5. CREATING KNOWLEDGE THROUGH PARTNERSHIPS, TRAINING AND INFORMATION/COMMUNICATION TECHNOLOGY

Conveners:

JERRY CARTER
International Data Centre
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Invited Speakers:

JOSÉ ACHACHE
Group on Earth Observations (GEO)
Switzerland

RICHARD G. BARANIUK
Rice University
United States of America

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ORAL PRESENTATIONS:

T5-O1. The global earth observation system of systems

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Recognizing the growing need for improved Earth observations, 140 governments and leading international organizations have established the Group on Earth Observations, or GEO, to collaborate and implement a Global Earth Observation System of Systems (GEOSS) by the year 2015. Countries and organizations are contributing their respective Earth monitoring systems, from satellites in space and in situ instruments on land, in the oceans and in the atmosphere. They are interlinking these systems so that, together, they provide a more complete picture of Earth's systems dynamics.
GEO is developing common technical standards to pool observations and ensure their cross calibration and validation. It is building a web-based infrastructure to ensure easy access to the wealth of data and services contributed to, or generated by, GEOSS. GEO has been promoting the free and open sharing and dissemination of Earth observation data which has already driven significant changes in data distribution policies of several key Earth observing satellites: Landsat, CBERS and the future Sentinels of GMES. GEO is also reflecting on solutions to transition research systems into operational observing systems and ensure their long-term sustainability.
GEO is also coordinating the development of information systems and services such as:
- the Supersites initiative, which ensures coordinated access to critical data and information on natural hazards in geologically active regions. In light of the recent tragedies in Haiti, Chile and more recently Japan, this project created a dedicated web portal where scientists could share in real time their maps of seismicity, tectonics, real and synthetic interferograms, GPS-derived displacement fields and Coulomb stress changes, as well as damage maps, ancillary data, and space images.
See http://supersites.earthobservations.org/
- the Forest Carbon Tracking (FCT) project coordinates the acquisition of observations from multi-spectral and radar (X, C and L-band) satellites, their processing through different models and methodologies and their validation by in situ measurements in 10 selected countries (National Demonstrators). The aim is to establish an operational capacity to support governments with their national reporting activities: the Global Forest Observation Initiative. The GFOI will provide a global monitoring and verification capacity for carbon storage and change in forests. Data and results can be viewed on-line at www.geo-fct.org.

T5-O2. Networks of knowledge

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The last 15 years have seen major shifts in the nature of knowledge production and circulation. The Internet has enabled new modes of authorship, new forms of open licensing and distribution, and new forms of collaboration and peer production to flourish. New online education projects, scientific journals, and reference works have rapidly gained critical mass. But in turn, new anxieties have arisen concerning the long-term sustainability and quality assurance of these enterprises. In this talk, we will review the past, present, and several potential futures of Internet-enabled scholarly publication with a particular emphasis on the global open-access movement in education.

T5-O3. Transnational cooperation: What and why?

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Transnational cooperation to advance and create knowledge can take several forms. One of these is the collaboration among scientists, and other analysts, to develop novel approaches to difficult international policy problems. These approaches are based in science, but their effectiveness derives also from the way in which different scientific communities are able to interact across borders. Several examples will be discussed, with attention to their broader implications for efforts to address other complex international issues.

T5-O4. Capacity building in the context of the Comprehensive Nuclear-Test-Ban Treaty

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The Provisional Technical Secretariat (PTS) was established to prepare the monitoring regime which will be used to monitor compliance with the CTBT, which prohibits nuclear explosions in all environments. The monitoring regime consists of three main components: the International Monitoring System (IMS), the International Data Centre (IDC), and On-Site Inspection (OSI). The IMS consists of a global network of 321 monitoring facilities, which includes seismic, hydroacoustic, infrasound, and radionuclide stations. These stations are designated in the Treaty, are built by the PTS, and are owned and operated by the hosting country. One aspect of capacity building involves training station operators to operate and maintain their IMS stations.
Data from the IMS stations are sent to the IDC, where the data are processed and analyzed. The results of this work, as well as the raw data from the IMS stations, are made available to States Signatories. Work done in these countries is most commonly performed at a National Data Centre (NDC), which is designated by the country for this purpose. The Treaty specifies that it is up to the member States to decide if a treaty relevant event has taken place, and to call for follow up actions, e.g., an On-Site Inspection. The data and products made available by the IDC are used by member states to assess compliance with the Treaty. Another aspect of capacity building involves training staff in member states on acquiring, analyzing, and synthesizing data and products in fulfilling their Treaty obligations. These data may also be used for civil and scientific application such as Tsunami warning.
Capacity Building efforts include a wide range of training and workshop opportunities. Training courses include station operator training, which includes hands on training for the specific type of equipment installed at a station, as well as training on the reporting tools which are used to report station problems. Capacity building opportunities for NDCs include brief introductory course, as well as a longer, two week course, which focuses on accessing and analyzing data and products obtained from the IDC.
Recently a capacity building initiative has started which focuses on providing training, expert services, and equipment in developing countries. Initially the needs of a country are assessed, to see how the project can be tailored to the existing needs and infrastructure. After the equipment is installed, on-site training is provided on how to use data and products in a national context.

T5-O5. Educational outreach as a capacity development strategy, using the Irish example, seismology in schools, Dublin Institute for Advanced Studies (DIAS) Outreach Programme

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In an attempt to attract students to study Earth science and seismology the School of Cosmic Physics, DIAS embarked on an outreach programme in 2007 to promote Earth science, particularly seismology, in schools, upto pre university level. As well as forming the basis for studies in earthquake behaviour, the project addresses ‘forensic seismology’ such as the Kurst submarine explosion, and the use of seismology as one of the four named verification techniques of the CTBTO. The Seismology in Schools programme seismometers are installed in over fifty schools across the State. Given that the population of Ireland is 4M this number of 1 per 80,000 compares favourably with the U.K. (70 in a population of 70M, 1 per 1M) and the U.S.A. (200 in a population of 300M, 1 per 1.5M) with an penetration of 15-20 times greater. The phenomenal success of our Seismology in Schools programme has been helped significantly by the support from the British Geological Survey (BGS) and IRIS (Incorporated Research Institutions for Seismology) in terms of hardware, software and advice. Similarly, the Directors of the Educational Centres (ATECI, Association of Teacher's/Education Centres in Ireland) funded the purchase of 34 additional seismometers. The seismometer is not used in the schools as a professional recording instrument but helps students visualize what seismology and the recording of earthquakes comprises. Strong emphasis was essential on providing teacher training days on the set-up and operation of the seismometer, and associated software. Regular contact is maintained with the teachers throughout the academic year.

T5-O6. CTBTO contribution to the global earthquake data collection: a view from the International Seismological Centre (ISC)

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The International Seismological Centre (ISC) is a non-governmental non-profit organization supported by 57 research and operational institutions and charged with production of the ISC Bulletin – the definitive global summary of seismicity based on reports from 120 networks worldwide. The Reviewed Event Bulletin (REB), produced by the International Data Centre (IDC) based on the data of the International Monitoring System (IMS) is an important integral part of the ISC Bulletin. It is a set of consistently produced waveform measurements and seismic event solutions that make large positive effect on completeness of the ISC Bulletin especially in oceanic areas. In return, the ISC Bulletin, based on an unrestricted network of 5,000 seismographs, serves as an important benchmark for monitoring detection capabilities of the IMS network. The ISC also provides a set of alternative man-made picks at academic sites co-located with IMS. The IASPEI Reference Event List (GT),

maintained by the ISC can be used for testing improvements in event location algorithms used at the IDC. The UK Foreign and Commonwealth Office along with partners from Nordic countries funded the original project to make the ISC database of seismic events securely linked with computer facilities of Preparatory Technical Secretariat and National Data Centers. The ISC Bulletin data have been made available through dedicated software designed to offer the ISC data in a way convenient to monitoring community. IDC CTBTO has now taken over the funding of this project with further capabilities of the system being planned and developed at the ISC.

