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Evidence for presence of a global quasi-resonant mode of oscillations during high-intensity long-duration continuous AE activity (HILDCAA) events

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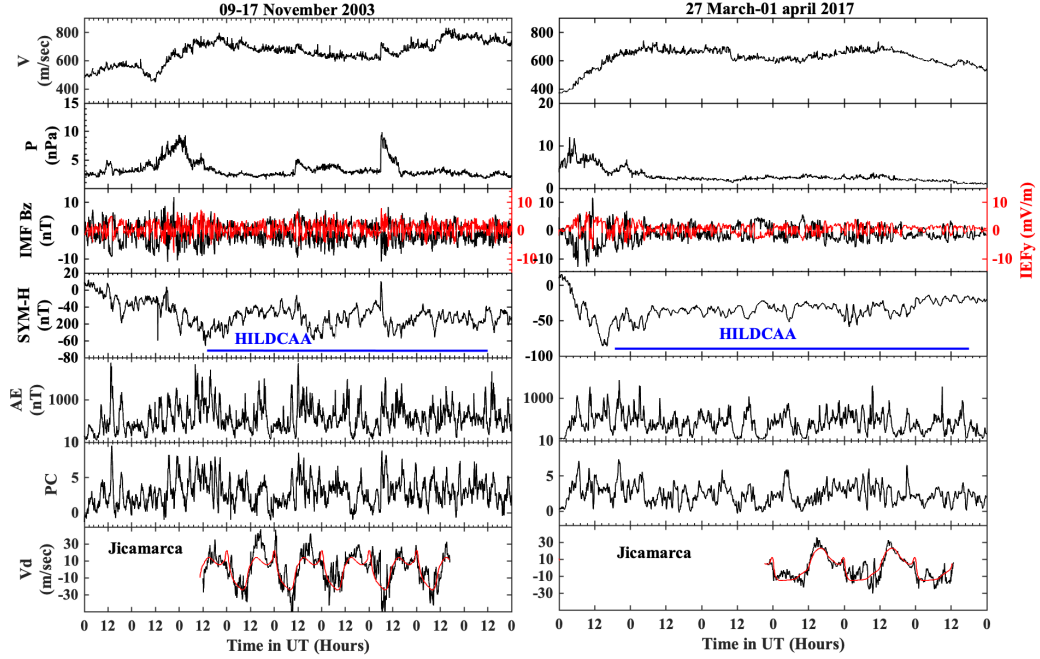
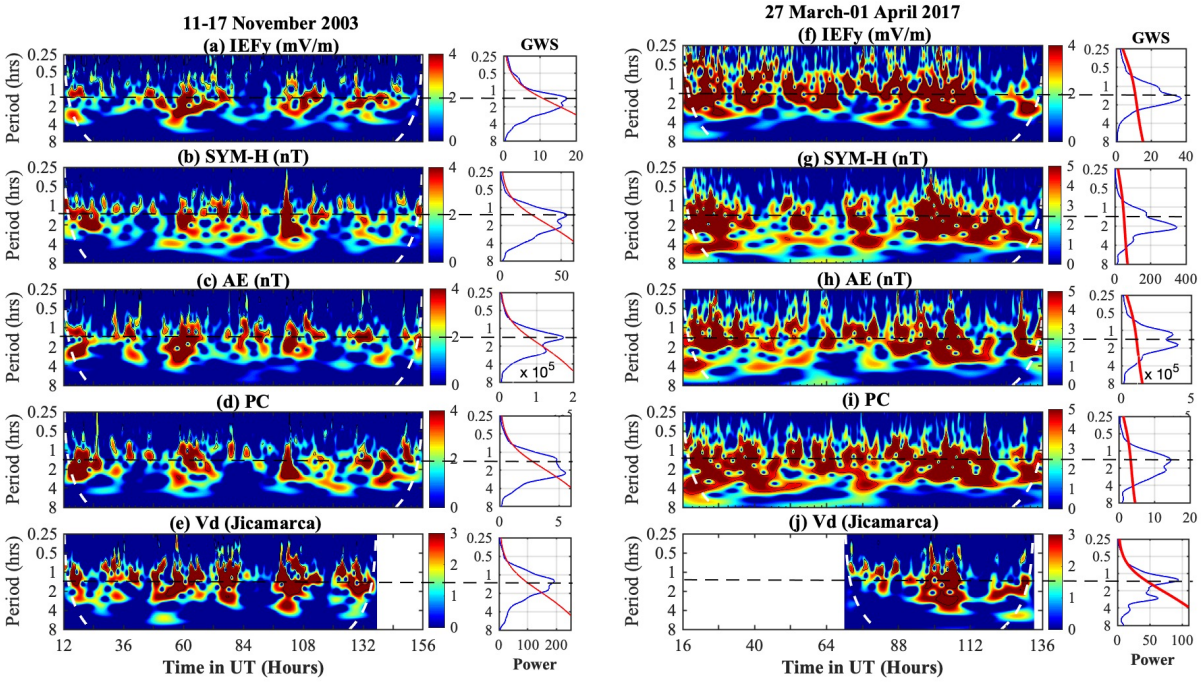
HILDCAA (High Intensity Long Duration Continuous AE Activity)

