Simultaneous observations of Pc 1 micropulsation activity and stratospheric electrodynamic perturbations on 27 January 2003

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The 2^{nd} Polar Patrol Balloon campaign (2^{nd}-PPB) was carried out at Syowa Station in Antarctica during 2002-2003. Identical stratospheric balloon payloads were launched as close together in time as allowed by weather conditions to constitute a cluster of balloons during their flights. Such a "Balloon Cluster" is suitable to observe temporal evolution and spatial distribution of phenomena in the ionospheric regions and boundaries that the balloons traversed during their circumpolar trajectory. In that experiment, two balloons were launched for the purpose of upper atmosphere physics observation. More than 20 days of simultaneous fair weather 3-axis electric field and stratospheric conductivity data were obtained at geomagnetic latitudes ranging from sub-auroral to the polar cap. Balloon separation varied from $\sim$60 to $\sim$500 km. A very pronounced negative ion conductivity enhancement was observed at 32 km in the stratosphere on 27 January 2003 from 1500 to 2200 UT. During this event, the conductivity doubled for an interval of about 7 hours. This perturbation was associated with an extensive Pc 1 or Pi 1 wave event that was observed by several Antarctic ground stations, balloon PPB 10, and the Polar spacecraft. No appreciable X-ray precipitation was observed in association with this event, which would point to $>$60 Mev proton precipitation as a possible magnetosphere-stratosphere coupling mechanism responsible for the conductivity enhancement. Such precipitation is consistent with the wave data. During the latter half of the event, E_z was briefly positive. There was a tropospheric Southern Ocean storm system underneath the balloon during this interval. If the event was associated with this storm system and not energetic proton precipitation, the observations imply an electrified Southern Ocean storm and major perturbations in stratospheric conductivity driven by a tropospheric disturbance. This event would represent a hitherto unrecognized source for global circuit current. Precipitating energetic proton data from Akebono and NOAA POES spacecraft will be reported in an effort to clarify this situtation.