T5-O7. The IMS network and the International Federation of Digital Seismograph Networks FDSN - a long and winding road

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The International Federation of Digital Seismograph Networks (FDSN) was created to foster collaboration among operators of broadband seismograph stations around the world. Its main goals are the standardization of data formats and data exchange protocols, improvement of data quality, establishing standards for instrumentation, coordinating station siting, and encouraging free and open access to data in real-time. The FDSN membership represents the main seismic operators of the scientific community worldwide. CTBTO is an active member of the FDSN. More than half of the IMS auxiliary seismic (AS) network is owned, operated and maintained by FDSN members. This bridge between the nuclear monitoring and the seismological communities has resulted in better data quality, a strong capacity building effort, and improvements in data transmission. The high quality and data availability requirements for IMS stations continue to be a challenge to most local operators. In this respect, the synergy between CTBT and FDSN has resulted in tangible benefits to both parties. FDSN provides access to a vast pool of experience in operating high-quality seismic stations, in direct benefit to the IMS station operators. CTBT, in turn, has supported the efforts to improve the technical capacity of station operators and to modernize equipment and facilities. FDSN promotes exchange and cooperation among its members on CTBT-related issues. Besides continuing the current path of productive collaboration, FDSN seeks to extend this cooperation to the open exchange of data. This would provide peer-review quality control and motivation for the community to support operators in providing highest quality data, supporting both parties in fulfilling their missions.

T5-O8. Contributions of the scientific community to CTBT monitoring and verification

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The scientific community has always played an important role for nuclear test monitoring. The opportunities and capabilities for scientists to make significant contributions have constantly evolved. They are making improvements to the methods and technologies for global monitoring, enhance the understanding and support for the CTBT in the public and diplomatic communities and they are able to derive independent data analysis and interpretation for suspicious events.
Based on systematic considerations the contributions of the scientific community are analyzed with regard to the different stages of verification and to the various degrees of integration with the official procedures. This paper picks up the three stages of verification (fact-finding, review, assessment) described by Den Dekker (2001), extends them by a fourth stage (determination of a rule violation according to the treaty text and related regulations). These four stages are framed by a preparatory stage (development of verification methods and procedures) and a post-processing stage (political judgment on treaty compliance). The degree of integration of scientific activities with the official procedures (indirect or informal interaction, official contribution) are adopted from Meier/Tenner (2001) and extended by the case where a norm but no treaty is in force.
From both parameters a matrix is formed with the stages in the lines and the degree of interaction in the columns. The fields in the matrix are used to locate a number of historic cases where scientists contributed to the monitoring and verification of the CTBT.

T5-O9. Infrasound calibration in the Eastern Mediterranean

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The CTBTO has a continuing interest in collaboration on experiments in its monitoring technologies to test, calibrate, and validate its sensors and processing systems. An important class of experiments measures the signals from events generated under controlled, or otherwise well-characterized, environments. The resulting ground-truth datasets provide important information on the usability of the IMS data to detect, locate, and quantify events.

Experiments related to infrasound monitoring are of particular interest, because routine global infrasound analysis is still in its infancy at the CTBTO, and a ground-truth data set is actively being assembled. Equally valuable to the nature of the infrasound sources is the propagation medium which demonstrates significant spatial and temporal variations. Therefore, conducting atmospheric events of known energy release under known conditions provide valuable data on how well the variables can be controlled in the data processing.

Two controlled atmospheric events of known energy release were conducted in the Eastern Mediterranean in January 2011. The first event was carried out on 24 January 2011, with an energy release of 8 tons of TNT equivalent. The second event was carried out on 26 January 2011, with an energy release of 80 tons of TNT equivalent.

In order to better record the infrasound signals at local and regional distances, a large scale deployment was carried out, which deployed over twenty temporary infrasound arrays in over fifteen countries. This collaborative undertaking included over fifty participants from over twenty countries. The equipment used for this temporary deployment included contributions from a number of different countries, as well as from the CTBTO.

This large scale collaborative effort also provided an opportunity to build knowledge and understanding of infrasound technology, through firsthand experience in site selection, deployment, field operation, data acquisition, and station processing. Data from this campaign are being analyzed, and will provide insight into atmospheric propagation and network processing.

T5-O10. Ghana's experience in the establishment of a National Data Centre

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The Government of Ghana in a bilateral agreement with the Preparatory Commission for the Comprehensive Nuclear Test - Ban Treaty Organisation have established a National Data Centre in Ghana with the aim of monitoring the testing of nuclear explosions. Seismic, hydroacoustic, radionuclide and infrasound methods are used for the monitoring. The Data Centre was commissioned on 3 February, 2010 at the Ghana Atomic Energy Commission. At present Ghana does not have any operational, centralised data (seismic, hydroacoustic, radionuclide and infrasound) acquisition system with the capability of accessing data from other international stations. Hence, the importance of setting up the National Data Centre which would enable us constantly monitor, manage and coordinate both natural and man-made seismic activities in the country and around the globe, upload data to the International Data Centre (IDC) as well as receive and use International Monitoring System(IMS) data and IDC products for treaty verification and compliance. Apart from these, the Centre also accesses and analyzes seismic waveforms relevant to its needs from the International Data Centre; makes data available to its stakeholder Institutions for earthquake disaster mitigation; reports on all aspects of disasters related to seismic to the relevant government agencies that deal with disasters; makes recommendations to the government of Ghana on earthquake safety measures; provides information to assist government Institutions develop appropriate land and building policies. The Centre in collaboration with stakeholder agencies periodically organises public lectures on earthquake disaster risk mitigation.

T5-O11. Creating knowledge and building capacity in Uganda

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In Uganda, a developing country, the knowledge of CTBTO activities goes relatively unnoticed. The CTBTO would gain greatly from engaging the young scientific community and developing this capacity by using knowledge networks that focus on region specific needs. This can be done by developing programs or projects that are geared towards the local science colleges for example calls for proposals from students at higher institutions of learning, this would bring about a situation where local research capacity is nurtured to deal with the problems arising in our particular situations such as landslides, earthquakes. Creation of networks necessitates Member States that have National Data Centers located in Africa to open up and allow for internship

opportunities on the continent for example in South Africa and Tanzania. This would create a deeper understanding of CTBTO activities; build local expertise and platforms for regional cooperation. This model for networking would further cascade the trainings to allow inter regional trainings for example in East Africa to identify expertise that can be engaged to create awareness of CTBTO activities. This proposal seeks to address the need for creation of networks which would take advantage building the local expertise/ capacity in the activities of CTBTO and the technologies used to solve pertinent problems affecting Member States. Furthermore, there is need create awareness of CTBTO at a pre-service institutions (local Universities, relevant tertiary institutions/ICT schools) to stimulate local research capacity and enhance participation in the CTBTO

T5-O12. A CTBT implementation process in Panama to forge broader partnerships

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In regard to CTBT implementation, many factors can cause problems: from the absence of related laws, regulations, policies and programs that should be in place to facilitate CTBT implementation to outmoded bureaucratic practices that hinder the effective operation of the monitoring facilities. The leadership of the Station RN50 of the IMS in Panama wants to make sure that CTBT has a first-rate implementation to ensure the continuing operation of that Station in the years to come. To attain that result, the CTBT implementation must be a participatory, deliberative process inclusive of a variety of stakeholders to generate greater understanding of CTBT norms and contribute to an effective internalization of those norms. This proposal seeks to reflect on the following aspects of the CTBT implementation process as a way of forging broader partnerships for the CTBT goals:

Who are the main stakeholders –from civil society, government, private sector, and academy- that should be involved in the CTBT implementation process to contribute to a sense of ownership of the CTBT mission and goals? Further, what are the elements of an advocacy plan for adopting legislation to implement CTBT that are participatory and inclusive?

