

Future Technologies for Earth Science with Spaceborne GPS

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Spaceborne Global Positioning System (GPS) receivers will one day make important contributions to atmospheric, ionospheric, and solid Earth science. A number of GPS microsatellite missions are already in preparation in several countries. These missions require GPS flight receivers with capabilities well beyond the utilitarian needs of most space missions. The full promise of spaceborne GPS science can be realized only with a dedicated constellation of orbiting GPS receivers specially designed for science use. Initial proposals are for a pilot constellation of a dozen or so microsats launched at once into a single orbit plane. Within ten years we may have on orbit hundreds of tiny GPS "sensorcraft", each with a mass of less than 1 kg, enveloping the earth in multiple orbit planes. This will require advances in spaceborne GPS receiver architecture and microsatellite design. Key tasks include reducing a high performance, multi-channel receiver to a 1-watt, credit-card size instrument; devising efficient 3-axis stabilization for microsats the size of a typical paperback book; and providing low-power cell phone communication from space. There could be a sizable commercial payoff to this work. The miniature receiver will have enormous appeal as both a flight instrument and a high end terrestrial receiver for surveying, geodesy, and aircraft applications. Moreover, the commercial value of atmospheric data for use in weather modeling could one day be substantial.