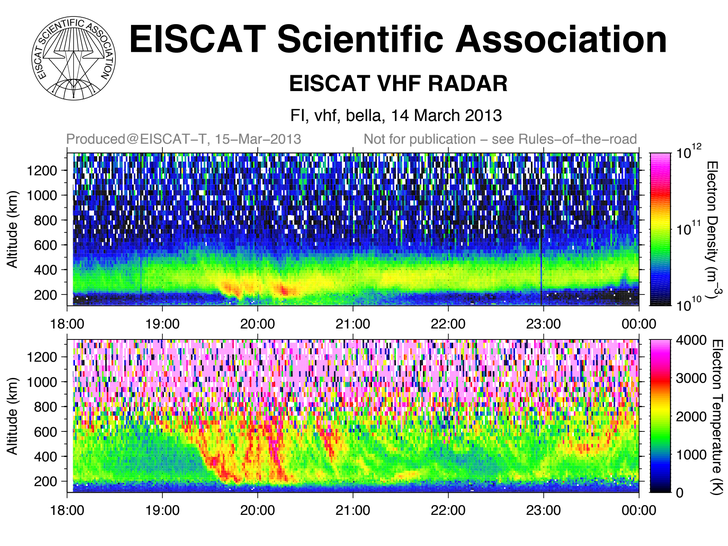


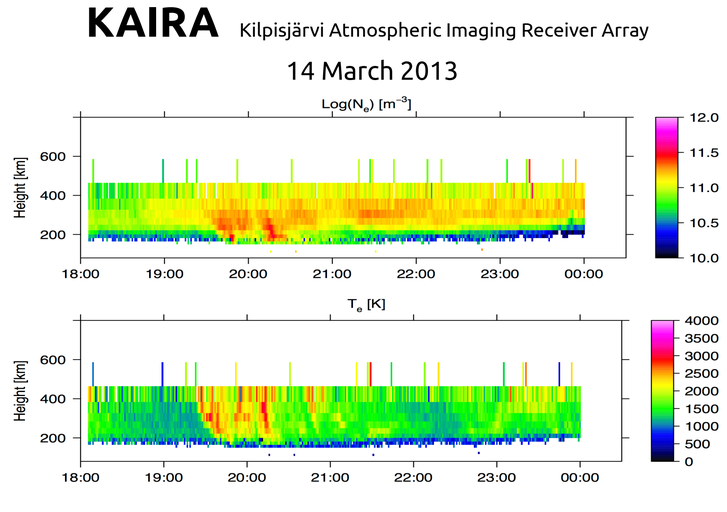
2012-11-13: A proof-of-concept study of the spectral riometry technique. **Panel a**: Radio noise power recorded by the KAIRA vertical beam. **Panel b**: The Quiet Day Surface used in the analysis. Colour scales are in the same (arbitrary) decibel scale for Panels a and b. Horizontal dashed lines represent the frequency band used in the analysis (17-55 MHz). Vertical dashed lines show the analysed period. **Panel c**: Absorption in decibels. **Panel d**: Electron density ($\log_{10}$, m^{-3}) inverted from the absorption data in Panel c. **Panel e**: EISCAT VHF radar data for comparison; same colour scale as Panel d.

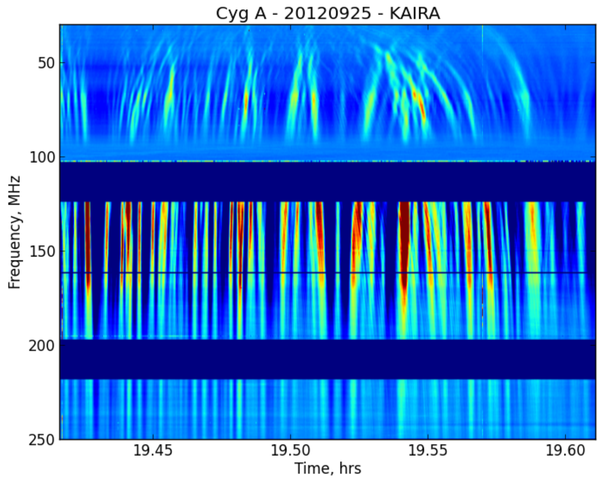


2012-08-17: First radar light on the KAIRA array from the EISCAT VHF radar lead to instant success with the first incoherent scatter spectrum received (inset above left). Soon afterwards the averaged lag-profile matrix (above right) was measured with KAIRA (incohrerent scatter autocorrelation functions of different ranges; ranges given as round-trip time). By late August 2012 we were able to fit plasma parameters to altitude-dependent spectra (above left; 30 beams, 512 s integration).

2013-03-14: In spring 2013 a dedicated comparison experiment was carried out with the EISCAT VHF and KAIRA. The plots on the right show electron densities and electron temperatures as seen by both receivers. Observations are in excellent agreement.







2012-09-25: A speciality of KAIRA is its broad-band mode "RCU-357" receiving from 30 to 250 MHz on both antenna arrays. Here, ionospheric (IoS) scintillation of Cygnus A was observed. The scintillation can be seen to progress from being "weak" at the higher frequencies to "strong" at the lower. In some observations, the effects of refraction by large-scale structures in the ionosphere can be seen.

The 2D power spectra of segments from these dynamic spectra, sometimes show an "arc" structure: These "scintillation arcs," only seen previously in two-dimensional power spectra from interstellar scintillation observations, offer a new method of studying the plasma structures giving rise to the scintillation, providing information on the height of the scattering in the ionosphere and the velocity of density structures.

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Poster: "KAIRA Space Weather Facility – First Results"

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SEVENTH FRAMEWORK PROGRAMME
UNIVERSITY of OULU
OULUN YLIOPISTO
Leverage from the EU 2007–2013
European Union
European Regional Development Fund