Is it desirable to develop and integrate human rights standards and practices into an effective CTBT implementation process? Should the linkage between human rights (e.g. right to life, right to a safe and healthy environment) and the ban on nuclear testing be brought into the foreground as a way of strengthening the CTBT implementation?

A CTBT implementation merely "on the books" would be not only insufficient, but rather dangerous: it would put the reliability of the whole CTBT monitoring system into question. So, on CTBT matters, effectiveness of the national laws, regulations, and practices is paramount. The chances for reaching that level of effectiveness increase when the CTBT implementation process opens up to the participation of an array of relevant stakeholders from civil society, government, academy, and private sector. It is expected that as a result of collaborative, long-term participation in the CTBT implementation process, institutional partnerships will be established, contributing thereby to the continuing operation of the RN50 Station of the IMS in the years to come.

T5-O13. Methodology for on-site inspections and lessons learned from different verification regimes

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Methodology for On-Site inspections and lessons learned from different verification regimes

On-site inspections, though intrusive in nature, is one of the most important and effective mechanism as a verification tool in order for a treaty to achieve its objectives. The IAEA safeguards inspection regime, which verifies the non-proliferation of nuclear weapons, has accumulated broad experience in the methodology and technology of conducting inspections on international, regional or national levels. The OPCW inspection regime, which verifies the prohibition of Chemical Weapons, though relatively new, has developed quite an effective methodology for their objectives. Other inspection regimes used for verifying other purposes, e.g. biological weapons, trafficking, illegal transport activities or networks and others provide different methodologies to achieve their goals.

Experience of these different methodologies of inspection regimes provide important lessons that could contribute important lessons learned for the effective implementation and conduct of a CTBTO On-Site inspection for the detection of possible nuclear test explosion. Discussion of the methodology and objectives of the main inspection regimes and Examples of possible common methodology and technology for different inspection regimes with that of the CTBTO are here discussed.

POSTER PRESENTATIONS:

T5-P1. More and more data formats, is it a plus?

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Ever since the revolution in information technology went rapidly forward in the last two decades, going in parallel with the ever-growing demand for scientific data, more and more makers of data loggers are each independently inventing his exclusive data format and communications protocols. Although this might cost data analysts and technologists more time and effort in format conversion and data manipulation, this may be giving us the advantage of having multiple systems at the same data center, as in the Jordan NDC, where completely separate systems act as a backup for each other, and enhance competitiveness between scientists using these different technologies.
Would we rather break the borders between these data formats and give more time and effort to scientific issues?? An answer is needed before it is too late.

T5-P2. The construction and development of the radionuclide station (RN42) at Tanah Rata

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One of Malaysia's obligations towards the Comprehensive Nuclear-Test-Ban Treaty (CTBT, is for the establishment in Malaysia, of a radionuclide monitoring station for the detection of radioactive fall-out due to nuclear weapon test explosion. The radionuclide monitoring station, named the RN42 station is situated at the Malaysian Meteorological Department (MMD) station at Tanah Rata in Cameron Highlands. The paper will glimpse through the construction and development phases of the radionuclide monitoring station and will highlight some of the challenges faced in implementing a project of this nature.

T5-P3. The recently acquired broadband and strong motion sensors network in Ghana and the access to CTBTO's data and products will help Ghana to update its National Seismic Hazard Assessment for a sustainable infrastructural development

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Seismic research in Ghana dates back to the colonial days and the first documented earthquake occurred in the year 1636. The first seismic equipment known as the Milnes Single boom was installed in Ghana in the year 1914. The south-eastern part of Ghana, especially the Capital City - Accra has been subjected to a significant number of earthquakes. Prominent amongst them is the 1939 earthquake of magnitude 6.4 which shook the entire Country and caused major destruction and loss of lives. The Government of Ghana was therefore compelled to operate an analogue seismic network in the southern part of Ghana in the year 1973. The seismic phase data obtained from the local earthquake recorded by this analogue system has since been used to perform hypocentral location and magnitude determination of seismic events. The magnitudes of the major seismic events and their frequencies are a threat to lives, infrastructure and the economy of Ghana. Moreover the identified active fault systems in Ghana run through the Capital city, Accra. In this circumstance of faulting directly under a high population centre, and with vulnerable buildings on weak foundations, moderate earthquakes may cause considerable casualties, loss of life and property. To better understand the seismicity in and around Ghana, it is important to determine the depth and faulting type through moment tensor inversion to know the kind of stress field operating in and around the country. But due to insufficient data this objective and many others have not been achieved. The Government of Ghana is therefore in the process of setting up a network of six seismic broad band stations to transmit real time seismic data, and ten standalone strong motion accelerometers on electrical power facilities and water supply and sewage treatment facilities. Also CTBTO has established a National Data Centre in Ghana and have given us access to use their data and products for seismic research. Ghana's emerging economy can realize a medium term real growth and development through a sustainable rapid infrastructure development that respects the environment for the ever growing population and industrial development. To achieve this, there is the urgent need for us to make a very good use of the above mentioned seismic infrastructural developments in the country to obtain Ground Motion Estimates to generate a new national seismic hazard map. This will then form the basis for a new Building Code Provision for new buildings, Seismic Rehabilitation of existing buildings, Seismic Design Criteria for Bridges, Dams, Overhead Transportation Systems and other Critical or Lifeline Structures based on the technical consideration and our

economic circumstances. Laws and Regulations also need to be elaborated for protection against earthquakes and to protect against the abuse of the natural environment.

T5-P4. The CTBTO link to the International Seismological Centre

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The CTBTO Link to the database of the International Seismological Centre (ISC) is a project to provide access to seismological data sets maintained by the ISC using specially designed interactive tools. The Link is open to National Data Centres and to the CTBTO. By means of graphical interfaces and database queries tailored to the needs of the monitoring community, the users are given access to a multitude of products. These include the ISC and ISS bulletins, covering the seismicity of the Earth since 1904; nuclear and chemical explosions; the EHB bulletin; the IASPEI Reference Event list (ground truth database); and the IDC Reviewed Event Bulletin.
The searches are divided into three main categories: The Area Based Search (a spatio-temporal search based on the ISC Bulletin), the REB search (a spatio-temporal search based on specific events in the REB) and the IMS Station Based Search (a search for historical patterns in the reports of seismic stations close to a particular IMS seismic station).
The outputs are HTML based web-pages with a simplified version of the ISC Bulletin showing the most relevant parameters with access to ISC, GT, EHB and REB Bulletins in IMS1.0 format for single or multiple events. The CTBTO Link offers a tool to view REB events in context within the historical seismicity, look at observations reported by non-IMS networks, and investigate station histories and residual patterns for stations registered in the International Seismographic Station Registry.

