2020 CEDAR Meeting – Active Experiments Session

JGR Space Physics

Technical Reports: Data

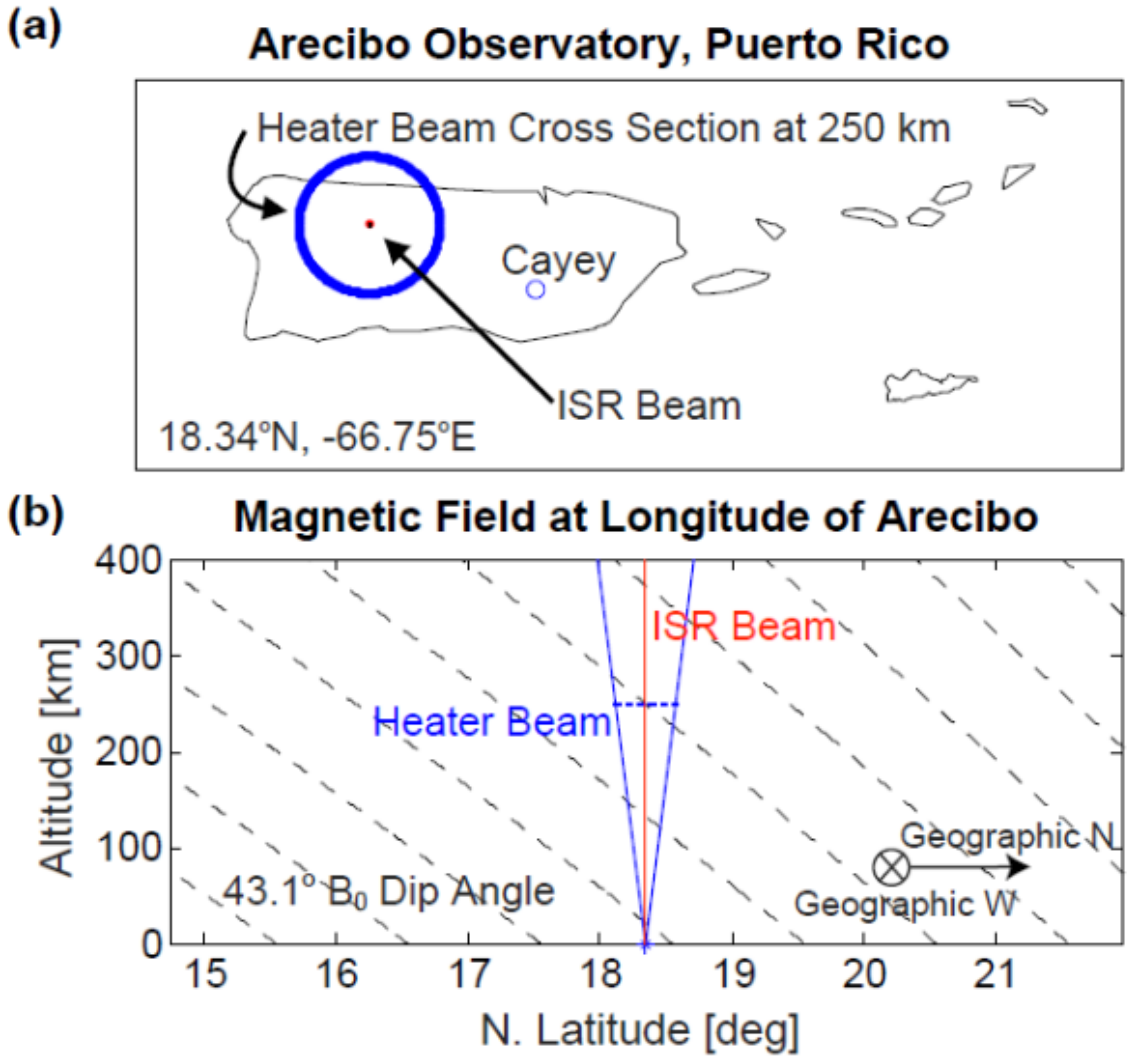
Plasma Cavity Formation During Ionospheric Heating at Arecibo

Edlyn V. Levine ✉, Paul A. Bernhardt, Michael P. Sulzer, Peter J. Sultan, Brian S. Henderson, Eliana Nossa, Stanley C. Briczinski, Phil Perillat

