Schumann Acoustic resonance reacting to a C3 solar storm event

Article · March 2022

1 author:

Sven Nordin
Telia Research

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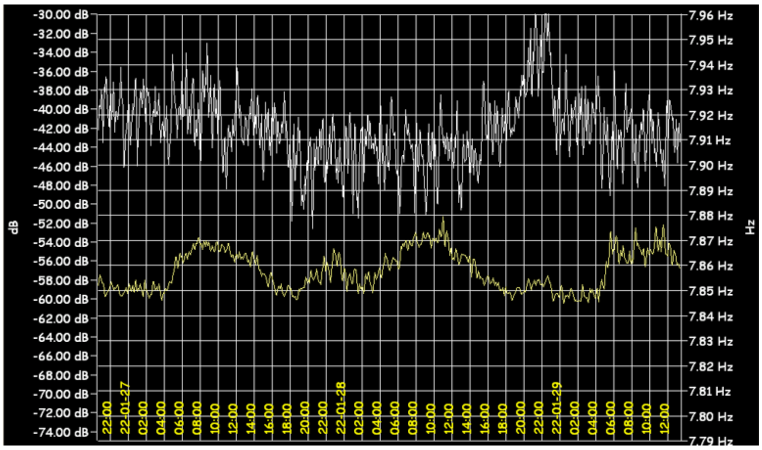
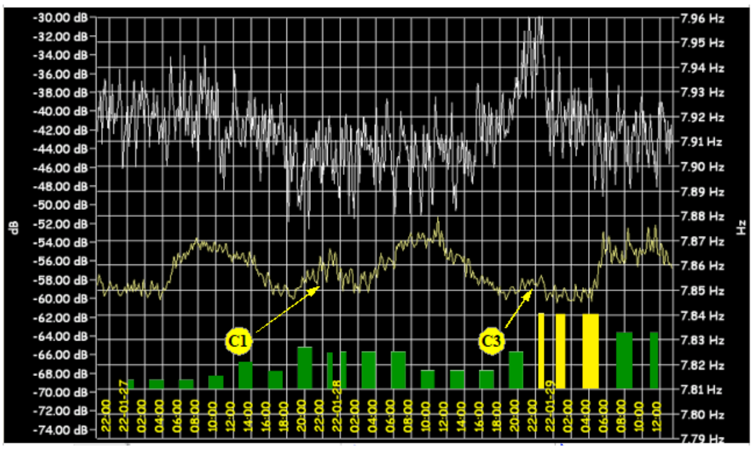
On January 28, 2022 17:35 a “C3” event took place from the sun. A frequency change and a minor amplitude change could be recorded on the Jonophone (the Jonophone is a vibration receiver for receiving Schumann's acoustic resonance). Below is a technical report and analysis of possible explanations for this acoustic event.



The above plot shows frequency and the amplitude for the 7.9 Hz Schumann acoustic resonance.
The white curve is frequency and the lower yellow curve is amplitude.
The amplitude increase at 10 UTC is normal daytime for the Schuman resonance and this gives an amplitude increase from the sun's nominal radiation.
The small amplitude increase around midnight is anomalous increases.
In the analysis below, an attempt is made to explain the frequency anomaly physical changes.



Same plot as above but with Kp-index (green and yellow bars) and C1 27/**12:26**, C3 28/**17:35** superimposed. The Kp-index ranges from 0 to 9 where a value of 0 means that there is very little geomagnetic activity and a value of 9 means extreme geomagnetic storming. On the plot it is “low to medium” 1-4. Also embedded is the “C” value; text from “spaceweatherlive” : *Solar flares are classified as A, B, C, M or X according to the peak flux (in watts per square metre, W/m2) of 1 to 8 Ångströms X-rays near Earth, as measured by XRS instrument on-board the GOES-15 satellite which is in a geostationary orbit over the Pacific Ocean.*

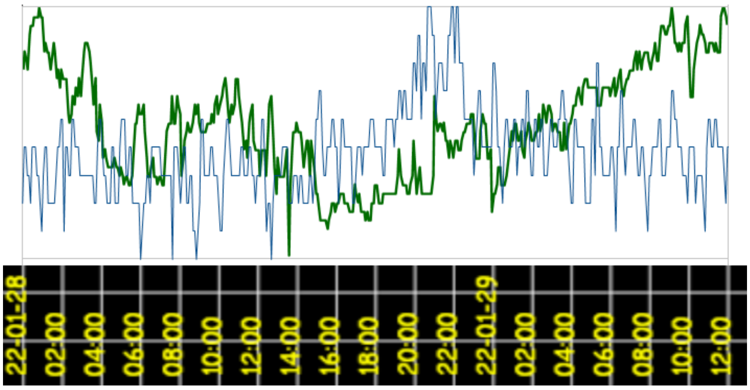
One might think that the frequency change is small and perhaps negligible, but this is not the case. Normal frequency change over a year is 0.5 Hz (+/-0.25 Hz) and for this measurement it is 0.06 Hz, ie 12% in relative change - this can be considered significant. The amplitude change is <3 db and less significant.