T5-P5. Datasets for monitoring research at the International Seismological Centre

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The International Seismological Centre (ISC) is an independent, non-governmental, non-profit organization supported by more than 50 research and operational institutions around the world. The mission of the ISC is to produce the ISC Bulletin – the definitive and most complete summary of world seismicity based on seismic reports from over 120 institutions. The ISC collects and maintains various data sets that are useful resources for monitoring research and other seismic studies, such as the IASPEI Reference Event List of globally distributed GT0-5 events, the groomed ISC bulletin (EHB), the IDC REB, USarray data, and historical ISS (International Seismological Summary, 1918-1964) bulletins. The ISC, jointly with NEIC, maintains the International Seismographic Station Registry and provides a number of additional services available from its web-site.
The International Seismological Centre (ISC) location algorithm remained virtually unchanged in the past 40 years. The introduction of the ak135 travel-time predictions in event locations since data year 2006 presented an opportunity to incorporate state-of-the-art methodologies in the ISC location procedures to further improve the accuracy of event locations in the ISC bulletin. From data year 2009 the ISC uses the new location algorithm to produce the ISC bulletin. The new location algorithm uses all ak135 predicted phases in the location; obtains the initial hypocentre via the Neighbourhood Algorithm; accounts for correlated model error structure; performs iterative linearized inversion using a priori estimates of the data covariance matrix; obtains depth-phase depth via depth-phase stacking; and provides robust network magnitude estimates with uncertainties. The new ISC location algorithm was validated by relocating more than 7,000 events in the IASPEI Reference Event List, as well as by relocating the entire ISC bulletin. We show that the new ISC location algorithm provides small, but consistent location improvements, considerable improvements in depth determination and significantly more accurate formal uncertainty estimates. We demonstrate that the new algorithm, through the use of later phases and testing for depth resolution, considerably tightens the event locations, thus providing an improved view of the seismicity of the Earth.

T5-P6. New ground truth events in Central Asia.

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Ground truth events play important role in the evaluation of the IDC data products. In this work we present information about two GT events, occurred in the Central Asia in 2009. First event is an explosion, detonated at Kara-Zhyra coal mine on 28 of November, 2009, at 07h20'36" The yield of the explosion was 49 ton TNT equivalent. Coordinates of the explosion are: 50.018323 N, 78.726551 E. Kara-Zhyra coal mine is located on the territory of the Former Semipalatinsk Test Site in Kazakhstan. This event was chosen as a test event for the

NPE09. Information submitted by the mine's authorities, allowed us to estimate the exact coordinates of the explosion with accuracy of about 1 kilometer. REB solution was at 6.532 km off to the GT coordinates. The second event is so called "Kambarata" explosion, detonated in Kyrgyzstan on the 22 of December, 2009 at 05h 54' 33.645''. Coordinates of the explosion, as measured by GPS are: 41,77467N, 73,33122E. In this case the REB location was in 15.19 km. off to the GT coordinates. The yield of the explosion was 2800 ton TNT equivalent. The purpose of the "Kambarata" explosion was to create the dam for hydroelectric power plant. For both of the two GT events the evaluation of the automatic and interactive IDC products was made. The comparison of the locations results using different velocity models was accomplished and new travel time tables were created.

T5-P7. International Training Center in support of the CTBTO

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The official opening ceremony for the "International Training Center in Support of the CTBTO" was held in Almaty (Kazakhstan) on 21 June 2010. This training center, in the first place intended for participants from Central Asian countries, is created on the basis of the Kazakhstan National Data Center. Financial support was provided by the Ministry of Foreign Affairs of Norway. The seismological center NORSAR in Norway provided scientific and technical support. The Institute of Geophysical Research of the National Nuclear Center of Kazakhstan prepared the new training Center with rooms for lectures and exercises. The duration of the training course is one month. The course program includes lectures and exercises on seismic data processing using different software products. In the beginning of each course a number of lectures, covering such topics as the CTBTO, the International Monitoring System, the International Data Center and its products are given. The lectures and exercises are guided by the most experienced specialists of the Kazakhstan NDC. The training is accomplished in the Russian language. This is helpful, since many specialists from post- Soviet countries have poor knowledge of the English language. Up to the present time, specialists from Tajikistan, Turkmenistan, Kyrgyzstan and several institutes in Kazakhstan have successfully completed the course. The next course will be for colleagues from Uzbekistan. Training courses will help increase the effectiveness of nuclear test monitoring, as well as facilitate solving the task of seismic hazard estimation and reduction of seismic risk in the seismically active region of Central Asia.

T5-P8. Building capacity to sustain disaster management and preparedness through civil applications of CTBTO's global verification regime

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Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) verification regime and the International monitoring system can assist host countries to effectively utilize the early warning system into their National disaster management and preparedness plans. In addition to its actual purpose of detecting nuclear explosions, the CTBTO's global verification regime can offer a wide range of civil and scientific applications. These applications have the potential to contribute significantly to sustainable development, knowledge expansion and human welfare. Tanzania has been experiencing a number of disasters that have caused losses of life, property and destruction to environment. National disaster management plans needs efficient and effective response systems, including infrastructure and financial components, emergency plans, procedures and internally consistent operational criteria to be critically factored into the guidelines on developing relevant national capabilities. The Tanzania National disaster management plan was formulated with objectives to develop higher level of preparedness, response and mitigation capacity for all types of disasters; promote public knowledge and awareness of disaster and enhance the involvement of the community in disaster management.; establish and maintain an effective institutional arrangement for the coordination, cooperation, collaboration and financial arrangements; promote research and technological development, establish and strengthen information systems appropriate for specific hazards at all levels. Under the National disaster management plan the country has a national radiological emergency preparedness plan that is incorporated in the whole national plan and strategies. Tanzania is hosting a CTBTO radionuclide station in Dar es salaam and has also a National Data Center capable of receiving IMS data. In this case the information, early warning systems and technology support will very much strengthen information systems on specific hazards than may emanate both within the country and outside. In this presentation, the authors will highlight the usefulness of CTBTO information including the use of virtual data exploitation platform in building capacity to sustain disaster management and preparedness.

T5-P9. Experiences gained by NDC Austria during the NDC Preparedness Exercise 2010

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The NDC Preparedness Exercise 2010 (NPE 2010) was the first radionuclide triggered test conducted by the National Data Centers (NDCs) of CTBT States Signatories. As part of the exercise, the German NDC selected a seismic event. It was assumed that this event was the epicentre of an underground nuclear fission explosion. By means of atmospheric transport modelling (ATM), concentrations of the four Radioxenon isotopes which would result from this hypothetical explosion were calculated by the Austrian NDC and interpolated to the IMS station locations. Participating NDCs only received information about the concentration of the isotopes at the station locations without knowing the underlying seismic event. The aim of the exercise was to identify this event.
As first step of its data analysis, NDC Austria applied the software-package WEBGRAPE to calculate the possible source region pertaining to the measurement scenario. As a result 41 possible seismic events were identified. Due to the ratio of the Xenon isotopes, the timeframe of the event was further constrained and the number of possible events was reduced. A subsequent analysis excluded events that were clearly of natural origin and the remaining events were further investigated using the software-package GEOTOOL. Forensic studies revealed the only possible event.
Some important conclusions were drawn based on the results of the exercise: First of all the concept of a radionuclide driven exercise proved to be important because the capabilities of the NDCs were tested across all technologies. Second it was demonstrated that the analysis of isotopic ratios of xenon-isotopes can be helpful in constraining the event period. Last but not least the verifiability of the treaty critically depends on a comprehensive knowledge of all technologies and their joint application.

T5-P10. Knowledge exchange and cooperation between National Data Centers (NDC)

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NDC Preparedness Exercises (NPE) provide an important opportunity to trigger the cooperation and Knowledge Exchange not only between established NDCs but also between established and new NDCs. Seismic knowledge is frequently available among new and emerging NDCs, but knowledge about Atmospheric Transport Modelling (ATM) and data fusion is lacking.
The goal of the project was to support the participation of the Tunisian NDC in the NPE2010. In this process the following aspects of knowledge-transfer were considered namely a step-by-step approach which finally results in a comprehensive knowledge about the training topic. In cooperation between the two NDCs a project concerning the software-package WEBGRAPE was started and a first tutorial was developed which can be used in further NDC Preparedness Exercises to facilitate participation.