(i) The peak value of AE index must reach an intensity greater than or equal to 1000 nT
(ii) AE index needs to be almost continuous and never drop below 200 nT for more than 2 h
(iii) the event must have a duration of at least 2 days
(iv) the event should occur after the main phase of magnetic storms. Tsurutani et al.,1995, 2006

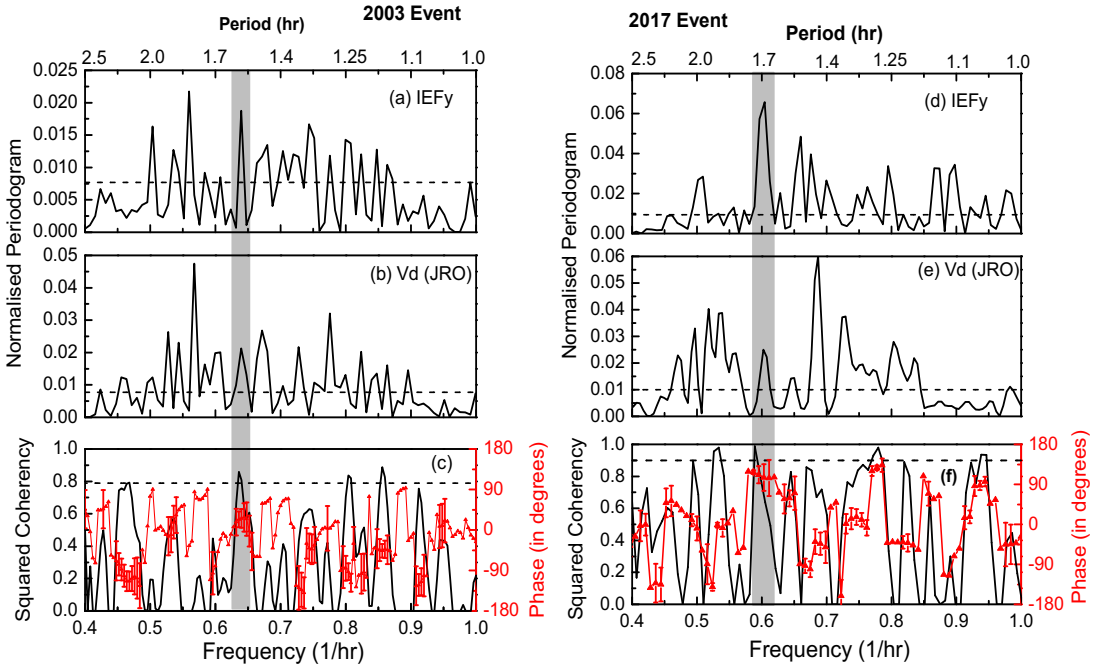


Wavelet power spectra of IEFy, SYM-H, AE, PC, and vertical drift over low-latitude (V_d)



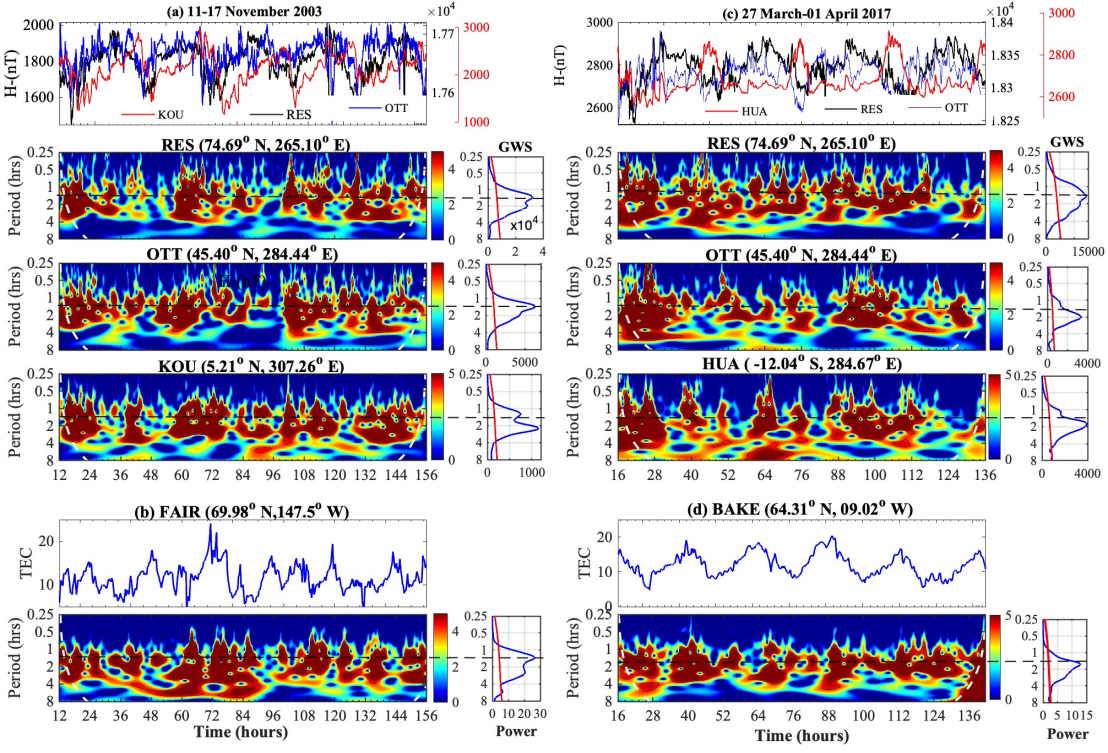
The concomitant occurrence of 1.5–2 h periodicity in IEFy, SYM-H, AE, PC, and V_d implies possible global oscillations during the HILDCAA events.

