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CTBT Science and Technology in the Global Context: Synergies with Global Challenges

PROMOTING THE PEACEFUL USE OF IMS DATA FOR CLIMATE RESEARCH AND CLIMATE CHANGE MONITORING

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BACKGROUND

The CTBTO operates the International Monitoring System (IMS).

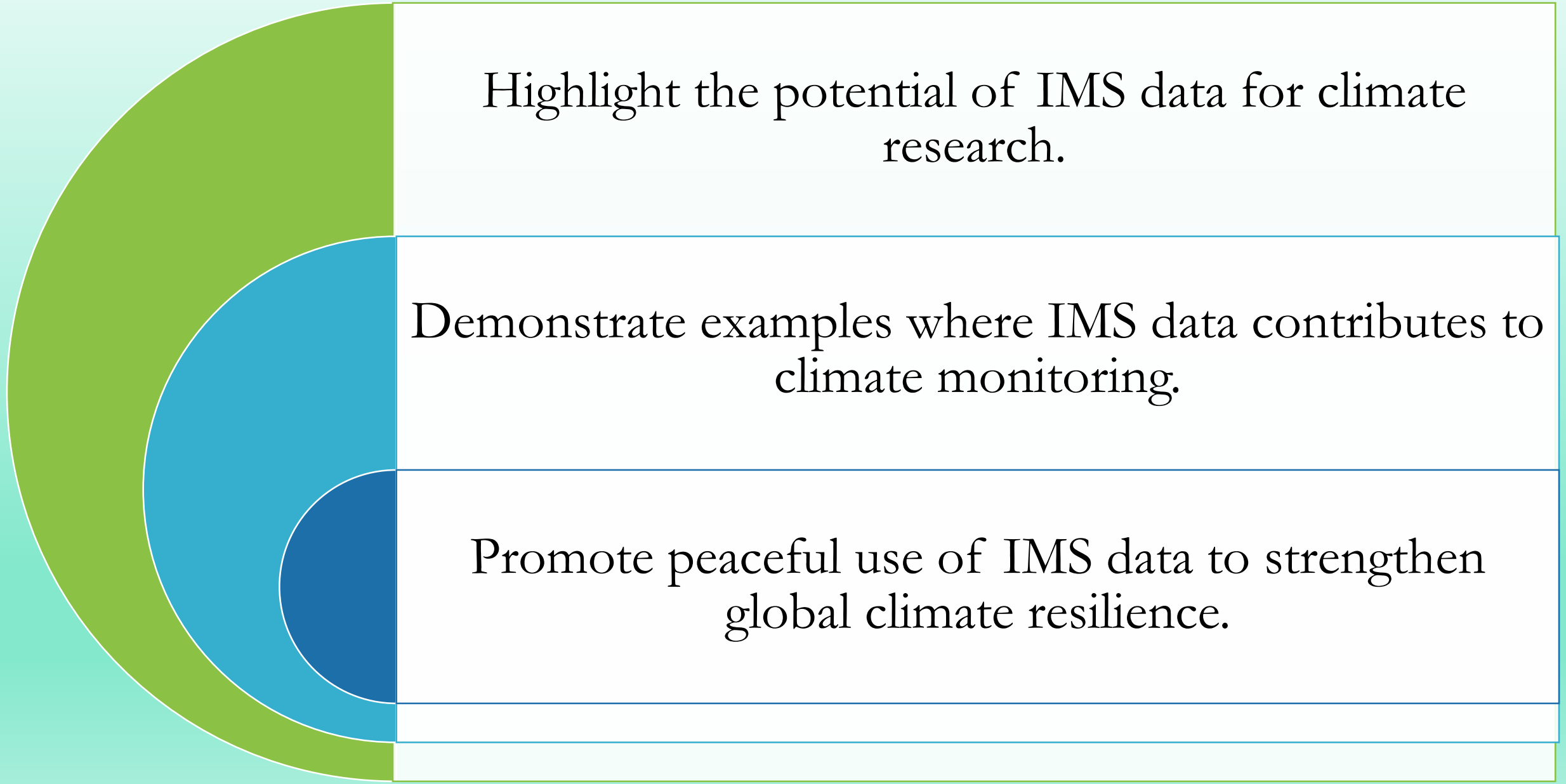
IMS is primarily designed for nuclear explosion monitoring and detection.

IMS data also has major potential for scientific and civil applications.

Climate change is one of the greatest global challenges; threatens supply chains, resources, water, health, and global security.

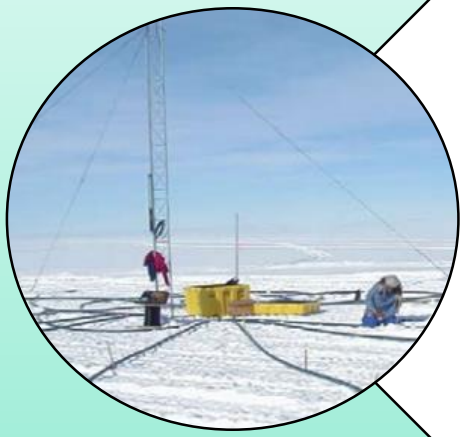
IMS technologies provide unique data to monitor and understand Earth system processes.

OBJECTIVES


Highlight the potential of IMS data for climate research.
Demonstrate examples where IMS data contributes to climate monitoring.
Promote peaceful use of IMS data to strengthen global climate resilience.

METHODS AND DATA

How IMS data contributes to climate research and climate change monitoring;



Infrasound Technology: Register manmade and natural events as indicators of climate change (e.g., iceberg calving, glacier movements, storm activity). Monitor landslides and avalanches as climate change indicators. Determine atmospheric property variations for climate change monitoring. Analyze meteorological data collected from infrasound stations to enhance climate change studies.