So the question is: **what causes the frequency variation** for this 7.9 Hz "atmospheric vibration"?

Let us first look at what variables are available from satellites.

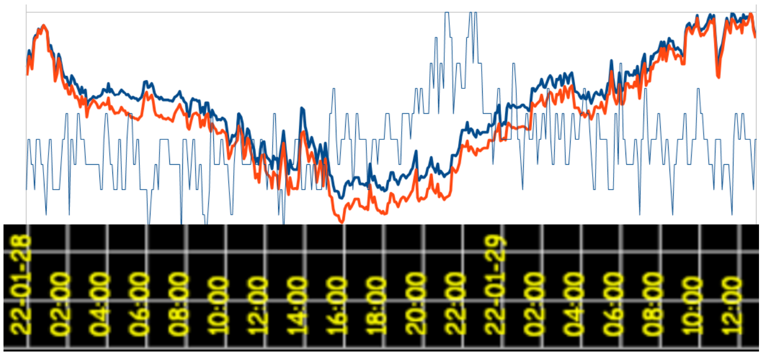
The first three plots (curves) are from CELIAS Proton Monitor. Satellite. CELIAS typically orbiting the L1 Lagrange point. L1 is a point in space where the Earth's and the sun's gravitational is in equilibrium.
TXT-files for plot see refrences.
Also the Jonophone curve is shown.

Green curve: Proton thermal speed.
“Most probable proton thermal speed”.
Light blue: Jonophone



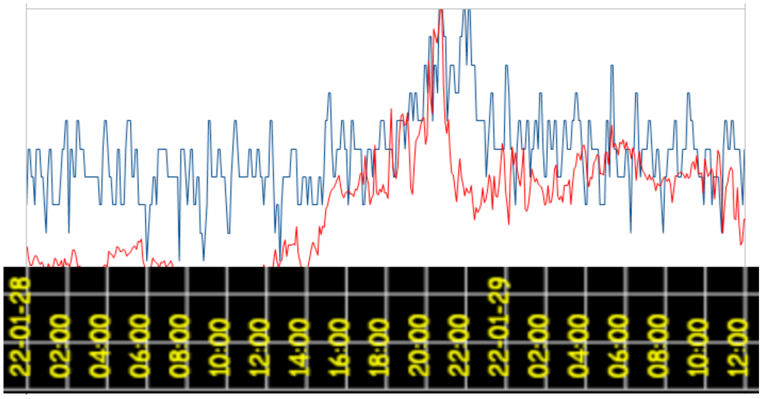
What is meant by thermal speed?
Thermal velocity or thermal speed is a typical velocity of the thermal motion of particles that make up a gas, liquid, etc. Thus, indirectly, thermal velocity is a measure of temperature.
Technically speaking, it is a measure of the width of the peak in the Maxwell–Boltzmann particle velocity distribution. (Source Wikipedia)
It was the author's hope that a correlation would emerge from these two plots. But that did not happen.
We try with the next curve sample.

Source same as above, CELIAS.
Blue curve: Proton speed
Red curve: V_He is the predicted (not measured) Helium speed
Light blue: Jonophone



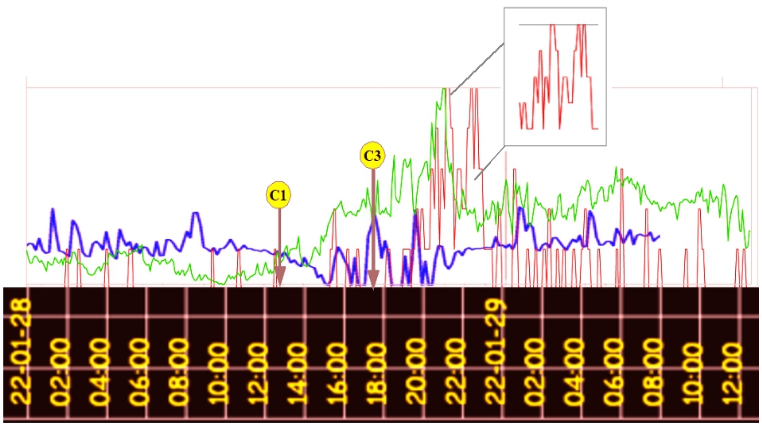
Proton speed does not seem to have any correlation either.

