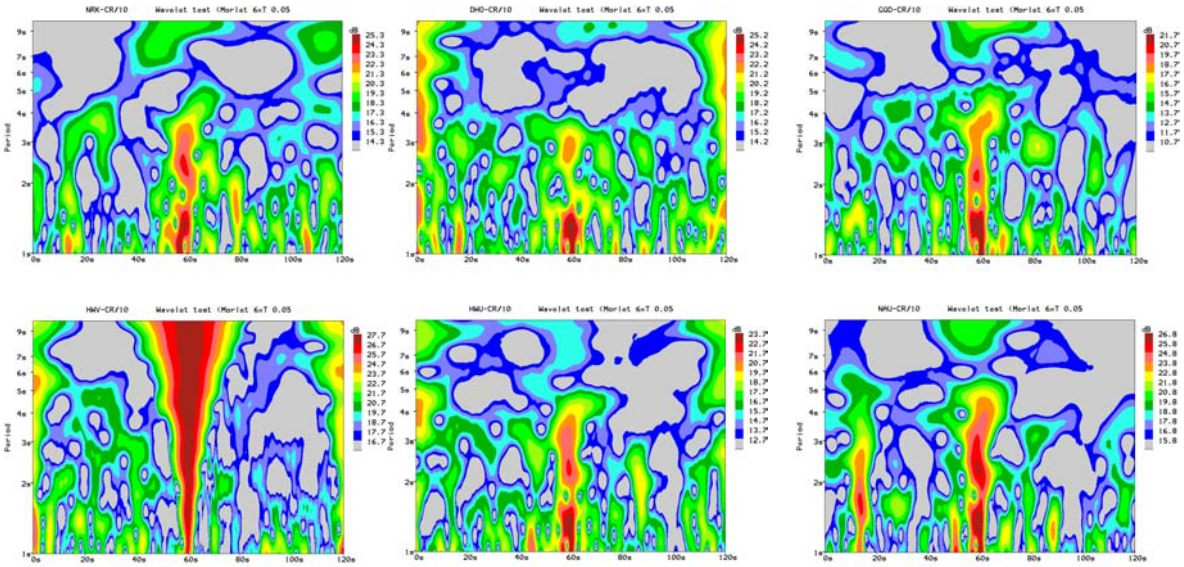
A search for sprite related VLF signatures in the frequency domain using wavelets

C. Haldoupis[1], C. Meek[2] and A. Mika[1]

(1) Physics Department, University of Crete, Heraklion, Crete, Greece
(2) Physics Department, University of Saskatchewan, Saskatoon, Canada

From 0200 to 0315 UT, on July 21, 2003, a camera system in the Pyrenees Mountains captured 28 sprites above a thunderstorm in Central France. A narrowband VLF receiver located on Crete, at about 2200 km southeast of the storm, observed subionospheric VLF signals from six ground-based transmitters having their GCPs converging to Crete through Western Europe, at distances from the storm in between ± 1500 km. The amplitude of one of the VLF signals, originating at a transmitter located 150 km west of the storm and passing through the storm region, exhibited clear rapid onset perturbations in nearly one to one association with the observed sprites. These "early" VLF events are consistent with a process of narrow-angle forward scattering from a volume of enhanced ionization above the storm generated at sprite occurrences. In the present paper we present wavelet spectrogram analysis results for all 6 VLF links using 2 minute-long, 6000 point, time series centered at the sprite onset. The idea was to search in the frequency domain for sprite related effects on the received VLF signals which may not be discernible in the commonly used time domain analysis of narrow band VLF recordings. Surprisingly, we have often identified evidence of spectral components with periods of a few seconds in nearly all six VLF links under consideration which must have occurred in association with the observed sprites. The present analysis is preliminary and we have no clear interpretation. The results suggest a peculiar, possibly intra-cloud, discharge activity during and after sprite occurrences and/or that the sprite related ionization is affecting CGPs passing at much larger distances from sprites than previously thought. We plan to do more work on this type of analysis.



Wavelet Analysis of CreteVLF recordings from 02:16:00 - 02:18:00 UT , June 21, 2003