A New South Pacific Ionosonde Station - Niue

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A new ionosonde station was opened at Niue Island (19.1ºS 169.9ºW, Dip -37.8º) on 31 October 2004, with the very capable assistance of the Niue Meteorological Service staff, who are now managing the equipment.

Location	Distance to Niue (km)
Raratonga (closed)	1072
Tahiti (closed)	2177
Auckland (closed)	2495
Norfolk Is.	2535
Christchurch	3191
Brisbane	3934
Kwajalein Atoll	3947
Canberra	4443
Townsville	4564
Maui (closed)	4670

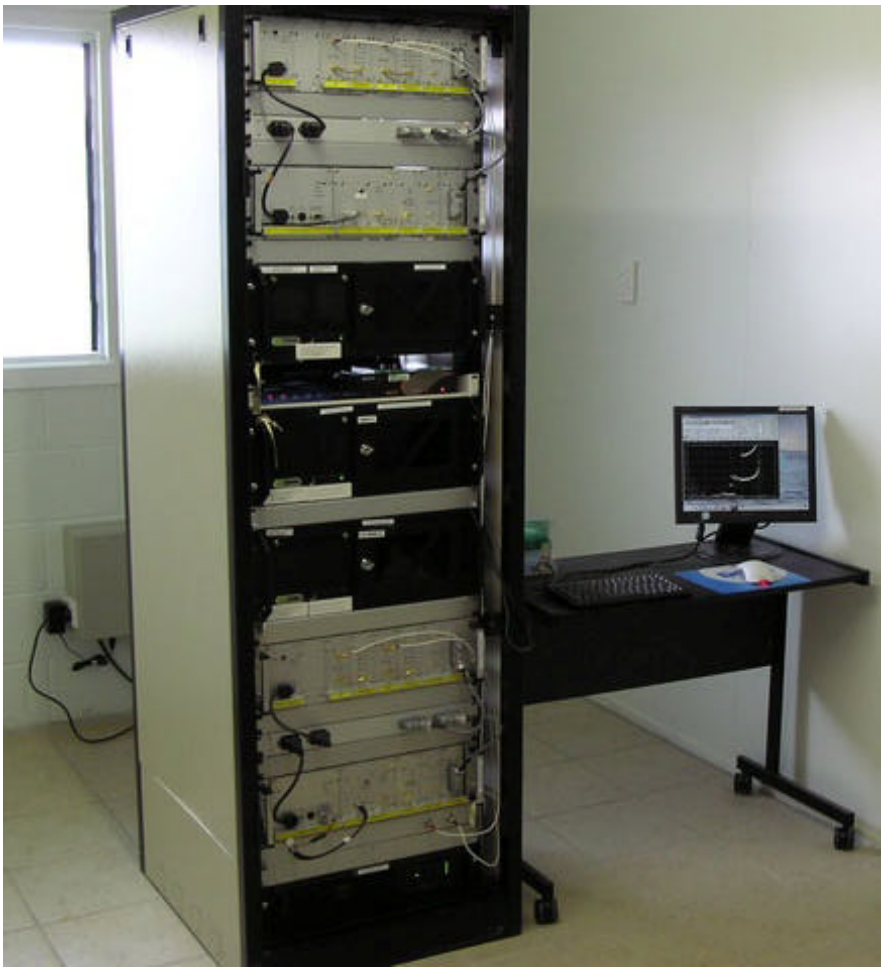
Niue is a South Pacific Nation located some distance from places that have previously contributed to ionospheric models. (as the table shows). The nearest location, Raratonga, has been closed for some years, as has Auckland. (Sites now closed, or thought to be closed, are shown in italics in the table above).

An IPS 5D ionosonde was installed at Niue. The operating characteristics of the ionosonde are shown on the next page. It is a conventional ionosonde in that it only records amplitude information from the returned ionospheric signals and ordinary and extra-ordinary components are separated using hardware.

The figure to the left shows the Niue Meteorological Station building and the 22m IPS 5D transmit and receive antennas. The initial installation took place in late October 2004 and was completed during a return visit in April 2005.

The following figure shows two IPS 5D ionosondes installed at Niue. Should one ionosonde fail, it is a simple matter to remotely switch over to the other. This level of redundancy ensures a more reliable data flow from the site.

Niue is serviced by a reliable Internet provider and all data are passed back to IPS (Sydney) each hour, the ionograms being displayed as GIFs on the IPS website (www.ips.gov.au).



Frequency range: 1 to 21.475MHz in 5kHz steps (Any subset of channels 0 – 4095, typically 512 channels selected from software list).

Transmitter

Output power: 1kW PEP nominal into 50 Ohm load (front panel BNC-f connector).

Pulse shape: RF pulse with a Gaussian envelope.

Pulse duration: 29µsec (-3dB), 120µsec (total).

