Geophysical Research Abstracts
Vol. 15, EGU2013-5696, 2013
EGU General Assembly 2013

On the origin of falling tone chorus elements in the Earth's inner magnetosphere

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The problem of generation of VLF chorus emissions in the Earth's magnetosphere has received great attention recently due to their significant role in the radiation belt dynamics. Though numerical models have successfully triggered rising-tone chorus elements, very few are able to generate realistic falling tones. In order to fulfill the lack of a general falling-tone chorus generation mechanism, we present a new simple model of the falling tones origin in the Earth's inner magnetosphere. We use ray tracing simulations with a realistic inner magnetospheric model to generate rising tone chorus elements at the magnetic equator. These elements propagate to higher latitudes and eventually reflect back to the equator. We demonstrate that falling tone chorus can originate from magnetospherically reflected rising tone elements generated at higher L-shells at the equator. We investigate the statistical properties of these falling tones at the equator, in comparison with the original rising tones characteristics. Our calculations show that falling tones are very oblique and less intense than rising tones, and are confined to lower L-shells. They also correspond to a lower frequency range with a narrower bandwidth. These results are in very good agreement with previous observations, notably recent statistical studies onboard THEMIS spacecraft [1, 2]. Our model can thus be considered as one of the possible mechanisms responsible for the generation of falling-tone chorus emissions.

References

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