First published:07 May 2020 | https://doi.org/10.1029/2019JA027715

- **Formation of a strong plasma cavity occurred during a recent ionospheric heating experiment.**
- **Cavity formation was simultaneous with disappearance of incoherent scatter radar enhanced ion and plasma lines.**
- **Incoherent scatter radar ion line spectra indicate strong enhancement of ion temperature in the plasma cavity.**

June 2019 Arecibo Heating Campaign Geometry



Heating Campaign 11-15 June 2019

Participants included NRL, NOAA, AFRL and Arecibo Observatory

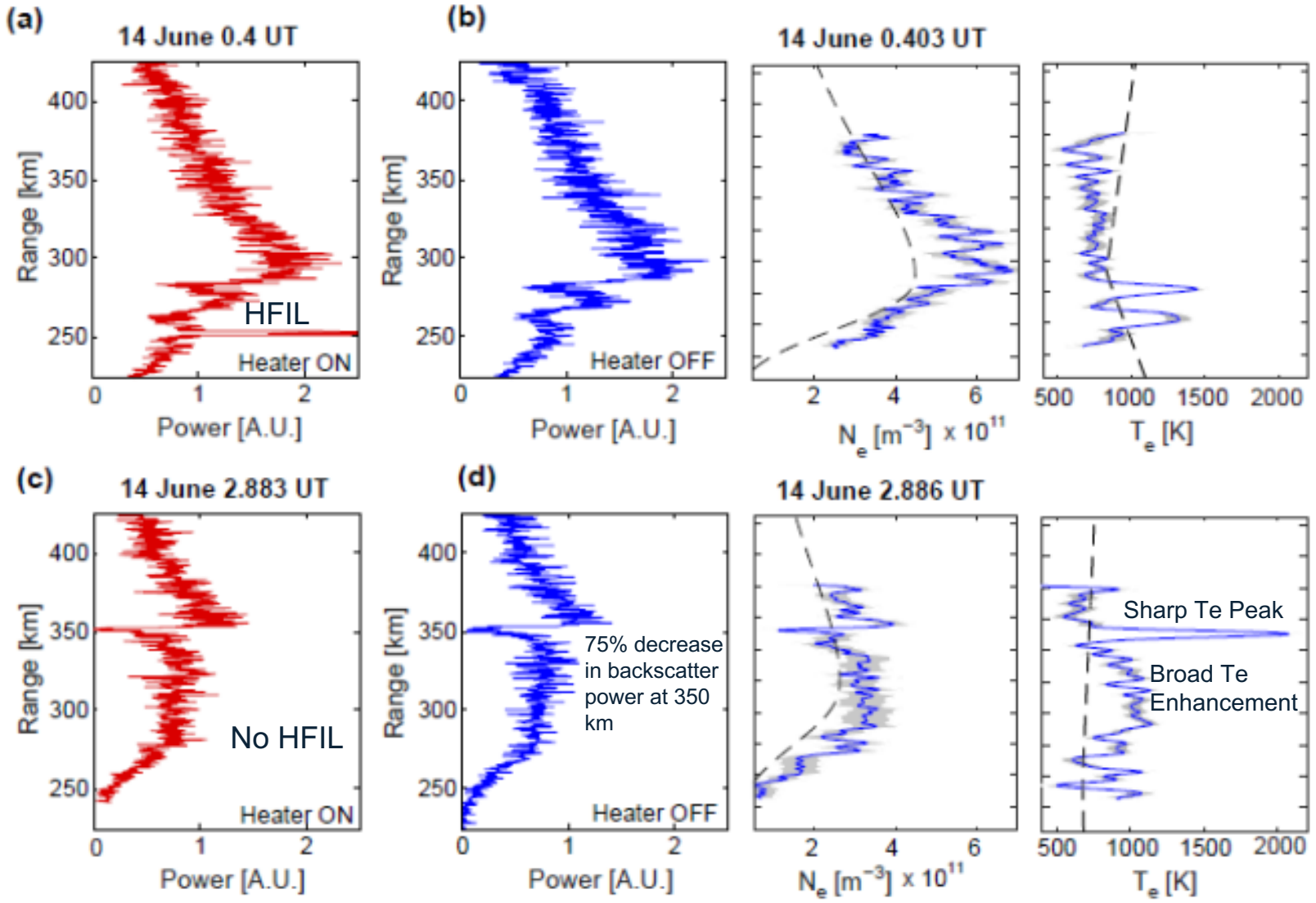
Instrumentation: Ionosonde at Cayey, Arecibo ISR

