

Joint UNAVCO / IRIS / NASA Remote Seismic / GPS / VSAT Installations

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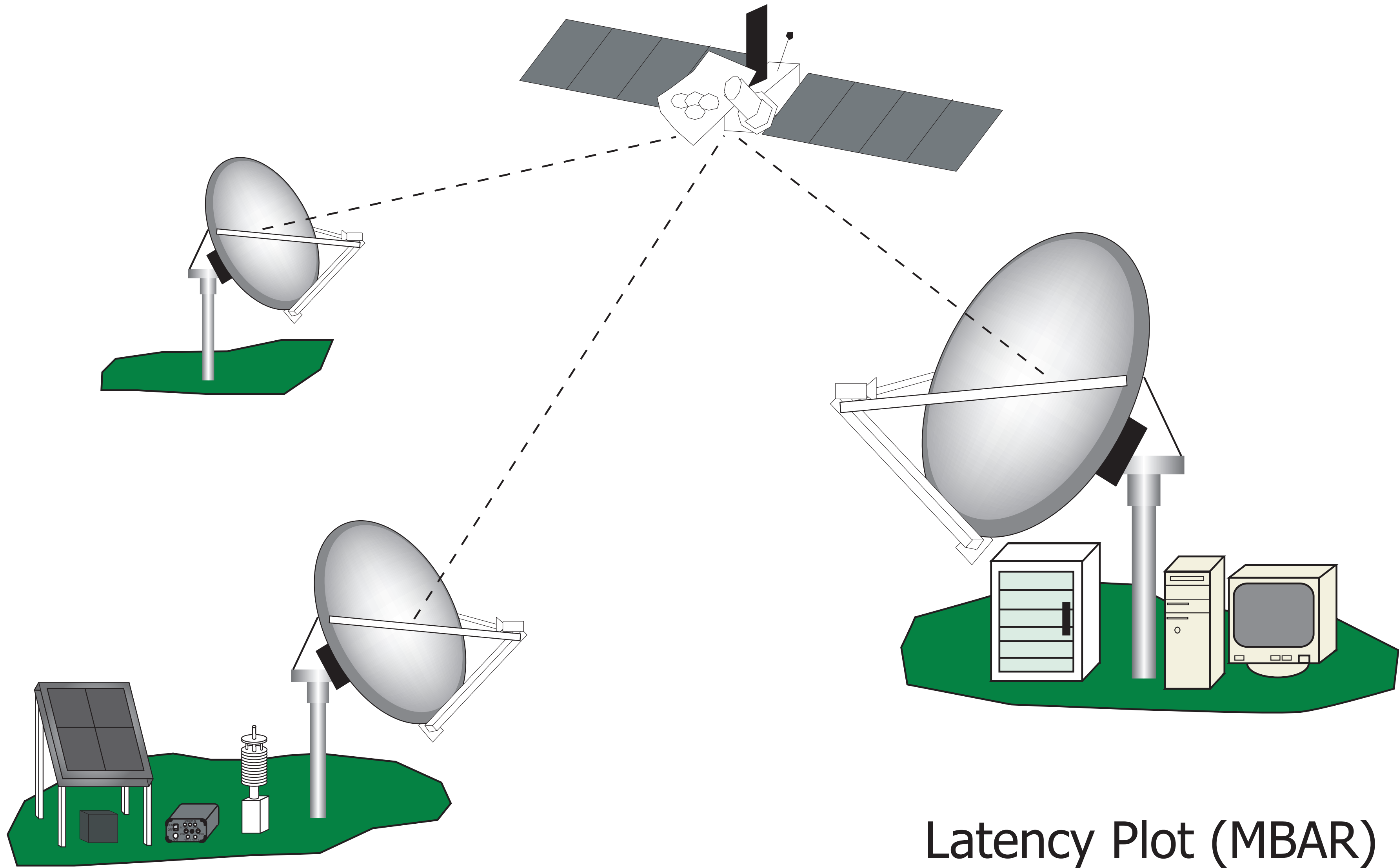
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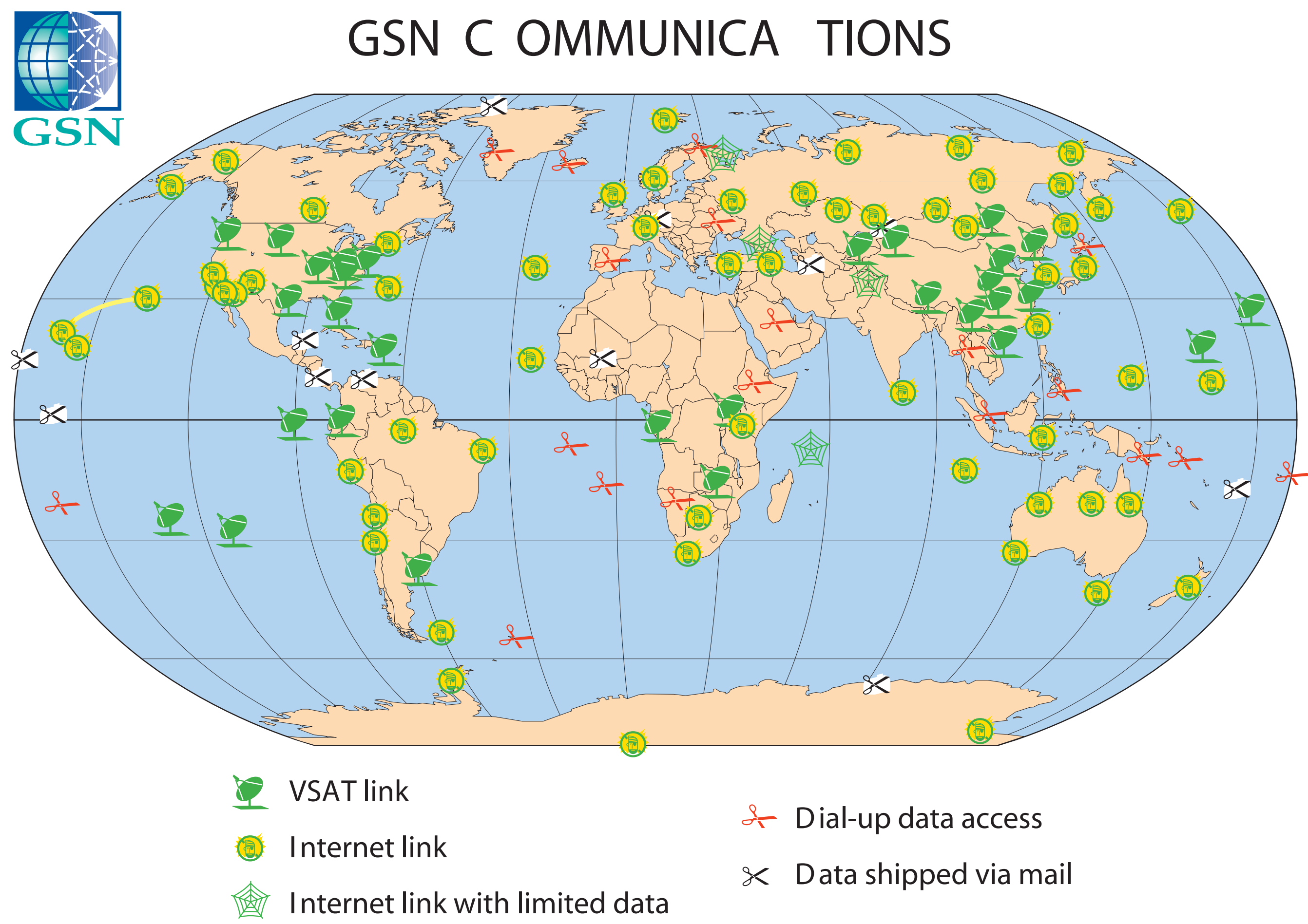
Abstract