Causal connection between IEFy and V_d during HILDCAA events

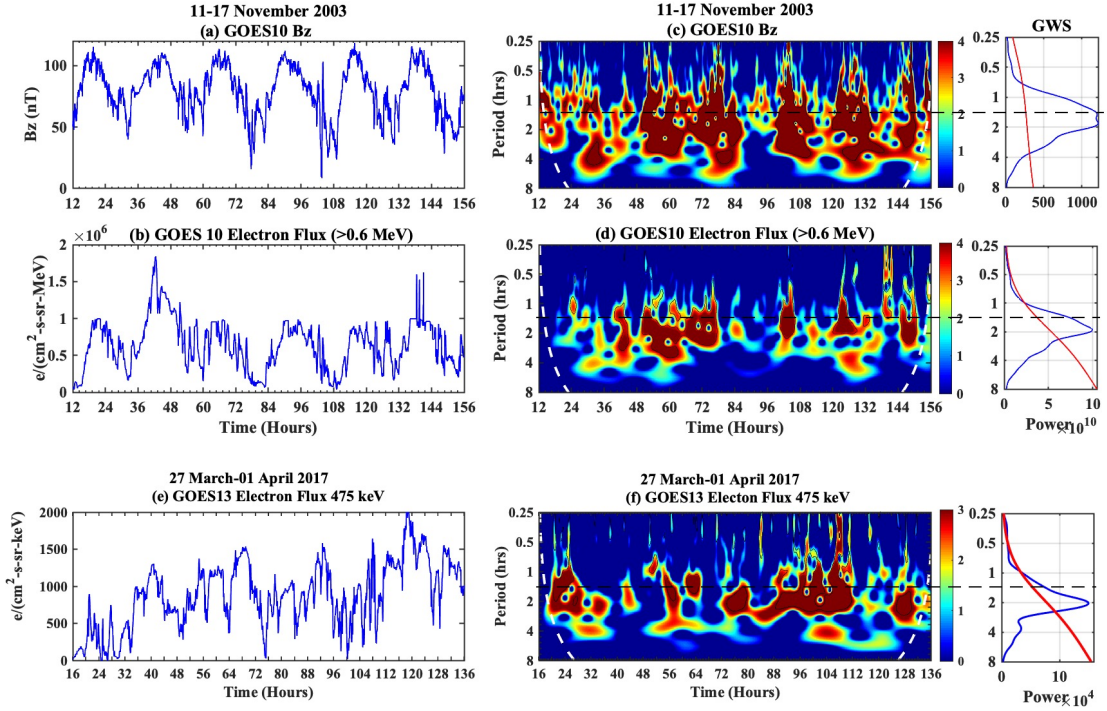


The DP2 type quasiperiodic fluctuations of 1.5-2 h in the vertical drift over Jicamarca are found to have causal connection with the similar fluctuations in IEFy.

Presence of quasi-periodic oscillations in global magnetometers and TEC over high latitude during the HILDCAA events



Presence of quasi-periodic oscillations in the magnetosphere during HILDCAA events



Quasi-periodic oscillations of 1.5–2 h are observed in the Z-component of the magnetic field for the 2003 event and electron fluxes at geosynchronous orbit for both the events.

Summary

- It is empirically showed that a quasi-periodic oscillation of 1.5–2 h in IMF Bz/IEFy drives the periodic changes in the magnetic field and electron flux at geosynchronous orbit, geomagnetic indices (SYM-H, AE, and PC), geomagnetic field on Earth (from high to low latitude), TEC over high latitude, and vertical plasma drift over the equator for several days during the HILDCAA events.

- The evidence of a global oscillation right from the solar wind to magnetosphere and eventually to low latitude ionosphere suggesting the presence of a "quasi-resonant" mode of oscillation during HILDCAA events for several days.

- These results are important not only to evaluate the solar wind–magnetosphere–ionosphere coupling process during the HILDCAA events but can also help to build up a forecasting strategy in the future.

Rout et al., 2022, EPS Express letter

Thank you for your kind attention!