

COMPARISON OF CHAMP AND DIGISONDE PLASMA FREQUENCIES AT JICAMARCA, PERU

McNamara, L.F.

Boston College Institute for Scientific Research

Ionospheric plasma frequencies at the altitude of the CHAMP satellite have been deduced from ionosonde true-height profiles for Jicamarca, Peru, and compared with the in situ measurements made by CHAMP.

All Jicamarca ionograms for the interval September 2001 to August 2002 were considered. The ionograms were hand-scaled, since indiscriminate use of autoscaled values is not recommended. The hand-scaled ionograms were filtered by the authors program QualScan, which scans the scaled ionogram traces (virtual height vs. plasma frequency) for acceptability using a rule-based system.

A satellite-ionosonde coincidence was defined as the sub-satellite point being less than 250 km from the ionosonde, and the CHAMP observation being within 15 minutes of an ionogram sounding. The ionogram filtering by QualScan, together with the spatial and temporal coincidence requirements, but mainly the latter, reduced the number of relevant Digisonde ionograms to 142 (from the original 27,000). This number was further reduced to 100 after visual inspection of the 142 ionograms, to exclude doubtful traces affected by weak ionosonde echoes and spread F.

The differences between the plasma frequencies have been found to be well within the uncertainties associated with the ionosonde profiles, confirming the validity of the CHAMP measurements. For satellite-ionosonde separations of less than 250 km, and for satellite altitudes below the peak of the F2 layer, the average discrepancy between the two plasma frequencies was 0.25 MHz or 4% (N = 198). For the most reliable ionosonde measurements, the average discrepancies reduced to 0.18 MHz or 1.7%, with a standard deviation of 0.16 MHz or 1.5% (N = 75). Most of the ionograms were recorded between about 10 and 20 LT.

Given the validity of the CHAMP plasma frequencies, corresponding ionosonde and CHAMP observations were then used to support the practice of extending the ionosonde profile above hmF2 by assuming a Chapman layer with a constant scale height equal to that of the lower side of the F2 layer peak. The average discrepancy for CHAMP passes above the peak of the F2 layer is 0.22 MHz or 2.6%, and the standard deviation is 0.8 MHz or 13.3% (N = 95). Most of the data points were for local times between 03 and 09LT, when foF2 is low and hmF2 is usually less than 400 km.

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1. (a)

Leo McNamara
Boston College Institute for Scientific Research
39 Carey Avenue, Apt. 4
Watertown, MA
02472 USA
leo.mcnamara@netzero.net

(b) 781 377 2625

(c)

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