5.125 MHz heater beam operated in a 10-second on/10-second off cycle

Off-heater times are clear of HF enhanced ion line (HFIL) Langmuir clutter

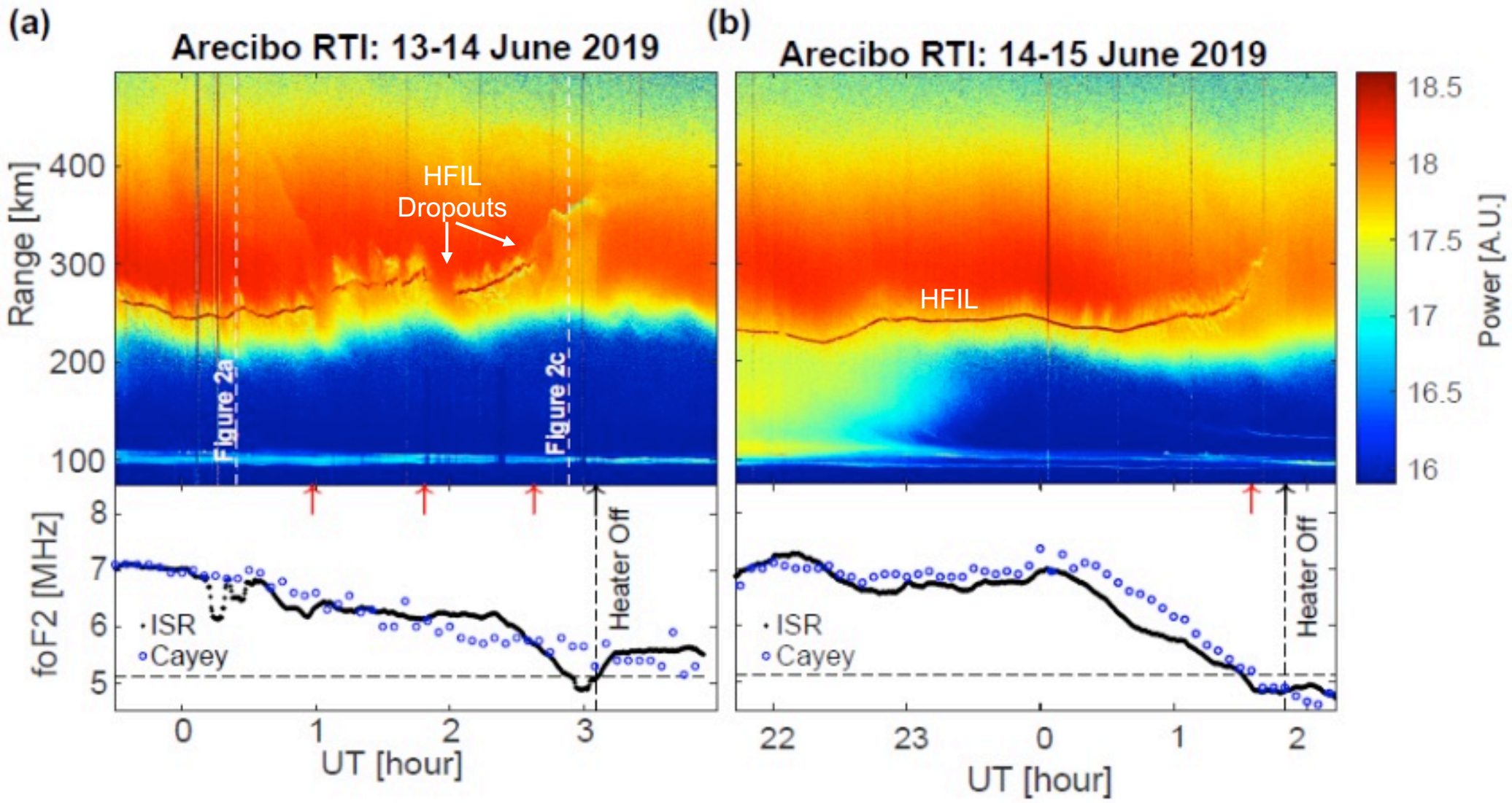
Coded long-pulse ISR spectral analysis fitting using Tikhanov regularization for Ne, Te, and Ti