Pulse bandwidth: 15kHz (-3dB), Gaussian.

Transmit energy: 15mJ per pulse.

Repetition rate: 8 to 10 msec typical on one frequency.

Average power: 0.6W (for typical soundings of 3 times in 75msec).

Receiver

Receiver channels: 2 (ordinary / extra-ordinary channels)

Bandwidth: 15kHz at –3dB, Gaussian,

Detector: Logarithmic amplitude detector, digitised to 8 bits at 0.3dB per step.

Detector range: 76.5dB.

Pre-detector range: 90dB.

RF dynamic range: »90dB.

RF attenuator: 0, 10, 20, 30dB, software selectable.

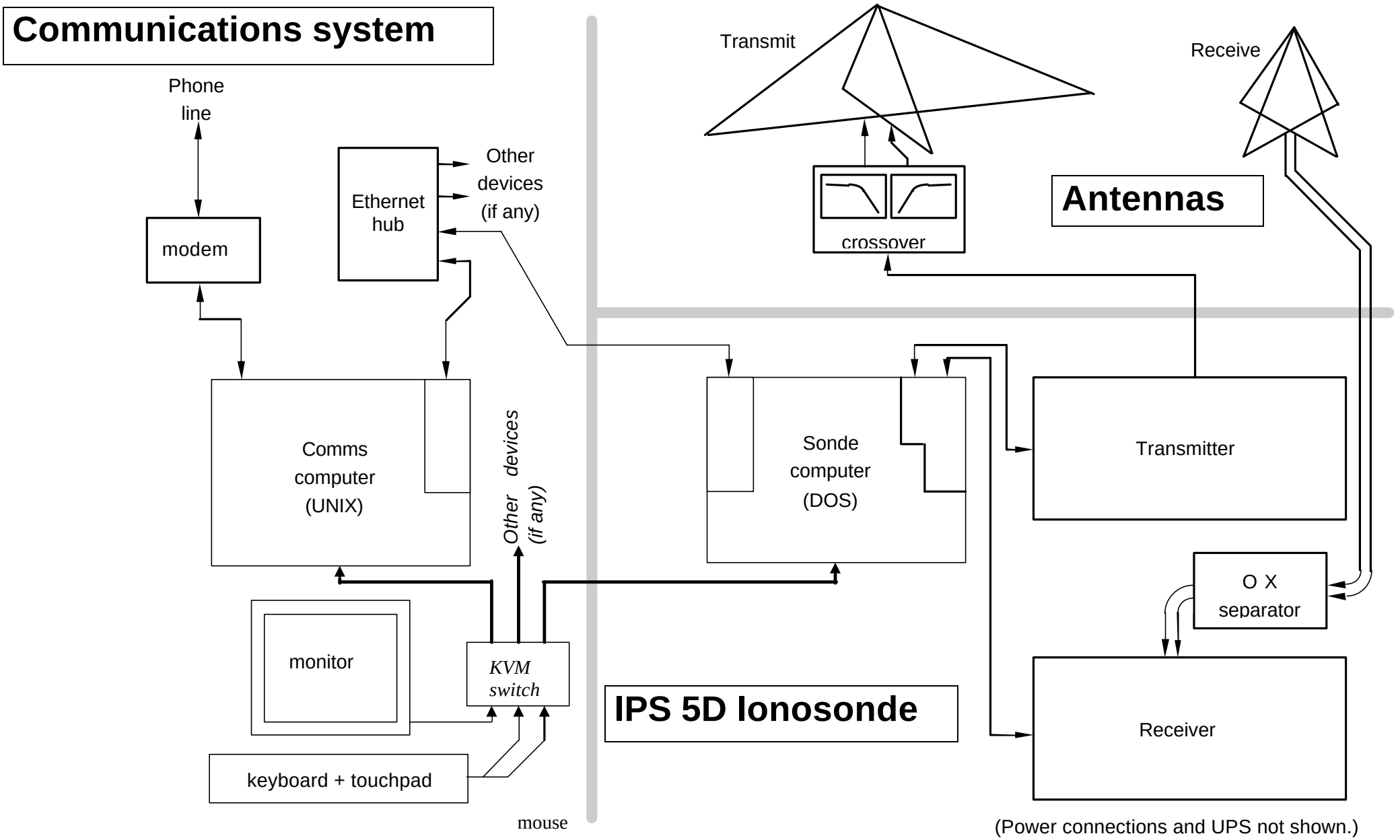
IF gain control: 0-31dB in 1dB steps, software selectable.

Sensitivity: better than –115dBm, typical -117dBm at max gain.