T5-P11. The new digital seismic network KRNET: Perspectives and capacity development

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During the last decade, national networks for seismic monitoring in Central Asia were equipped with digital stations. In 2008, within the frame of CTBT capacity building, NORSAR, with support from the Ministry of Foreign Affairs of Norway, provided the Institute of Seismology of the National Academy of Sciences of the Kyrgyz Republic with ten digital broad-band stations. Most of these stations have been installed in the seismically highly active south of Kyrgyzstan. The stations together with the KNET stations located in the north and northwest of Kyrgyzstan, have provided a good coverage of Kyrgyz territory, and have allowed significant improvement of the accuracy of seismic event locations in the region. Owing to carefully conducted site surveys with respect to geology and seismic noise characteristics, all new sites are highly sensitive both to local and regional events. The KRNET stations recorded the nuclear explosion conducted by North Korea on 25 May 2009, as well as the strong chemical explosion conducted on 22 December 2009 in the territory of Kyrgyz Republic to construct the hydroelectric power station "Kambar-Ata2". The latter explosion can be used for calibration of seismic stations in the region. The KRNET data are used for seismic hazard assessment and seismic zoning and to study crust and upper mantle. The Institute of Seismology archives several thousands of historical seismograms of nuclear explosions, which after digitizing can be used both for seismic station calibration and identification of nuclear explosions and earthquakes.

T5-P12. The Republic of Mali's participation in the CTBT verification regime

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The landlocked Republic of Mali with an area of 1,241,000 square km has political borders with several countries: Algeria, Mauritania, Senegal, Guinea, Niger, Côte d'Ivoire and Burkina Faso.
The location of the country is a preferential area for the activities of CTBTO.
Structurally, Mali is one part of the West African craton, which is not absolutely stable as demonstrated by an earthquake which hit the Republic of Guinea in 1983. The epicentre of the earthquake came from Atlantic Ocean.
The geology of Mali is composed of many rock types with different age. The oldest terrain (2.100 m.y) contain lot of gold (actually we have six gold mines), some uranium occurrences and other important minerals.
Uranium surveying is very advanced and the deposits could be mined in the medium to long term. The Republic of Mali has ratified and signed the contract for the entry into force of the CTBTO respectively on February 18th and August 4th, 1998.
Since a long time ago, the country is sheltering an Auxiliary Seismic Station (ASS 062) at KOWA (Mopti).
Recent works included the installation of solar panels, blinded battery connection system of the Auxiliary Station of KOWA (ASS 062) by the Oman Solar company. Mali is also preparing to get a National Data Center (NDC). The equipments have already arrived at Bamako.
Future works will focus on sending and receiving data through IMS (in Vienna) and Bamako Station through the VSAT antenna.
Some of DNGM young geologists are receiving training for the inspection sites and also for the data interpretation in the frame of the CTBTO activities in Mali and in the sub region.
The contact between CTBTO and Mali is ensured by the National Directorate of Geology and Mines (*DNGM*).
We will present the status of the installation of AAS062 and of the Mali NDC.

T5-P13. CTBTO capacity building follow-up visits in Africa

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The technical follow-up visit to Member States under the Capacity Building project in Africa is one strategic component utilized to provide technical assistance to beneficiary Member States. The objective is to support the local National Data Centre (NDC) in their efforts to establish a sustainable routine use of International Monitoring System (IMS) Data and International Data Centre (IDC) products to fulfill their verification responsibilities.
Prior to the mission the NDC's needs and interest are pre-assessed using the Country Profile. During the initial kick-off meeting with the NDC staff, the proposed tailored Agenda and an interactive onthe- job technical hands-on training methodology is discussed refined as needed. The round table discussion addresses and prioritizes the pressing needs and interest of the NDC. The five days technical hands-on on-the-job training focuses on step-by-step seismic data analysis techniques using NDC-in-a-Box software, and is typically the primary achievement of the follow-up visit. The basic theoretical background knowledge pertinent to routine data analysis techniques is presented.
The technical visit identifies the missing gaps and addresses key elements for the day to day functions of the NDC including operational and analysis working procedures.
The efforts made during this project are expected to result in the increased use of IMS data and IDC products for treaty verification as well as for civil and scientific purposes in the country. This visit also provides an opportunity to become familiar with infrasound and hydroacoustic data, in addition to seismic data, depending on the needs and interests of the participants. To consolidate partnership and sustain the achievement of the project in a country, a strategy and roadmap is proposed. After the visit, the usage of data and products by the NDC can be reviewed, to assess how the NDC is building upon the knowledge used during the visit. It is also important to provide venues for the exchange of experience with other institutions, for both bilateral and/or regional cooperation.

T5-P14. The "Global Seismological Observation" training course

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The International Institute of Seismology and Earthquake Engineering of the Building Research Institute (hereafter referred as the IISEE) has been providing a training course entitled "Global Seismological Observation" in cooperation with Japan International Cooperation Agency (JICA) and Japan Meteorological Agency since 1995. The course objective is to nurture personnel who have knowledge and advanced techniques of global seismological observation and are able to play important roles in the seismological monitoring for nuclear tests. The course duration is about two months and the IISEE gives this training once every year for participants from developing countries who apply to this course through JICA local offices. The number of participants is around ten every year. In total, 149 participants from 69 countries have participated in our training course by March, 2010. The course program has the following subjects: (1) the CTBT, the IMS, and National

data center, (2) Seismological observation, (3) Data analyses (hypocenter determination, array analyses, source mechanism, discrimination techniques, etc.). Since 2003, lecturers from the PTS have visited us to provide a lecture on the CTBT, the IMS and the IDC. In this presentation, we introduce our training course and show how ex-participants are actively working in the relevant fields.

T5-P15. Advances in data distribution systems, high-level product generation, and the measurement of data quality metrics at the IRIS Data Management Center

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The IRIS Data Management Center (DMC) manages the largest concentration of broadband seismological data in the world. DMC data and services are free and open. A rich variety of request tools are currently being extended using Representational State Transfer (REST) web services. These new methods of providing access to data will greatly simplify a research or monitoring group's ability to retrieve information quickly, reliably, and in a form that is readily usable. In addition to raw time series data, the IRIS DMC is developing higher-order products intended to raise the level from which subsequent research begins. These products include such things as ground motion visualizations, a variety of event plot displays, synthetic seismograms, management of tomographic models along with visualization tools, GCMTs, calibration information, and receiver functions. These products are available through web services from the IRIS DMC's new product management system, SPUD. A final project, being built using web services, is an entirely new implementation of the IRIS DMC's quality assurance system, QUACK. The new system will use web services in a manner that allows attributes of data quality for any time series channel (seismic, infrasound, hydro acoustic, etc) to be calculated. The modular system will include several improvements over the existing system, providing better scalability, flexibility, and usability. This presentation will introduce an overview to these new services (data access, products, and quality metrics) to the CTBTO community.

T5-P16. Database of digitized historical seismograms for nuclear tests monitoring tasks

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Continuous seismological observations in Kazakhstan started in 1927. Detailed observations by permanent network of seismic stations started in Kazakhstan and Kyrgyzstan in 1951. To record nuclear explosions at regional distances, temporary stations were installed. Archives of different Organizations contain thousands of seismograms of nuclear explosions from different areas of the world. IGR NNC RK started to transfer historical analog seismograms containing nuclear records into digital form in 2005. Digitizing technology was developed, information about stations parameters, recording equipment and sources was collected. Up to the present moment more than 3000 seismograms of nuclear explosions conducted since 1961 and recorded at regional and teleseismic distances were digitized. Currently the created database is efficiently used to solve different investigative tasks of seismology: to improve and test nuclear tests monitoring technologies, to develop new methods of nuclear explosions identification, to enhance accuracy of its parameters evaluation, to calibrate stations of the CTBTO International Monitoring System, to precise regional travel-time curves, to investigate lithosphere and asthenosphere structure at the regions of nuclear tests conduction, to investigate geodynamics and consequences of underground nuclear explosions influence on medium.