The UNAVCO Boulder Facility on behalf of NASA is collaborating with the Incorporated Research Institutions for Seismology (IRIS) on remote broadband seismic and GPS installations in support of the Global GPS Network (GGN) and the Global Seismographic Network (GSN). Seismic and GPS instruments share VSAT communications, power, facilities, maintenance, and site security at a number of locations around the world. Collaborative sites include Mbarara Uganda, Franceville Gabon, Galapagos Islands, and Easter Island. High quality seismic and GPS data are now flowing to the GGN and GSN data collection centers through these high-speed satellite links. Future opportunities for collaboration include 16 co-located seismic and GPS installations as part of the NSN/GSN component of EarthScope.

By integrating high accuracy GPS and meteorological sensors with seismic installations, researchers now have an opportunity to investigate geological and tectonic events using several data sets, and the associated cost sharing reduces the fiscal burden of each organization without sacrificing science goals. VSAT technology is particularly suited to areas that lack commercial or private Internet infrastructure, and at the same time covers holes in the GPS global tracking network. In this case, VSAT is currently the only viable solution for real-time or near real-time data transfer. These collaborations have proven the feasibility of running solar power installations in remote areas and have produced new knowledge and technology achievements for future remote GPS/Seismic installations.

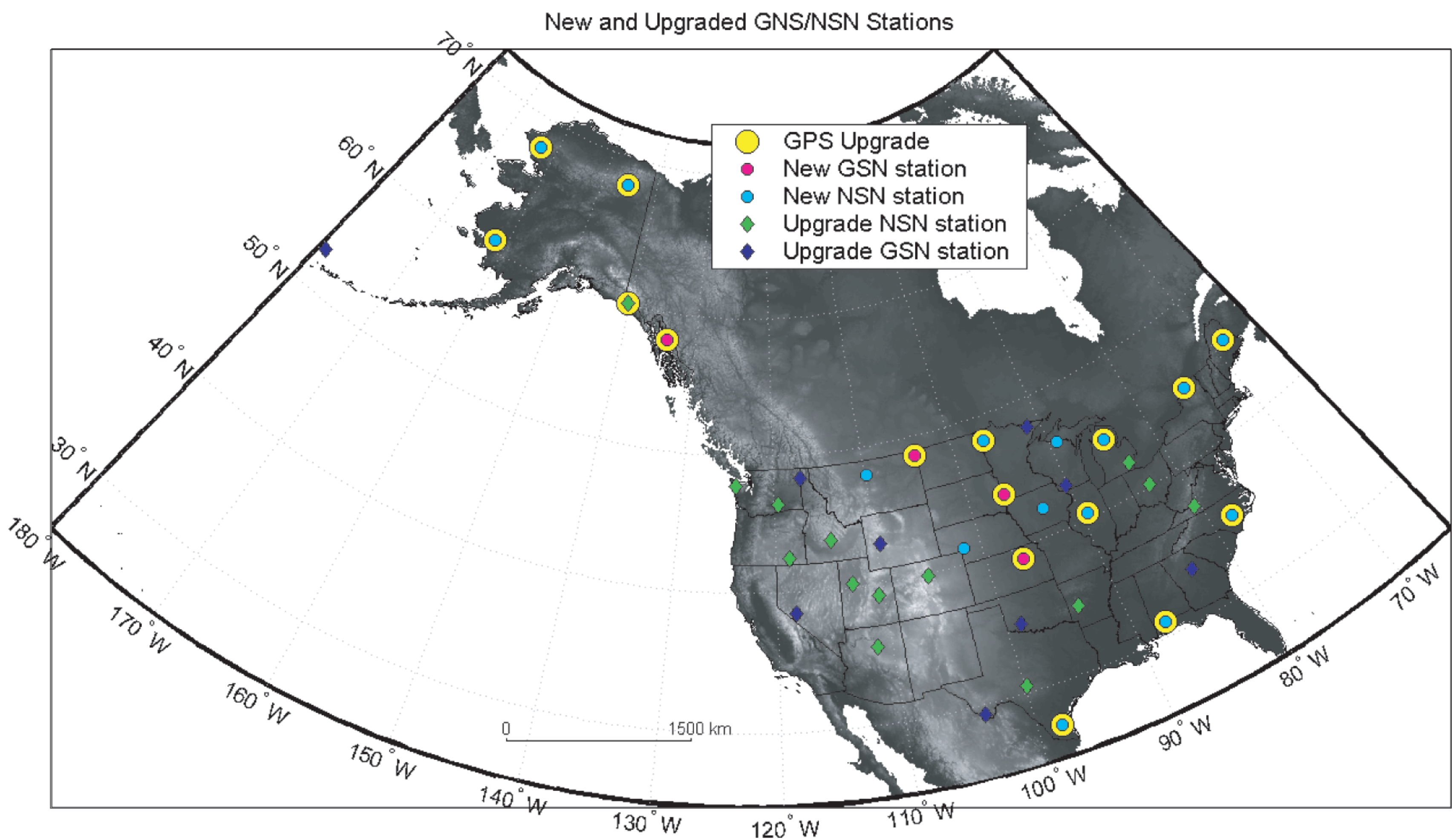


Global Seismographic Network Communications



The Global Seismographic Network currently employs a diverse range of communications to its stations. Direct real-time connections are available to 75% of the GSN via Internet and VSAT systems. The infrastructure has evolved with the technology and in partnership with many organizations. These partnerships extend the reach of global geosciences and build bridges with sister disciplines. For example, GSN infrastructure in Russia currently hosts GPS communications in collaboration with Columbia University and NASA.