Source same as above, CELIAS.
Red curve: Proton density
Light blue: Jonophone



There is a strong correlation here.
The first part of the Jonophone signal coincides well with the proton density.
So, it will be proton density we get to invest in.
A more detailed explanation comes further down.

Blue curve:
GOES X-RAY FLUX from GOES-17
@ Geostationary orbit 35,700 km altitude
Longitude 137.2° West
Green curve: Proton decency
Red curve: Jonophone

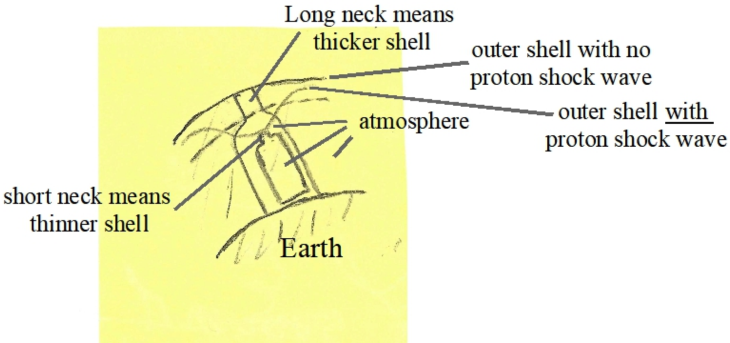


The X-ray is photon like signal and will hit earth first, as it is traveling with the speed of light (blue curve).

The X-ray will fit in with “C3” as it should.
About 4-5 hours later, the proton shock wave will reach the earth and cause the Schumann acoustic receiver to react, the plywood disc begins to vibrate. All this seems logical.

But what about the frequency change?
This must be seen from an electromechanical perspective for the Schumann acoustic resonance. The air ions are bound together (compressed) by the force of the resonance. This mechanical resistance provides a resistance when the proton shock comes with its increased density. It becomes a dent on the shell of the resonator, much like pressing a balloon with your finger. This in turn means that the resonance volume decreases and the shell becomes thinner. These two parameters provide a frequency increase according to the Helmholtz resonator principle.

Post-it note made at the breakfast table...



So, thinner shell gives higher frequency according to the Helmholtz resonator principle.
The bubble in the shell is thus an effect of the proton shock wave.

But why are there two peaks in the received signal?
Alternative a:
There may be another plasma shock that came later but no such verification can be found.
Alternative b:This is also possible; when the bubble shell goes back after the shock (to its ordinary position), it rises backwards, much like when a drop falls on a water surface, this creates a new received signal and could explain why there are two received signals.

This "C3" action created this Aurora Borealis. Maybe not the most spectacular but very useful for research. Thanks to Lights Over Lapland.

11:00 PM is
22:00 Saturday Jan 28 2022 UTC

Picture credit:
www.lightsoverlapland.com

Summary

This measurement shows that Schumann's resonance is an acoustic resonance.

Apparently, it is mostly the proton shock wave that affects the Schuman acoustic resonance frequency at solar storms.

Due to the returned wave effect (the bounce) there is a risk that the Schumann atmospheric acoustic resonance contributes to the distractions of satellites.
Quote (from The Birmingham Times): Dr Mark Conde, a physicist at the University of Alaska Fairbanks "At around 250 miles above Earth, spacecraft feel more drag, sort of like they've hit a speed bump,".

During this test, there was no so-called "cracking sound".

No direct connection emerged between visual auroras and Schumann's acoustic resonance did not emerged.

The author's previous articles in ResearchGate:
1. It's not just radio waves in the antenna - a scrutiny of Schumann Resonance and its acoustic resonance
2. Helmholtz Resonator Model test
3. Schumann Resonance octave detection
4. The acoustic Schumann Resonance 7.9 Hz is compared with a solar storm event
5. The altitude maximum for Schumann Resonance

Internet references
Txt-file for plots from here
https://space.umd.edu/pm/ https://l1.umd.edu/2022_CELIAS_Proton_Monitor_5min.zip

https://space.umd.edu/pm/

https://www.spaceweatherlive.com/en.html

https://www.swpc.noaa.gov/products/goes-x-ray-flux

https://www.swpc.noaa.gov/

https://www.birminghamtimes.com/2021/12/sun-thing-spooky-nasa-rocket-to-probe-mysterious-speed-bumps-at-earths-poles/#:~:text=%E2%80%9CAt%20around%20250%20miles%20above,CREX%2D2%20sounding%20rocket%20mission.

https://www.sciencedaily.com/releases/2019/04/190423114031.htm

Book
Atmospheric Acoustics Xunren Yang
https://www.degruyter.com/search?query=atmospheric+acoustics

in february 2022
Sven Nordin
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