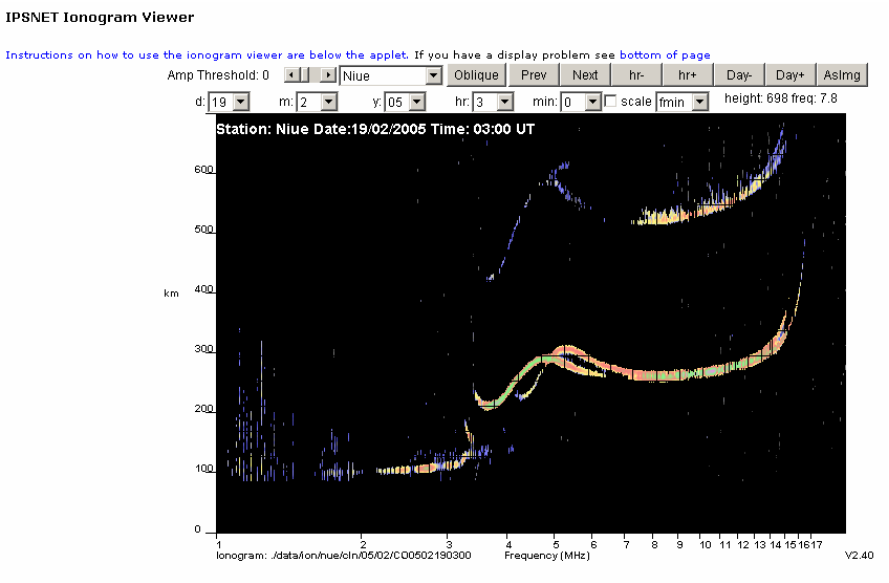
Height/Time max range: Ground to 2445km or equivalent 0 to 16,368µsec.

Bin size: 1.2km or equivalent 8µsec.

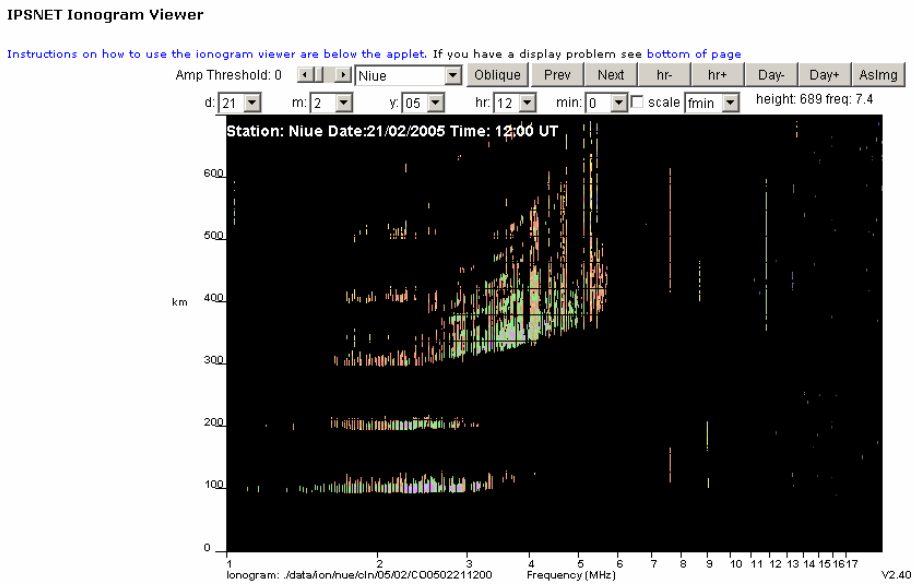
Communications system



The previous page shows the basic station layout. This layout is similar to most IPS sites. Control of all equipment is managed from the Communication Computer (to the left), which is running a UNIX operating system, and is connected to the internet. It can be over-ridden locally using the keyboard and touchpad.



A Niue ionogram as it appears on the IPS website using the JAVA applet viewer, is shown above. This ionogram was recorded before the hardware for separating the magneto-ionic components was installed. Some features are of interest. First, the top frequency observed on this day was near 17 MHz. There is also a clear descending sporadic E layer developing. The interference below 2 MHz is a persistent daytime phenomena and appears to be due to a local source that has not yet been identified. Fortunately, it does not have a major impact on the ionograms and is not present at night.



The next example is a night-time ionogram showing equatorial spread F. Past observations from both Raratonga and Maui suggest equatorial spread F will be observed at Niue.

Based on a small sample, the Niue F2-region is successfully captured by current empirical ionospheric models (IRI – URSI/ITU-CCIR, IPS) although possibly it is marginally less well-modelled than sites that contributed data to the generation of these models. During a reasonably quiet period (Nov 1 – 7) the daytime ionosphere at Niue appeared to follow the low latitude stations while at night the Niue ionosphere followed nearby mid-latitude stations more closely.

Summarising: the Niue ionosonde station is now open and recording reliable data that is available in near real time on the IPS website.