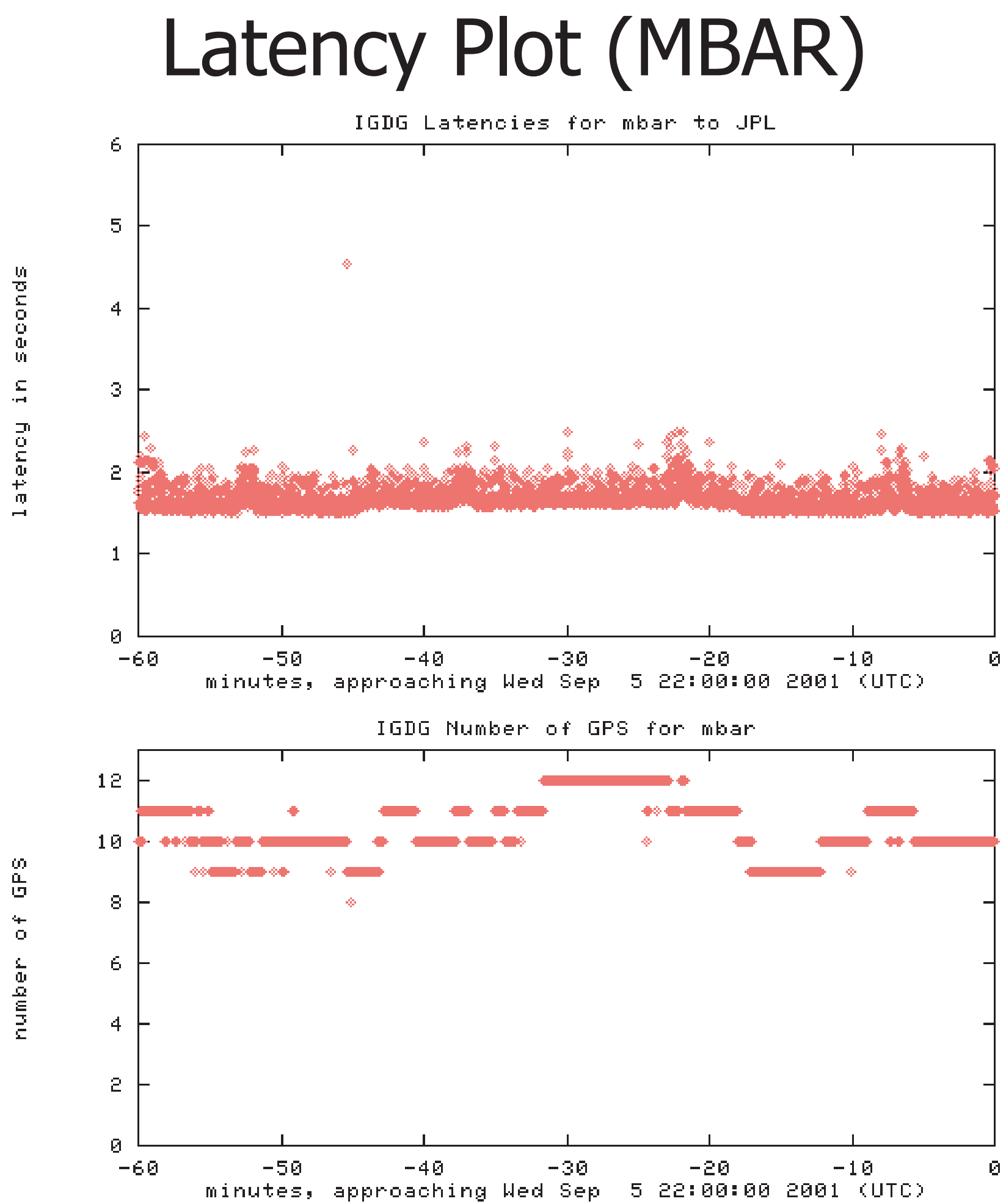
One of the core elements of the EarthScope, USArray will augment permanent stations of the USGS National Seismic Network (NSN) and the IRIS / USGS Global Seismographic Network (GSN). Sixteen of the stations will be upgraded with geodetic quality GPS systems. The proposed collocated stations were chosen to extend the geodetic coverage of the Plate Boundary Observatory (PBO), also a core facility under EarthScope, into the Eastern United States and provide collaborative stations in Alaska (circled in color in the figure below). GPS data from these sites will be quality checked, archived, and processed as part of the Plate Boundary initiative.



Mbarara, Uganda (MBAR)

