New Experiments in Ionospheric Heating with Low-Latitude HF Facilities

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A low-latitude ionospheric heating facility is being considered for construction a near the Jicamarca Radio Observation in Peru. The primary purpose of this facility is to modulate the equatorial electrojet currents for generation of ELF and VLF waves. A wide range of F-region experiments, however, can be conducted with this low-latitude-heating (LLH) facility. First, equatorial spread-F can be initiated, suppressed and controlled with the HF facility. In an unstable F-region environment after sunset, the LLH facility can be used to seed equatorial bubbles by heating the plasma and using the plasma thermal pressure to push the plasma along dipole field lines to lower altitudes where the plasma recombines leaving a depleted flux tube. Polarization electric fields will form in the tube cause it to rise and bifurcate by the gravitational Rayleigh-Taylor instability. If heating enhances the cross-field conductivity at the foot of the magnetic field lines, the growth of the equatorial bubbles may be inhibited. One way of enhancing the Pedersen conductivity by inducing electron precipitation that yields collisional ionization to from an enhanced E-layer. This may be possible by directly coupling high-power electromagnetic waves from the LLH facility into Langmuir waves that resonantly accelerate electrons to high energy field-aligned beams. Similar processes can yield artificial aurora at equatorial latitudes. The unique conditions for low-latitude ionospheric are modeled with a full-wave electromagnetic code that propagates in the SAMI-3 physics based ionospheric model. Diagnostics of the equatorial heating effects will involve ground based radars and optical systems as well as diagnostic satellites like the US Air Force C/NOFS and the Canadian Space Agency ePOP/CASSIOPE.