1. THE EARTH AS A COMPLEX SYSTEM

Conveners:

IVAN KITOV
International Data Centre
CTBTO

ROBERT G. PEARCE
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PAUL G. RICHARDS
Lamont-Doherty Earth Observatory
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Invited Speakers:

ELISABETH BLANC
Commissariat à l'Energie Atomique (CEA), France

CATHERINE DEGROOT-HEDLIN
Scripps Institution of Oceanography, Univesity of California, United States of America

EMILE OKAL
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ORAL PRESENTATIONS:

T1-O1. Infrasound: from explosion monitoring to atmospheric studies and climate

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This presentation reviews the scientific work performed, in the infrasound topic, in relation with the Earth system. This work has been undertaken to better understand the atmospheric effects which control the infrasound propagation. First studies, using as source, supersonic aircrafts, volcanic eruptions and ocean swell, allowed to determine the infrasound deviation produced by the stratospheric winds and then to improve the localization precision.
However, the precision of atmospheric models is not sufficient to explain all observations. Recent work shows that small scale disturbances and gravity waves significantly increase infrasound reflections towards the ground. New atmospheric tomography studies extract atmospheric parameters from infrasound signals to improve the atmospheric models. Detection capability maps are computed to predict the detection conditions everywhere in the world. Ground trust events as explosions, volcanoes, meteorites, are intensively used to validate the simulations. Dense acoustic and seismic networks are developed at a semi-continental scale for a better description of sources and propagation. The Eyjafjallajökull eruption on April-May 2010 was recorded by many infrasound arrays across Europe, revealing the source dynamics of ash eruptions. New projects proposing infrasound monitoring of the ash clouds present a large interest for aircraft safety. Large scale atmospheric waves play a key role in atmospheric mixing and atmospheric global circulation. Their assimilation in the atmospheric models is needed to improve the prediction of tropospheric weather and climate. Observations of the atmospheric dynamics by infrasound, Lidar and airglow layer networks are proposed by the ARISE project, opening new challenging studies in relation with climate.

T1-O2. Rupture dynamics of large earthquakes inferred from hydroacoustic data

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Within the past decade, hydroacoustic arrays have been installed as part of the IMS (International Monitoring System), allowing for unprecedented observations of megathrust earthquakes occurring at subduction zones along continental margins. Each array consists of three hydrophones moored at the ocean sound speed minimum depth, configured as a triangle with sides of approximately two kilometers in length, allowing for accurate estimation of the receiver to source azimuth. Data from IMS hydrophones have been used to analyze the rupture dynamics of three large earthquakes: the December 2004 Sumatra-Andaman and March 2005 Sumatra events caused by subduction along the Sunda Trench, and the February 2010 Chilean rupture. For the first event, hydroacoustic arrivals with durations up to thirty minutes were recorded at three locations within the Indian Ocean. Analysis of a series of short time windows within the coda shows that the apparent source of the hydroacoustic energy moved northward along the Sunda trench, tracking event rupture. The data imply that the rupture proceeded in two distinct phases; initially it progressed northwest along the Sunda trench with a velocity of approximately 2.4 km/s for 600 km, then slowed as it propagated further to the northwest. For the second event, the rupture proceeded southward for several hundred kilometers. For the final event the sole recording hydrophone array was located in a sound shadow with respect to part of the rupture zone. However, it recorded hydroacoustic arrivals for over 30 minutes prior to its total destruction by the tsunami generated by the rupture.

T1-O3. Extracurricular geophysics, or tsunamis in the complex earth system

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Over the past seven years, two catastrophic tsunamis, the 2004 Sumatra and 2011 Tohoku events, have made this Japanese idiom a worldwide household word. In addition, since the Sumatra disaster, no fewer than 10 additional tsunamis have provoked damage and death along the shores of the Pacific and Indian Oceans, on a scale unrivaled since the 1960s. The considerable progress in instrumentation across many disciplines of science and engineering has allowed recording of tsunamis on an unprecendented scale, occasionally by instruments which had not been designed for this purpose. Such records often illustrate a form of weak coupling between two intrisincally different media (e.g., the ocean, the solid Earth, the atmosphere), which requires exceptionally large sources to be clearly observed. In turn, they provide insight into the nature of such effects and of the physical agents controlling the coupling. The examples which we will examine include tsunami records by land-based and ocean-bottom seismometers, hydrophones, infrasound stations, magnetometers and GPS arrays, as well as perturbations they induce in the optical properties of the atmosphere. Some of these observations lend

themselves to reasonably accurate quantification, and could thus lead to fascinating suggestions in terms of improving tsunami warning procedures, even though such endeavors obviously face phenomenal challenges.

