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An approach for long-term study of Schumann Resonances

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A new method to obtain the parameters of Schumann Resonances (SR) from experimental ELF horizontal magnetic field measurements has recently been proposed in the paper "On the need of a unified methodology for processing Schumann resonance measurements". The main purpose of this paper is to study the influence that different changes in the processing method may have on the resulting SR parameters (amplitude, central frequency and width) and to determine which is the best and most stable configuration.

This work is intended to be a continuation towards studying the links between the observations of SR and environmental phenomena. A scheme to track the long-term variations in the parameters as well as other characteristics of the SR is proposed.

After processing each 10-min raw data interval using the method proposed in the cited paper, the SR parameters for each interval are conveniently stored for further study together with the percentage of saturated windows, the total energy of the spectra within the range 6.25-23.75 Hz (fitting band) and the chi square for the fit.

It is needed to deal with some problems that affect the long-term analysis. Although the initial conditions for the lorentzian fits are defined in order to minimize the number of unacceptable solutions, it is inevitable that the fit fails at providing admissible parameters for a small amount of intervals. In order to discard these anomalous fits, masks are implemented. It has been studied which range of values should be considered acceptable for each parameter.

There are also many intervals for which the spectra show anormalities, like rather narrow peaks at a certain frequency, too much fluctuation or the absence of resonances. These intervals are stored and classified since they could correlate with local events or with alterations in the Earth-ionosphere cavity.

The saturations of both NS and EW sensors could also be useful as they could correlate with especially strong or close lightning events. A script to detect the exact instant at which every saturation is detected and conveniently store it has also been developed.

As a result of this work, versatile plots and comparisons of very different properties of SR can be immediately obtained, which allows to easily visualize every characteristic of the behaviour of SR we are interested in.