T5-P17. Identification of industrial blasts in seismic bulletins for Kazakhstan Territory

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Currently the territory of Kazakhstan possesses large amount of mineral deposits developed by industrial blasts; total number of blasts recorded by seismic stations reaches several thousands per year. The explosions yield at the most quarries is from 15 to 40 tons, but at individual large quarries the average yield may reach 100 and 200 tons, and maximal explosion yield may reach 600 tons. The IGR NNC RK solves the task of identification of seismic events nature in order to distinct between industrial blasts and earthquakes on two directions: scientific investigations on development of discrimination techniques of quarry blasts by seismic records, search of discriminators and criteria, field works on investigating industrial blasts at active quarries and other facilities with creation of a database of industrial blasts and atlas of ground-truth explosion records. Special attention is paid to search of ground-truth explosions for which accurate parameters explosion, explosion coordinates at an individual quarry and corresponding records of a station are available. Data of ground-truth explosions are used to investigate velocity characteristics of geological medium, to enhance events localization accuracy and test

abilities of monitoring stations networks. In 2010 the IGR NNC RK under financial support of AFTAC conducted an experiment on recording several chemical explosions on the territory of quarries located in Western Kazakhstan. The explosions were recorded by permanent and temporary station networks. The précised travel-time curves for this Kazakhstan region were received.

T5-P18. Creating a seismic network and knowledge through collaborations, training in Zimbabwe

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"Education is the most powerful weapon that you can use to change the world" Nelson Mandela once said, so I believe there is need to carry out capacity buildings in developing countries for the global development of Seismology and continuous operation of the earthquake monitoring system. Success and sustainability of a seismic network depends on addressing local needs, developing partnerships' and collaborations in research. There is need for greater collaborations in the funding of setting up of more seismic stations in Zimbabwe since currently two stations are working There is a greater need for an increase in our station network in Zimbabwe in this era of global climate change as more data is needed for basic research into the earth's structure. Modern seismology also involves monitoring nuclear explosions and earthquake disaster risk reduction. An increase in the seismic stations/ networks is needed locally, regionally and globally in order to improve earthquake and nuclear explosions monitoring. Regular trainings are also needed to acquire skills to operate the seismic network and to fully utilize the data. This would create a system in the organization whereby earthquake monitoring and analysis is done by qualified personnel who can easily monitor the equipment and infrastructure at the same time producing useful, reliable output for sustainable development. Greater opportunities are also available in research areas and collaborations would be greatly appreciated using the available data (MATP-CTBTO).There is greater need for CTBT and us (NDC) to determine the potential mechanisms for research collaborations, scientific studies and pilot projects that would greatly enhance capacity building. The results would be used to alert and inform the public, government, nongovernmental organizations on seismic hazard analysis and the mapping of earthquake hazards in Zimbabwe. Support and collaborations in research would contribute to the development of policies and mitigation practices that would help to reduce the effects of the seismic hazards. The booming sector of construction and mining would greatly benefit as seismic and aseismic areas would be demarcated and mapped and also building codes would be made. A viable earthquake monitoring system would produce information on earthquake locations, size and would help in the rapid dissemination of information and the prompt estimation of the loss due to the disaster.

T5-P19. IMS sustainment for an operational, reliable and credible IMS - a close coordinated and joint effort achievable goal

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The International Monitoring System (IMS) is to consist of 321 monitoring facilities, scattered around the globe, of four different technologies.
But how to ensure that this global network remains operational, reliable and credible?
The entire life cycle of a system goes from conceptual design, installation/fabrication to operation & maintenance until disposal. This is commonly referred to as through life sustainment of a system. Planning for optimal and cost effective sustainment of any system always requires efficient cooperation by all involved in the various life cycle stages.
Specifically to the International Monitoring System (IMS), the Treaty has been created as a universal Treaty of unlimited duration. Accordingly, the IMS is intended to exist in perpetuity. Ownership and responsibilities as detailed in the Treaty add another level of complexity which makes it even more important to clearly plan and secure sources of support with an unequivocal common goal in mind.
Currently, the PTS which monitors and manage the network centrally in Vienna, establishes contracts with several facility operators. Equipment support contracts are also established with major equipment vendors and Facility Agreements (FA) are established with every countries hosting IMS facilities.
This paper details the various sources of support involved in sustaining the IMS, concentrating on their specific roles in achieving the common goal of Ensuring the highest level of data availability from the IMS, and attempt to draw conclusions as to their efficiencies and possible way forward to ensure that the IMS remains operational, reliable and credible.

T5-P20. IMS sustainment – Modeling and logistic support analysis – from theory to reality sustainment

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The International Monitoring System (IMS) is to consist of 321 monitoring facilities, scattered around the globe, of four different technologies, design, equipment types and environments.
Still, this network is expected to reach extremely high level of reliability, 98% for waveform technologies and 95% for radionuclide. Minimum operational downtime is therefore the ultimate goal at optimal costs.
As of today, the network is over 80% certified and operational and is comprised of more than 15,000 items from over 2,500 different models in XX different countries. Support scenarios can therefore not be left to inspiration of the moment. Supportability data from various sources such as reliability information from the equipment vendors, historical field data, failure analysis, etc will be used to produce support scenario simulations, network and stations modelizations, failure probabilities, hypothetical repair and shipping times, and so on, with the objective to increase our confidence in all possible support scenarios and our ability to react in a timely manner.
Result of such simulations will be instrumental in validating the Integrated Logistic Support (ILS) strategy, the Engineering Design and associated redundancy requirements and ultimately the overall Network effectiveness and capability.

T5-P21. ORFEUS: Facilitating seismological observatory cooperation and open data access

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ORFEUS (Observatories and Research Facilities for European Seismology; www.orfeus-eu.org) coordinates the seismological observational research infrastructures in Europe and its surroundings and promotes open data access.
Consequently, ORFEUS is the core seismology partner in the European Research Infrastructure initiative EPOS (European Plate Observing System: www.epos-eu.org).
We will present five aspects of ORFEUS and its data center operations. First, the Virtual European Broadband Seismic Network (VEBSN), coordinated by ORFEUS, is a consortium of seismological observatories (currently 54 networks and more than 500 stations), which agree to exchange real time (or close to real time) data for observational and long-time archiving purposes; this concept facilitates efficient data access for research. Secondly, the European Integrated waveform Data Archive (EIDA), based on a data transfer protocol ArcLink, aims at linking together large data archiving facilities (currently four) and providing the user with one data access interface. Thirdly the EC-project NERA (www.nera-eu.org; grant 262330), managed by ORFEUS integrates the seismological and the acceleration observational research infrastructure relevant for the seismological and earthquake engineering communities in Europe. Fourthly, ORFEUS implements new innovative data access facilities based on web services and portal technologies in collaboration with the EMSC. The seismic data portal (www.seismicportal.eu) provides the first step of this initiative well coordinated globally with other similar initiatives. Finally, data quality management: ORFEUS and its networks develop efficient tools for automatic quality control (QC). Diverse networks, equipment, operators, real-time data transfer, incomplete data information, etc all hamper data quality. We will present a short concise overview.
All this work is done in collaboration with the ORFEUS, VEBSN and NERA participants.