T1-O4. Monitoring of explosive volcano eruptions in Kamchatka and the Kuriles Islands on acoustic data from IMS and KBGS RAS stations

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On the Kamchatka peninsula, an IS44 acoustic station, located at the observation site Nachiki (NCHK), was installed for monitoring of unauthorized nuclear explosions (IMS). The Kamchatka Branch of the Geophysical Survey the Russian Academy of Sciences (KBGS RAS) operates a station, located at the observation site Paratunka. These stations monitor large explosive eruptions from Bezymianny, an andesitic type of volcano, which is located at a distance of over 361 km from NCHK station. This paper presents the study of kinematic and dynamic parameters of signals accompanying the 2009—2010 eruptions of Bezymianny. Wave disturbances that accompanied the December 16, 2009 eruption produced an impulse-type signal likely related to a powerful lightning stroke that occurred during the formation of an eruptive cloud. An explosive eruption of Kizimen, an andesitic type of volcano, took place in early 2011. Wave disturbances from this eruption were recorded at both stations.
It was noted that a low-frequency discharging phase of over 60 s occurred at the early recorded acoustic signals accompanying large eruptions of andesitic volcanoes. Apparently the discharging phase occurred due to the rapid condensation of superheated juvenile vapor being ejected to the atmosphere during strong explosions.
An effort has been made to add acoustic channels at the KB GS RAS seismic telemetry stations located next to the volcanoes in order to record infrasound signals in close proximity to the source.

T1-O5. Civil applications of CTBT verification software and technologies: Volcano eruption in Iceland

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In April and May 2010 the eruption of the volcano Eyjafjallajökull in Iceland substantially affected the European airspace, causing a high economic impact. During this event, the Austrian Meteorological and Geophysical Service (ZAMG) was able to set up a volcanic ash modeling system within a few hours. This could only be achieved due the experience gained during the annual NDC Preparedness Exercises. To simulate the ash plume the atmospheric transport (ATM) model FLEXPART was applied in a configuration similar to the one used by the PTS. To visualize the results of the atmospheric transport modelling (ATM) the software-Package WEBGRAPE developed by the PTS was utilized. Austria was among the first countries reacting to the volcano eruption and provided model results to the national aviation authorities for decision making. A comparison with monitoring results showed a very good model performance.
Beside ATM that is important to forecast plume propagation, data from the CTBTO/IMS Infrasound monitoring network is important to detect eruptions and to monitor the volcanic activity. In a recent study, signals were investigated during the eruption period and compared with the source information of the Volcanic Ash Advisory Center (VAAC) in London.
Generally, the volcano event in Iceland can serve as an example of the usefulness of CTBTSoftware, IMS-Data and NDC preparedness regarding civil applications in the field of disaster management.

T1-O6. Determination of an uncertainty radius for back tracing infrasound signals to source caused by atmospheric wave activity

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Infrasound propagation in the atmosphere strongly depends on the dominant temperature and wind structure. For modelling purposes these parameters are usually determined using a combination of climatologies and numerical weather forecast models. However, climatologies and numerical weather forecast models are not able to adequately represent gravity wave signatures. Even planetary wave activity is only included in parts in climatologies. But gravity and planetary waves are usually very variable in time and space and can make up differences of several ten Kelvin in the middle and upper atmosphere leading to an incorrect source determination when tracing back the infrasound signature.

A concept for the determination of an uncertainty radius around the infrasound source is presented relying on a near-real time consideration of wave signatures. A first case study for infrasound propagation modelling based on ERA-40 and TIMED/SABER temperature measurements covering the middle atmosphere is shown.

T1-O7. Argon 37: What is the suspicious threshold activity in soil air?

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The radioactive noble gas Argon-37 has a high potential for on-site inspections (OSI) under the Comprehensive Nuclear-Test-Ban Treaty (CTBT). The characterisation and understanding of natural background concentrations in soil air and their controlling factors are the basis for an unambiguous identification of artificially elevated values. In the talk a review about production, release and transport of Argon-37 in the shallow subsoil is given.

T1-O8. The South Sarigan submarine volcanic eruption, May 2010: an example of International Monitoring System waveform data synergy.