(Image: Infrasound station 55, Windless Bight, Antarctica, United States)

Radionuclide Technology: Measure concentrations of natural radionuclides to track air mass transport and validate atmospheric models. Monitor stratosphere/troposphere exchange and validate global climate models. Track seasonal and yearly variations of radionuclides connected to climate variations. Analyze dust, pollen, chemical contents, and solar activity changes for climate change studies. (Image: Radionuclide station 13, Edea, Cameroon)

METHODS AND DATA

How IMS data contributes to climate research and climate change monitoring;

Hydroacoustic Technology: Use background noise data for research on ice shelf break-up and warming. Improve weather prediction and estimates through ocean temperature interference. Study ocean processes, marine life, and whale populations affected by climate change. Measure water temperature via acoustic thermometry for climate analysis.

(Image: Deployment of hydrophone at hydroacoustic station 11, Wake Island, USA)

Seismic Technology: Aid in acquiring and disseminating earthquake data and Earth's structure research. Study glacier melting and its impact on seismic signals. Use co-located seismic and infrasound stations to analyze wave travel time in the lower atmosphere for climate change studies.

(Image: Auxiliary seismic station 69, Rata Peaks, New Zealand)

METHODS AND DATA

The discussed IMS technologies offer valuable insights into climate change research by monitoring various indicators, validating models, and studying Earth's systems and phenomena.

Harnessing the potential of IMS data enhances our understanding of climate change, facilitates effective mitigation measures, and supports the development of resilient communities.

Literature review of CTBTO case studies.

Comparative analysis with conventional climate monitoring systems(e.g., satellites, weather stations, ocean buoys) to identify gaps and added value.

APPLICATIONS; SCIENTIFIC RESEARCH

Scientists have presented their findings on the use of IMS data for climate monitoring applications. These include:

- ✓Identification Signals from Atmospheric Storms
- ✓Tracking Icebergs with Hydro-Acoustic Arrays of the IMS
- ✓Global Infrasound from Nonlinear Ocean Wave Interactions
- ✓Climate change as observed by the CTBTO radionuclide IMS stations e.g., A cosmogenic radionuclide measured at ground-level, beryllium-7, was utilized in a research paper as a proxy to study atmospheric dynamics.

The analysis indicated that at least to some extent, radioisotopes demonstrate changes in global atmospheric circulation possibly caused by global warming.

- ✓Ocean Acoustic Thermometry Using Active Biological Sources Recorded by the IMS and the list still goes on.

RESULTS

Benefits of IMS Data for Climate Studies include:

- Detecting atmospheric and oceanic events.
- Verifying emission reduction efforts.
- Providing evidence of changes in global circulation.
- Enhancing monitoring of oceans, storms, and cryosphere.
- Complements climate datasets and improves model accuracy.

CONCLUSION

IMS data extends beyond nuclear monitoring.

Provides unique perspectives on climate change.

Supports improved climate modeling and trend analysis.

Strengthens global cooperation in climate science.

By raising awareness and promoting the peaceful use of IMS data for climate studies, we can garner support for this important cause while contributing to the global effort of achieving the universalization, and entry into force of the CTBT.

Call to Action: Continue integrating IMS data into climate monitoring!

REFERENCES

- Basak, S. (2023) "Climate Change and Global Security Nexus: Prospects for CTBT". Paper and presentation during the 7th CTBTO Science and Technology Conference, Vienna.
- Betancourt, A. R. (2023) "Climate Change, Global Warming, Tsunamis, Earthquakes and the Role of the CTBTO". Paper and presentation during the 7th CTBTO Science and Technology Conference, Vienna.
- Betancourt, A. R. (2023) "Climate Change and the Increased of Registered Seismic Events, Effects in the Caribbean". Paper and presentation during the 7th CTBTO Science and Technology Conference, Vienna.
- Evers, L. G., Assink J. D. & Shani-Kadmiel, S. (2023) "Long Term IMS Infrasound Measurements as a Passive Probe for Climate Change". Paper and presentation during the 7th CTBTO Science and Technology Conference, Vienna.
- Kuśmierczyk-Michulec, J. & Baré, J. (2023) "Climate Change as Observed by the CTBTO Radionuclide IMS Stations: the Case of Spitzbergen ". Paper and presentation during the 7th CTBTO Science and Technology Conference, Vienna.
- Niklasson, S. M., Veneziani, M., Rowe, C. A., Worcester, P. F., Dzieciuch, M. A., Bilek, S. L., Price, S. F. & Roberts, A. F. (2023) "Hydroacoustic Modeling in a Rapidly Evolving Arctic Ocean". Paper and presentation during the 7th CTBTO Science and Technology Conference, Vienna.
- Public Information Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO). (2008) "The nuclear test-ban verification regime: An untapped source for climate change monitoring".
- Riungu, M. V., Tamarit, V. M. & Kalinowski, M. (2023) "Promoting Peaceful Use of the IMS Data for Climate Research and Climate Change Monitoring". Paper and presentation during the 7th CTBTO Science and Technology Conference, Vienna.
- Terzi, L., Wotawa, G., Schoeppner, M., Kalinowski, M., Saey, P. R. J., Steinmann, P., Luan, L. & Staten, P. W. (2020) "Radioisotopes demonstrate changes in global atmospheric circulation possibly caused by global warming". Scientific Reports 10 (1), 10695. Available at https://doi.org/10.1038/s41598-020-66541-5
- The CTBTO Youth Group Introductory Curriculum. Available at https://youthgroup.ctbto.org/group/12/about