Representative Parameter Profiles



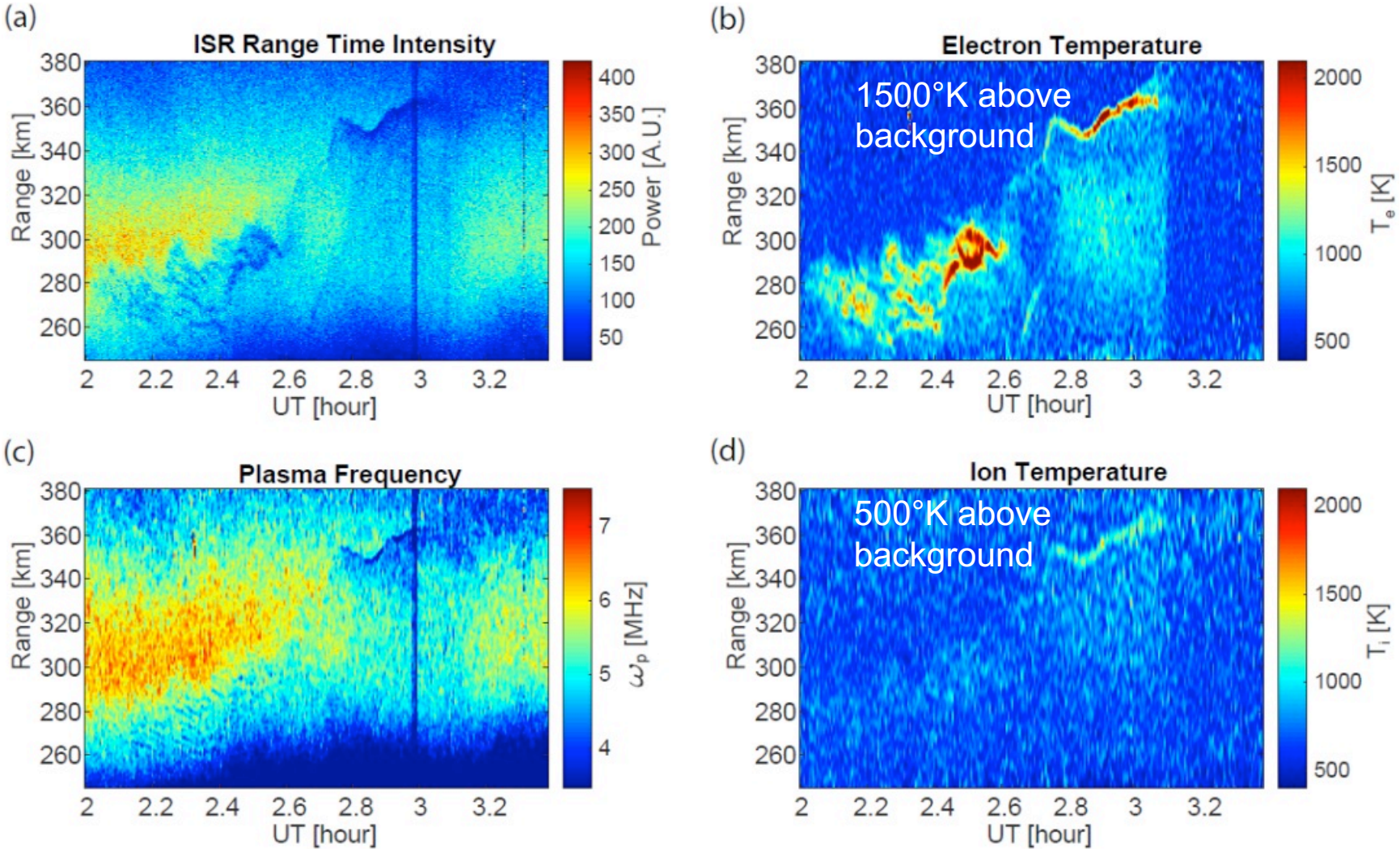
Dashed lines show IRI-16 electron density and temperature

Backscatter Power RTI



Red Arrows indicate when HFIL disappears

2.7 UT Strong High-Altitude Density Depletion



Data plotted are all heater-off profiles

Observation of features in HF heating region:

- **Anomalously large depletion of background electron density**
- **Enhancement of electron temperature (expected)**
- **Enhancement of ion temperature (unexpected)**
- **Physical mechanisms still being investigated**
  - Ion-neutral collision frequency at 350 km is 4-times smaller in 2019 than during solar max
  - N. Magnetic field at Cayey reduced by 25 nT from 22.8 UT on 13 June to 2.8 UT on 14 June
  - FPI Neutral wind shift from Eastward to Westward near 2.7 UT