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Three waveform technologies are utilized within the International Monitoring System (IMS) of the Comprehensive Nuclear-Test-Ban Treaty Organization: seismic, hydroacoustic and infrasound. Integrating data from combinations of the three technologies is useful for identifying and characterizing sources close to the interfaces between the solid earth, ocean and atmosphere. This synergy is clearly illustrated by an analysis of the south Sarigan (16.6N, 145.8E) submarine volcanic eruption in the northwest Pacific during May 2010. A detailed chronology of the volcanic unrest, lasting approximately 2.5 days, can be constructed from recordings at IMS stations. The earliest signs of volcanic activity consisted of repeating swarms of impulsive hydroacoustic signals recorded at a range of over 2200km (H11, Wake Island). As the eruption progressed the swarms of activity become more closely separated in time and larger in signal amplitude, allowing associated seismic signals to be identified at teleseismic distances. During the climactic phase of the eruption, contemporaneous with reports of a 12km high volcanic plume, infrasound was also generated and recorded at a range of 1580km (IS39, Palau). The identification of associated infrasound suggests that the eruption at this time had both submarine and subaerial components. This study shows that the IMS can provide excellent data which can assist in monitoring volcanic activity and understanding volcanic processes in largely inaccessible and poorly monitored submarine environments.

T1-O9. Next-level shake zoning for modeling seismic-wave propagation in the U.S. Intermountain West

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A multi-institutional collaboration is developing "Next-Level ShakeZoning" procedures tailored for defining potential earthquake shaking and hazards across the many geologic basins of the U.S. Intermountain West. These procedures include deterministic modeling of seismic wave propagation through detailed regional 3-d geologic models. The 2008 Wells and Mogul events in Nevada showed in particular that a generalized statistical approach, as taken by the USGS ShakeMap tool, cannot match actual data on shaking from earthquakes in the Intermountain West, even to first order. Next-Level ShakeZoning relies on physics and geology to define earthquake shaking hazards, rather than statistics. Excellent new data sets are now available for parts of Nevada. Clark County, Nevada has completed the very first effort in the U.S. to map earthquake hazard class systematically through an entire urban area, resulting in an unprecedented 10,721 geotechnical site characterizations over a an area of 500 square miles. Using the new Parcel Map in computing shaking in Clark County for scenario earthquakes is crucial for obtaining realistic predictions of ground motions. In an educational element of the project, a dozen undergraduate students are computing 50 separate earthquake scenarios affecting Las Vegas Valley, using the Next-Level ShakeZoning process. Despite affecting only the upper 30 m, the Vs30 geotechnical shear-velocity from the Parcel Map shows unexpectedly large effects on even the longer-wavelength 0.1-Hz to 1.0-Hz shaking predictions. The detailed geotechnical data, with the fully 3-d Next-Level ShakeZoning scenarios, show many areas of shaking amplification and de-amplification that traditional 1-d methods cannot predict.

T1-O10. Ground motion studies for critical sites in north-east Bangladesh

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Seismic sources in and around Bangladesh are capable of causing major earthquakes. The northeastern region of Bangladesh, separated from the rest of the country by the mighty rivers Jamuna and Padma, can be affected by large magnitude earthquakes in different fault zones. According to Professor Bruce Bolt, the 1885 magnitude 7.0 Bengal earthquake originated within this region. This paper utilizes comprehensive and systematic seismic hazard assessment studies to assess probable ground motion at two critically important sites in this region: (i) 4.8 km long Bangabandhu Bridge over Jamuna river and (ii) proposed nuclear power plant site at Rooppur. The Bangabandhu Bridge has been designed for major ground shaking and uses earthquake protection devices. The country's first nuclear power plant is planned to be constructed at Rooppur on the banks of Padma river. An up to date earthquake catalogue has been formed up to 2009 incorporating historical earthquakes and using data from various sources. As part of the study, attenuation law describing attenuation of ground motion within Bangladesh has been developed by the authors from isoseismals of major earthquakes and compared with other attenuation laws. Using multiple seismic source zoning and standard probabilistic hazard assessment procedures, the peak ground acceleration is estimated at the two sites for different return periods. The site effect of surface soil is studied considering one dimensional vertical wave propagation and equivalent linear model for soil. Results obtained for Jamuna bridge site are compared with design earthquake spectrum used for the seismic design of the bridge