T5-P22. Cooperative seismology between Michigan State University in the USA, and Russia

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Michigan State University in the USA, and several seismic networks and institutions in Russia, primarily in the east, have been cooperating in seismology for over 20 years. Our cooperative program has produced a large seismological database, and the most complete seismicity map of eastern Russia. One main focus is the improvement of hypocenter determinations and the acquisition of high quality GT data. We have recently determined GT0 or GT1 locations for all PNEs that were conducted in Yakutia. For about half of these PNEs, published coordinates were seismically determined, and we find that the locations move about 7 km on average to the new GT0 or GT1 location. We are actively researching a new set of GT determination criteria for use with the seismological data of eastern Russia. In this region, most recorded seismological phases reported are secondary Pg and Sg (Lg onset) phases, which are not compatible with the GT criteria established by Bondar. With the assistance of mining companies in the Magadan region, we record blasting at both permanent and temporary seismic stations, and analyze the data in the same manner as earthquakes, with particular attention to secondary phase time picks. Subsequently, through statistical methods applied to varying recorded phases and station distributions, we determine a set of rules for GT classification of events.

T5-P23. Processing results from the infrasound campaign in the Eastern Mediterranean

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In its effort to improve the knowledge on infrasound technology and extend its worldwide collaborations, the PTS has proposed to conduct an experiment in the eastern Mediterranean region during the winter months, when the different weather patterns favor observation in Middle-East and Central Asia. The PTS invited interested Member States to collaborate on this experiment and encouraged capable organizations to deploy sensors to observe the explosion at various distance ranges and azimuths. Two controlled atmospheric events of known energy release were conducted in the Eastern Mediterranean in January 2011. The first event was carried out on 24 January 2011, with an energy release of 8 tons of TNT equivalent. The second event was carried out on 26 January 2011, with an energy release of 80 tons of TNT equivalent.
The infrasonic waves produced by the largest explosion were detected by the 3 IMS infrasound stations IS31 (Kazakhstan), IS46 (Russia) and IS34 (Mongolia) at distances up to 6,250 km. Seismoacoustic signals were also detected by the regional auxiliary IMS seismic stations (EIL, MMAI and ASF). The event produced by the second explosion appeared in the standard products of the IDC.
In addition to the IMS network and in order to better record the infrasound signals at local and regional distances, a large scale deployment was carried out, which deployed over twenty temporary infrasound arrays in over fifteen countries. This collaborative undertaking included over fifty participants from over twenty countries.
This large scale collaborative effort also provided an opportunity to build knowledge and understanding of infrasound technology. The scope of this work is to present the results of the processing and analysis from the infrasound campaign. These results will allow to better understand the propagation of infrasonic waves produced by explosive sources. It will also help to improve the calibration of the infrasound sensors and the enhancement of processing algorithms.

T5-P24. Regional infrasound observations from the Sayarim 2011 experiment

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A large-scale experiment, designed to test and calibrate the IMS infrasound network, was conducted in January at the Sayarim Military Range in Israel. The experiment consisted of two explosions, of 10t and 100t TNT equivalent. The explosions were carried out by the Geophysical Institute of Israel under contract to the CTBTO Preparatory Commission.
The 10t explosion took place on 24 January at 1217 UTC, the 100t explosion took place on 26 January at 0917 UTC. Infrasound arrays were installed throughout the region to record the signals received from the explosions.

This presentation will focus on the regional recordings in Israel. In Israel, complicated waveforms with stratospheric and thermospheric arrivals were measured at 307, 330 km and 360 km to the north of the source location. The evolution of the arrival's waveforms and wavefront parameters will be discussed and compared to theoretical predictions that involve atmospheric specifications.

T5-P25. Potentials of using radionuclide monitoring derived-data for scientific research

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One of the CTBTO verification systems is the operation of radionuclide monitoring station for air particulates. The Philippines through the Philippine Nuclear Research Institute operates and maintains such type of verification regimes, RN-52 Station. The station is co-located at the Weather and Radar Station of the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) in Tanay, Rizal, Philippines. RN-52 is a manual station, whose primary function is to provide continuous monitoring of the levels of radioactivity in the air. This involves collection of particulate materials on a filter; performance of gamma spectroscopy to identify radionuclides in the air filter samples and transmittal of raw spectral data using the Global Communications Infrastructure(GCI)to the International Data Centre (IDC) for processing and analysis. The designated operator manually operates the station daily to change the filter and complete the daily routine. Other tasks such as data collection, data formatting and transmission are performed automatically.
This poster will present two ways of possible utilization of air particulates data for conducting scientific studies. One such study is the assessment of the contribution of natural radionuclides in the air particulates to the effective dose estimate of Filipinos. In this study, the concentration of natural radionuclide from the Uranium and Thorium series and Potassium-40 will be source from the RN52 data and will be processed and integrated in the calculations for dose assessment purposes. The other prospective use would be on the measurement of the atmospheric flux of natural radio nuclides such as Be-7 and Pb-210 for the establishment of the inventory of these radionuclides which can be used as tracers of soil movement. The concentration of Be-7 and Pb-210 will be analyzed and a comparative analysis in conjunction with the concentration of these radionuclides in the soil will be made.

T5-P26. Regional cooperation in science and technology capacity building for IMS and CTBT verification regime

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Since the inception of preparatory commission for Comprehensive Nuclear Test Ban Treaty Organisation (CTBTO) in 1996, more States have expressed the willingness to sign and ratify the Comprehensive Nuclear Test Ban Treaty (CTBT). However, cooperation in science and technology capacity building for CTBT verification regime at regional levels and State parties in Africa is slowly growing.
IMS and CTBT verification regime requires that high quality human resources verification technologies are trained and sustained.
PTS as provided in paragraph 43 of CTBT has to effectively operate IMS, IDC, routinely receive process, analyse and timely report on data to the NDCs and regional data centres for verification regime to work. Scientists and civil society need to be encouraged to support the CTBT activities of non proliferation and State Parties have to meet their financial obligations to CTBTO.
Equally too, more human resources in all verification technologies have to be trained where PTS and State Parties should workout comprehensive capacity building programmes aimed at including the all verification technologies courses. Universities and research centres can play a vital role in sustaining information technology support and training. For instance Makerere University in Uganda has now got an infrastructure. PTS needs to negotiate MOUs with Universities and encourage them to offer courses that will create a pool of professionals to support the Treaty on a long term.

T5-P27. Using infrasound data of Nairobi Station (IS32) to study Bubuda landslide in eastern Uganda

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On 1st March 2010 between 12 Pm and 1 Pm of that day, Bududa area on slopes of Mt Elgon in Eastern Uganda was devastated by a catastrophic landslide that buried 300 people and left others homeless. The landslide was triggered by heavy rainfall. The infrasound (IS32) station data from Nairobi was used to study the event. The International Monitoring System (IMS) comprises of monitoring technologies such as seismological, radionuclide, hydroacoustic, and infrasound, supported by communication and certified laboratories infrastructures. Article IV paragraphs 1 and 16-18 of Comprehensive Nuclear Test Ban Treaty (CTBT) calls for establishment of a verification regime consisting of other elements and an IMS and data exchange. The IMS data can be used for research and civil protection. Thus, a request for infrasound data recorded at Nairobi Infrasound station (IS32) for a period of February to March 2010 representing pre-Bududa landslide, Bududa landslide and post Bududa landslide was submitted to International Data Centre (IDC). The data was received from IDC on a Compact Disk (CD) and studied. The landslide history was recorded by IS32 station in Nairobi. Infrasound stations record useful data for landslide studies; however more research and capacity building is needed to improve our models in landslide prediction and early warning systems. These efforts demonstrate the strength of IMS verification technologies in civil protection.

