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WHEN MEASUREMENTS MATTER

CASE STUDY

Studying Atmospheric Electricity and Climate Change

SUMMARY

Mission:
To develop a scientific observation platform on the NRP Sagres School Ship for the collection of atmosphere and ocean data.

Expected Results:
Increasing climate knowledge and better predicting climate evolution by studying the effects of climate changes on the planet's electrical circuit.

Our Contribution:
Campbell Scientific supplied the sensor that enables them to measure the atmospheric electric field at the earth's surface.

Location:
Atlantic Ocean

Customer:
INESC TEC

CS110 ELECTRIC FIELD METER TO RECREATE THE CARNEGIE CURVE OF EARTH'S FAIR-WEATHER ELECTRIC POTENTIAL GRADIENT

INESC TEC, together with the Portuguese Navy, within the scope of the Space Atmosphere Ocean Interactions in the Marine Boundary Layer (SAIL) project, is helping to equip the Sagres School Ship. The vessel is being transformed into a true scientific laboratory that will allow a pioneer study in atmospheric electricity and climate change.

Campbell Scientific supplied the electric field meter sensors to enable INESC TEC to measure the vertical component of the atmospheric electric field at the earth's surface. The geophysical data collected during the planned year-long voyage around the world will allow scientists to study the effects of climate change and increased atmospheric pollution on the planet's global electrical circuit. Data could also inform long-term weather models for better prediction of future climate trends.

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DELIVERING DATA - CS110 ELECTRIC FIELD METER FOR HIGH-FIDELITY ATMOSPHERIC ELECTRICITY MEASUREMENTS IN CHALLENGING MARINE ENVIRONMENT

The Carnegie Curve

The Carnegie curve widely refers to the daily cycle of the Earth's fair weather atmospheric electrical field. In clean air, it shows an average daily fluctuation that follows universal time, regardless of measurement position.

The Carnegie curve is important because it provides a reference variation against which atmospheric electricity measurements are still compared to today. It is thought to originate from diurnal variations in atmospheric electrification associated with the different global disturbed weather regions.

The Mission

One of the scientific objectives of the voyage is to recreate the famous Carnegie curve of atmospheric electric field around the globe. The original data was collected 100 years ago so scientists are interested if recent climate changes have affected the diurnal cycle of the Earth's electrical circuit.

The choice of the instrument for this mission was driven by the high accuracy, sensitivity, field ruggedness, and reliability of the electric field meter made by Campbell Scientific.

The Carnegie under full sail, in 1909 (Carnegie Institution of Washington, Department of Terrestrial Magnetism)

The System

The CS110, Campbell Scientific's electric field meter, is a research-grade, high-fidelity, low-offset sensor that measures the vertical component of the local atmospheric electric field. It has low power consumption, and is designed for critical lightning warning and research applications. The sensor has a reciprocating shutter design, with a reliable earth-ground connection. The sensitive charge amplifier electrode has a leakage compensation circuit tolerant to contamination and salt spray.

The CS110 is integrated with a CR1000 datalogger/controller that provides measurement, control, data processing, and final storage functions, as well as a flexible user interface language (CRBasic) and variety of digital communication options.

The CS110 onboard the NRP Sagres School Ship in 2019

Expected Results

The geophysical data collected in the marine environment will allow scientists to study the effects of climate change and increased atmospheric pollution on the planet's global electrical circuit. Data could also inform long-term weather models for better prediction of future climate trends.

The project also looks to assess the health of the ocean, which has a significant global impact on sectors such as fisheries, marine activities, or even energy, by collecting biological samples (fishes) for further laboratory analysis.

A follow-up case study will be done once the trip has been completed, which will showcase the actual data gathered and performance of the CS110.

References

Inesc Tec *BIP Inesc Tec Magazine* [online] Portugal (2019). http://bip.inesctec.pt/en/noticias/inesc-tec-equips-school-ship-sagres-to-study-atmospheric-electricity-and-climate-change

Harrison, R.G. The Carnegie Curve. Surv Geophys 34, 209–232 (2013). https://doi.org/10.1007/s10712-012-9210-2

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Follow @sail_sagres on Twitter for updates on the project.