T1-O11. Prediction of aftershocks distribution using artificial neural networks

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In this paper an approach is presented to predict the concentration and the trend of aftershocks of earthquake. The method is based on inputting first aftershocks to Kohonen artificial neural network. Artificial neural networks, which are inspired from human brain, consist of several artificial neurons which are connected with some weight vectors to each other. Artificial neural networks are able to classify a large volume of input data (i.e. earthquake catalogue) simultaneously and in parallel, and can recognize seismic patterns very well. Kohonen neural networks consist of several neurons that effect mutually on each other to display important statistical characteristics of the input space (i.e. first aftershocks). Combination of associative and competitive learning rules results in formation of Kohonen's self-organizing feature map (SOFM) algorithm. SOFM algorithm has converged; the feature map computed by the SOFM algorithm indicates that concentration and the trend of aftershocks precisely. Kohonen artificial neural networks have become powerful intelligent tools in recent years, used widely in pattern recognition and data clustering.

T1-O12. Neural classification of infrasonic signals from hazardous volcanic eruptions

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Large volcanic eruptions radiate infrasonic signals which can be detected by the global infrasound array network and used for early warning to the aviation industry. The Acoustic Surveillance for Hazardous Eruptions (ASHE) team performed detailed studies of the 2006-2010 eruptions of Tungurahua volcano and prototyped real-time eruption notification systems for evaluation by the DC Volcano Ash Advisory Center (VAAC). The International Civil Aviation Organization (ICAO) and World Meteorological Organization (WMO) gave a positive evaluation of the ASHE project during the 2010 International Airways Volcano Watch Operations Group (IAVWOPSG 5) coordination meeting. They requested that an ad hoc working group consisting of the IAVWOPSG Members of Australia, Canada, France, Japan and New Zealand (a) examine the development and testing of a prototype, real-time "significant" eruption notification system for the VAACs, (b) pursue the collaborative work between VAACs and CTBTO, and (c) report back to the IAVWOPSG/6 Meeting (Senegal, Fall 2011). Thus one of our primary technical aims is to evaluate and reduce false alarm rates. Using a training data set consisting of well-characterized infrasonic eruption signals, Florida Tech developed neurocomputing signal classification

algorithms that can identify hazardous eruptions and supplement existing array signal processing methodologies. The neurocomputing approach also permits an assessment of the classifier performance through receiver operating characteristic (ROC) curves. In this work, our international team seeks to extend this prototype signal classification algorithm to other events of interest with the objective of reliably identifying "significant" eruptions.

T1-O13. Seismicity and seismic hazard assessment of the arid western regions of South Africa

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There are two nuclear reactors in South Africa, a research reactor at Pelindaba near Pretoria and a power-generating reactor at Koeberg near Cape Town. High level radioactive waste (HLW) in the form of spent fuel is currently stored in the designated spent-fuel pools on the Koeberg site. The shorter lived, low- and intermediate-level waste (half-life ≤31 years) is sent to the Vaalputs National Radioactive Waste Disposal Facility in the Northern Cape Province, currently managed by the South African Nuclear Energy Corporation (Necsa).
According to the Radioactive Waste Management Policy and Strategy for the Republic of South Africa it is prudent to begin gathering the data needed to assess future HLW disposal sites, and explore other options like the reprocessing of spent nuclear fuel.
Site selection criteria for a nuclear waste disposal site include proximity to settlements, agricultural potential of land, geological stability and seismic activity. This study will make a detailed investigation of the seismic activity in the arid western region of South Africa, as this region is likely to prove suitable, in principle, for the disposal of radioactive waste.
The current Necsa seismic database shows that the Vaalputs site is seismically stable, yet there has been sporadic seismic activity in Namaqualand with swarms in 1996, 2001, and again (near Augrabies) in 2010. The network will be used to assess the reliability of the reported magnitudes, to define active faults and seismotectonic zones, and to derive seismic source mechanisms. This will yield more accurate seismic hazard assessments.

T1-O14. Crustal thickness and average VP/VS ratio variations in northern Viet Nam from teleseismic receiver function analysis