T5-P28. Government initiatives and international cooperation in seismology providing knowledge and training in Namibia

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The Geological Survey of Namibia established a National Seismological Network in 2000 which has expanded to seven seismological stations to date, with a view to improve seismological records and ultimately generate a Seismic Hazard Map of the country. As a signatory of the Comprehensive Nuclear-Test- Ban Treaty (CTBT), the government in cooperation with CTBTO established an International Monitoring Station (IMS) in Tsumeb which monitors nuclear explosions worldwide. Collaborative projects include researches in Geosciences and weather studies with AfricaArray, with the main objective of studying the crustal studies. Walvis Bay Ridge Passive Source and Active Seismic Experiments with German Research Centre for Geoscience (GFZ) wwith a view of understanding the roll of the plume-lithosphere interaction during break-up of the Southern Atlantic Ocean and lithospheric structure of the passive volcanic margin of Namibia. More recently, seismology in schools project in collaboration with the British Geological Survey has been started, with a primary object of encouraging learners to take science as career.

T5-P29. National earthquake monitoring and tsunami early warning system in Thailand

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After the destructive Indian Ocean tsunami in 2004, a National Earthquake Monitoring and Tsunami Early Warning System was developed and established in Thailand at the Thai Meteorological Department (TMD). The system components follow the UNESCO/IOC concept of an end-to-end tsunami warning system which has been widely applied to manage earthquake risk and tsunami hazard. Firstly real time earth observatories and water level stations were installed throughout the country to monitor local and distant earthquakes including the observation of abruptly changing sea water level at the coast in real time .
Currently there are many monitoring stations for automatically detecting earthquakes. The system comprises 40 seismic stations, 9 tide gauge stations, 4 GPS stations including real time input of more than 200 signals from other seismic station networks, one DART buoy from NOAA and 9 tide gauge stations to detect tsunamis. Due to the high capacity of monitoring system, within few minutes after an earthquake automatic analysis will give results of epicentre, then information and warning messages will instantly notify assigned channels and lists (via SMS , Fax, Web site, TV, Radio , Siren tower etc). All people in the risk area would continuously be alerted and follow the further official warning messages as they have practised in advance. In addition, coordination among agencies concerned, such as UNESCO/IOC, USGS, JMA, CTBTO, IRIS, AEIC have been involved for sharing data and information. Measures and management of earthquake and tsunami disaster at the national level, international level or regional level have been developed in order to save lives and properties in the future.

T5-P30. Science, technology and values in the context of global threats

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Even though it is not yet in force, the Comprehensive Nuclear Test Ban Treaty, which was approved by a significant majority of the United Nations General Assembly in 1996, is an impressive achievement. It shows that nations are prepared to renounce some part of their own self-interest in favour of an international agreement aimed at preventing harm to the world's population as a whole. By contrast, international agreement on implementing ways to slow down (and eventually reverse) anthropogenic global warming, which stands to inflict considerable harm on much of the world's population, is proving difficult if not impossible to achieve. The questions posed in the first part of this paper are: To what extent can the success of the CTBTO serve as a model for getting nations to collaborate on slowing global warming? Which differences between the two situations would militate against the CTBTO's being a viable model?
The larger question raised by this issue concerns the role played by values in the transitions between science and technologies and their deployment and use. Since the atomic bombing of Hiroshima and Nagasaki, the 'neutrality of science' argument (which claims that scientists who do the ground-work for lethal technologies can remain morally blameless) is no longer plausible. What kinds of life values are relevant in this context, and how can they alleviate our insistence on using technologies that stand to harm rather than enhance human life on the planet?

T5-P31. Large-scale explosion sources at Sayarim, Israel, for infrasound calibration of the International Monitoring System

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Recently two large-scale calibration explosions were successfully conducted by the Geophysical Institute of Israel (GII) at the Sayarim Military Range, Negev desert, Israel, on 24 and 26 January 2011. The experiment included two on-surface explosions of 10 tons and 100 tons of ANFO explosives, conducted in different time of the day. The explosives were assembled as a pyramid/ hemisphere on the soft sediment surface, and detonated upward. Near-source high-pressures in airshock waves were measured, and preliminary results correspond to expected peak-pressure values for these charges.
The experiment was a collaboration between the CTBTO in Vienna, Middle East and European countries and the USA. The main goal of this calibration experiment is to provide fully controlled infrasound sources (the strongest since the establishment of the IMS network), monitored by extensive observations for calibration of IMS infrasound stations in Europe, Middle East and Asia. The experiment is intended to contribute to the understanding of the infrasound propagation in the atmosphere, under winter conditions and improve IMS monitoring capabilities. The infrasound signals from the 100 tons shot were observed at IMS infrasound stations in Russia, Kazakhstan and Mongolia up to a distance of 6,250 km.
GII conducted a previous calibration explosion of a similar yield at the same Sayarim site in August 2009 under summer weather conditions. Clear infrasound signals were recorded at that time at many regional and IMS stations to the West and North-West, up to a distance 3,500 km, near Paris, France. This pair of large-scale explosions in different seasons (weather patterns) demonstrated clear favorable westward and eastward propagations. An extensive dataset of audio-visual, acoustic, seismic and infrasound records was obtained at wide range 0.1-6,250 km, based on broad international cooperation in observation of these explosions.

T5-P32. Problematics of the remote consequences of influence of amazing factors of the nuclear weapon on direct participants of military-nuclear actions

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T5-P33. Partnership in multidisciplinary research in earth and polar sciences: the contribution of the European Science Foundation

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The current year is a key milestone for the European Science Foundation with the culmination of several scientific initiatives.
In this framework, it is of paramount importance to encourage coordination of policy, strategy and governance of new opportunities for interdisciplinary scientific research in several frontier areas.
The Life, Earth, Environment and Polar Sciences Unit of the European Science Foundation has a special focus on Earth Sciences and science in Polar Areas.
The mandate of the Life, Earth, Environment and Polar Sciences Unit inside ESF makes it especially tailored to develop a close interaction with CTBTO, being a natural playground to facilitate the partnerships and knowledge exchange between the CTBTO and the broader scientific community working in areas related to the four CTBTO's monitoring technologies.
Some examples of coordination of networking activities and potential links with a number of
CTBTO activities will be provided.

T5-P34. Inter-university platform for acquisition, sharing, and processing seismic data

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The record of geophysical data takes place, often, in remote locations. These sites are distant from each other, in places of difficult access and far from urban centers. In order to process and analyze this data, it must be transmitted from remote sites to one or more processing centers. The data can be transmitted via radio, satellite, microwave, etc. The difficulty is that these channels of transmission are not always allowed considering the location of the remote sites and/or the cost of the transmission.
An alternative option is to transmit data via cell phone. The data can be transmitted using a modem from the remote site through a wireless carrier, eventually via Internet to a data center and then redistributed to one or more additional data centers, in order to perform the analysis of data in real time.
This work outlines the feasibility of using cellular phones and Internet for transmission of geophysical data. The first phase corresponds to the homogenization of the formats of seismic data of three regional seismic networks in Colombia (South America): the Network of the Seismological Observatory of the University of Quindio, the Seismological Network of Bogota, and the Network of Seismological Observatory of Colombian Southwest, in order to transmit the data from remote seismic stations to the Data Centers and exchange data between these centers by using RENATA network (RENATA-"Colombian National Academic Network of High Technologies", which is a member of CLARA-"Latin American Cooperation of Advanced Networks").
Sharing data between these networks will allow to process the data simultaneously in 3 data centers, applying different algorithms, whose results will lead to a better understanding of the particularities of the records, which will allow to characterize the seismic regime in the region, and to distinguish between different kind of (natural or artificial) events.