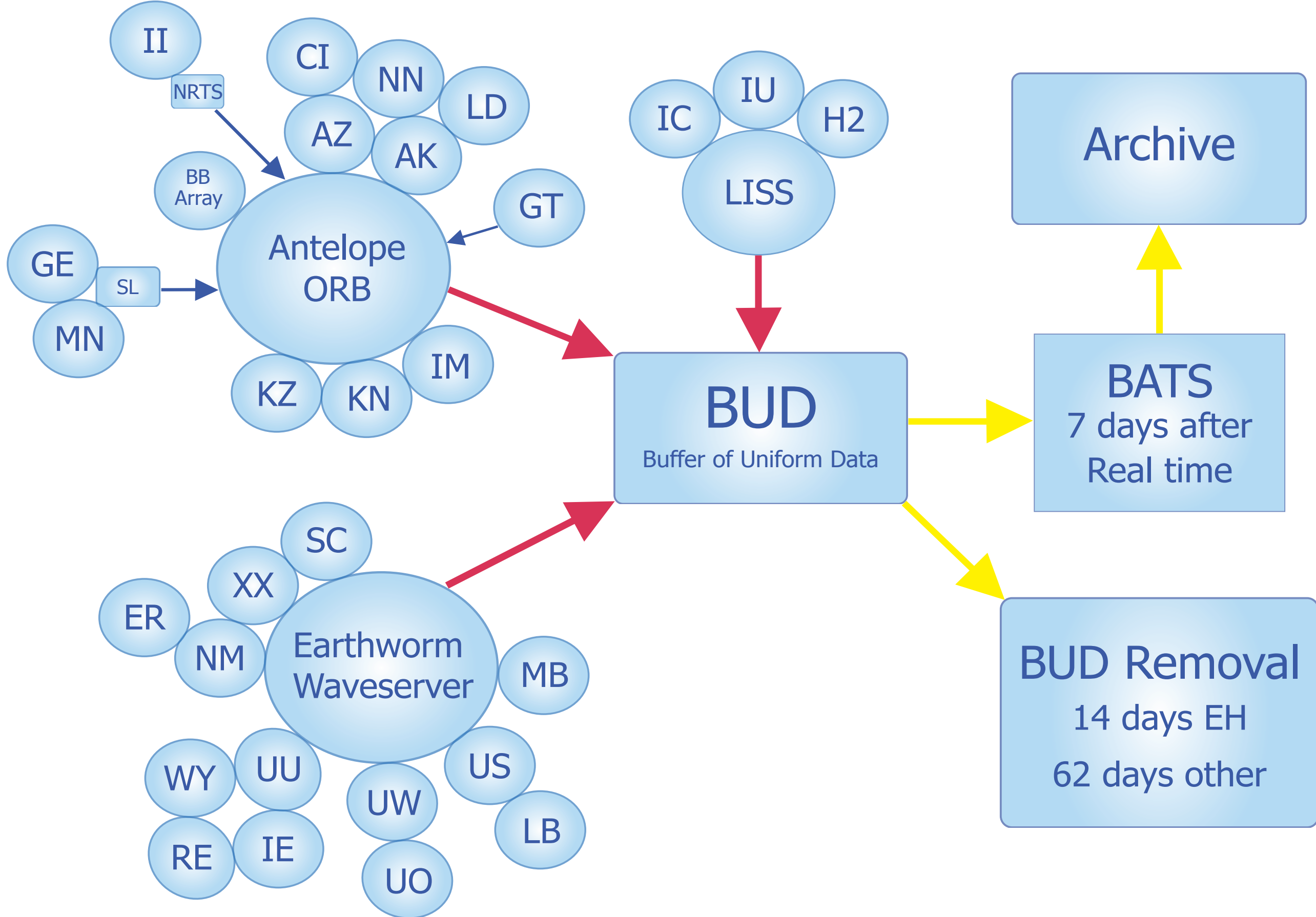


C-band VSAT dish from Meissa installed by IRIS. UNAVCO / JPL operates an Ashtech Z-XII3 receiver and a Paroscientific MET pack. Both VSAT & GPS equipment are running off of a self-contained solar power system. The Ashtech is streaming real-time, 1 HZ data in UDP packets to JPL at 19200 baud over the VSAT link. The data collection computer is a UNAVCO designed PC-104 system running Red Hat Linux 5.2. The GPS monument was excavated to a depth of 2.2 meters and constructed of a rebar re-enforced concrete pillar. The concrete is anchored to rebar driven to refusal in the surrounding consolidated soil.



Top plot shows latency for 1 Hz data received at JPL from MBAR. Typical latencies are about 1-2 seconds. Lower plot shows number of satellites tracked. The plots are updated every 30 minutes. Spikes (increases) in latencies about every 15 minutes show times that the binned raw files are ftp'd back to JPL for creation of IGS products.

Real Time Data Flow Through the IRIS Data Management Center



Great thanks and acknowledgements are also due to the various organizations for help in accommodating and facilitating the installation of these VSAT stations: Universite des Sciences et Techniques de Masuku - Franceville Gabon; Geological Survey, Mines Department and Ministry of Energy and Mineral Development - Entebbe Uganda; Charles Darwin Foundation - Galapagos; National Research Institute for Earth Science and Disaster Prevention - Japan; Centro De Estudios Espaciales Universidad de Chile - Santiago Chile; USGS Albuquerque Seismological Laboratory; University of California at San Diego; Pacific Tsunami Warning Center; US National Weather Service.