Design and implementation of an experimental satellite measuring abiotic factors

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1. Introduction

There are increasingly frequent warning signs that our planet is stressed due to increasing human population and the subsequent pollution. This has led scientists trying to find new planets that could support life in order to alleviate the situation in the long term. Thus studying the biotic and abiotic factors of a planet far away is of great importance [1]. The aim of this study is to construct a module that can be dropped of by satellites. It will land in specific spots and will study abiotic factors that are essential for supporting life in another planet. Our module will be launched at the CanSat in Greece competition by missile at 1 Km height and must be the size of a can. It will withstand accelerations up to 20g and must weigh no more than 350gr. It will have full telemetry capabilities and will descend by parachute.

2. Method

Many abiotic factors are measured using a particular arrangement of sensors and in some cases fusing their data in order to draw more conclusions. The abiotic factors include light intensity separately measured in the red green and blue range, UV radiation levels [2], magnetic field strength, gravitational acceleration, volatile organic compounds concentration, CO_2, pressure, temperature and humidity. In our case we are going to use commercially available sensors to create a sensor package. It is to be used in the competition as an autonomous payload on a platform for interchangeable missions. For instance we can use our data for pressure and temperature in order to determine the existence of liquid water using as reference existing scientific models.

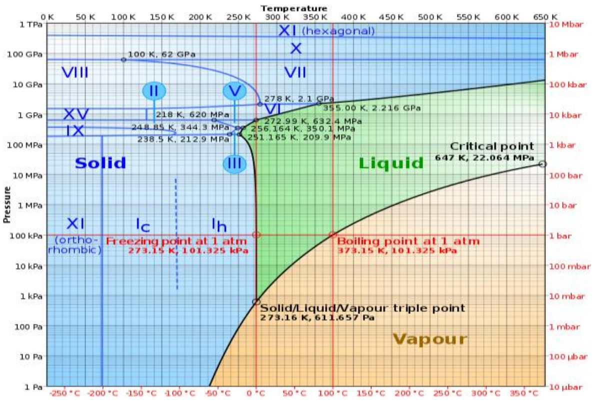

Figure 1 - The water phase diagram based on pressure and temperature

Furthermore we can calculate a planet's radius by using the measurements of gravity acceleration at different heights. We can use the following equation this purpose:

$$R = \frac{h}{\sqrt{\frac{g_0}{g_h} - 1}}$$

R is the radius of a planet, h the distance from the surface, g_0 is the gravitational acceleration on the surface and g_h the gravitational acceleration at height h.

3. Results

In many tests performed to improve the data we collect by fine tuning the sensors we were able to acquire enough data in order to be able to draw conclusions and improve the final experiment. The tests were performed at almost the actual scale. No missile was used but a mountain climb by car. Data analysis proved that our course of actions is correct as the factors collected showed that life can be supported here on earth. Pressure and temperature readings showed us, there is water in liquid form, UV levels are not deadly, the magnetic field is organized and sufficient to protect us from solar wind and there is enough light for plant photosynthesis.Furthermore we calculated our planets radius at 6371006.29646 which is quite accurate.

4. Conclusion

It has turned out to be a quite effective and low cost approach of studying a planet's conditions for supporting life. The final missile launch in the upcoming cansat competition is expected to confirm the existing data by providing an additional dataset.The only limiting factor of our mission is our available budget which limits the quality of our sensors and we plan on improving our measurement accuracy by manually calibrating our sensors.We hope that we will have the chance and with our hard work improve further our experimental satellite.

5. References

[1] C Michael Hogan, «Abiotic factors», Encyclopedia of Earth, July 31,(2010)

[2] Sukrit Ranjan, Robin D. Wordsworth, Dimitar D. Sasselov «Implications for Prebiotic Chemistry and the Need for Experimental Follow-up» The Astrophysical Journal, ApJ, 843,11, (2017)