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A 24-station broadband seismic array was installed in northern Vietnam since December of 2005. High quality data were collected from this array observation. In this study, we use the teleseismic receiver function technique to determine the crustal thickness and Vp/Vs ratios beneath each station and map out the lateral variation of Moho depth under northern Vietnam. The best estimations of crustal thickness and Vp/Vs ratios are found when the three converted phases (Ps, PpPs and PpSs+PsPs) are stacked coherently. By stacking receiver functions from different distances and directions, effects of lateral structural variation are suppressed and an average crustal model is obtained. The best estimation of crustal thickness from 24 broadband stations beneath the northern Vietnam area is 30.8 km on average and varies from 26.5 km to 36.4 km. A thinner Moho is found in the Red River delta with depth variation from 26.5 km to 29.5 km. The northwestern part is represented by deeper Moho which varies from 30.5 km to 36.4 km, under Nui Con Voi Range suture, the Moho depth is deepest that ranging from 33 km to 36.4 km. The Moho is found to be relatively flat in the northeastern part beneath this array, those values are about 29km to 32 km. A new relationship between Moho depth and Bouguer gravity anomaly was proposed for northern Vietnam. A Vp/Vs ratio on average is found to be 1.71, with higher ratios of 1.70 to 1.82 in the northwestern part and lower ratios of 1.64 to 1.70 in the northeastern part and Red River delta. The higher ratios in the northwest may suggest ductile phenomena in the lowermost crustal layer and the lower ratios are probably related to a general absence of mafic lowermost crustal layer beneath northeast and Red River delta areas.

T1-O15. Scattering and intrinsic attenuation structure in Central Anatolia, Turkey using BRTR (PS-43) array data

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We attempt to obtain the attenuation structure in the region of Central Anatolia (Turkey) analyzing about 250 local earthquakes recorded with the IMS primary array station BRTR (PS-43). We have applied Coda Normalization method for the measurement of Qs-1 as a function of frequency. Additionally Multiple Lapse Time Window Analysis (MLTWA) method was applied in order to get a better picture of the crustal structure and the seismic hazard of the region. MLTWA method allowed a separation between the intrinsic attenuation and scattering attenuation. Preliminary results show a relatively low attenuation compared to western and eastern anatolia regions. A study of the regional and site attenuation of seismic waves of earthquakes in this area will contribute in predicting earthquake generated ground-motion and becomes vital in making decisions for earthquake regulations and building codes and also may improve signal interpretation in order to contribute to the verification system.

T1-O16. Detection of earthquake hazard in southwest peninsular India – Spurt of various unusual geological incidents

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The mounting prototype of seismicity in Kerala together with sudden surge of various unusual geological incidents during 2001 swell over a huge area in a 550 km long segment trending northwest-southeast clearly designate towards the unstable state of the crustal block in this part of the peninsular shield. It seems that the incident of sudden spurt and slaughter of sequences of incidents are the surface manifestation of entrenched tectonic activity which have caused possibly due to change in stress regime by the process of redistribution of stresses along certain active fault in central Kerala region. The series of strange geological incidents have occurred all the way through the Kerala State (Southwest Peninsular India) for the period of the year 2001 mainly in two active phases i.e. February to March, and June to November 2001. This argument is also supported by the sequential patterns of cumulative number of incidents with time. In the beginning during February-March 2001, oscillations and rise in water levels, wavy formations and spouting up of water in the open wells, cracks in the buildings, perceptible ground fissures, shaking of trees/bushes and enhanced micro-earthquake activity have occurred. Collapse of shallow open wells, draining of water, lowering of water level, land subsidence, ground fissures etc., and further increased microearthquake activity were the prevailing incidents in various parts of the State during June to November 2001. Interestingly, no such incidents had occurred in the past in this region. The rate of recurrence of all the above incidents, including micro-earthquakes activity, reduced considerably to background level beyond November 2001 except a few earthquakes during 2002 and 2003. This parade of incidents was preceded by two moderate size earthquakes of M~5 on 12 December 2000 and 7 January 2001 which were not capable to trigger such widespread incidents in the region. Using the spatial distribution of these incidents including micro-earthquake activity and past significant earthquakes, an east-west trending potential area (10.7-10.9 oN; 76.0-76.8 oE) is delineated in the central Kerala region as the preparatory zone for the location of future earthquake

T1-O17. Upper crust structure under CTBTO station «Petropavlovsk-Kamchatsky» by endogenic microseismic activity

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CTBTO station «Petropavlovsk-Kamchatsky» includes PS36, IS44 and RN60. Primary seismic station PS36 consists of an 11-element array and one CRF, which receives data from the remote collection arrays and transmits it to IDC (Vienna, Austria). PS36 is located in central part of Kamchatka peninsula in the area with low human activity. At early stages, emplacement of large intrusives and an intense Paleeeogene-Neogene hydrothermal activity were associated with this zone. Fractures of this zone control outflows of the Nachikinsky hydrothermal deposit in near-field region of PS36. For investigation of crust structure we used microseismic emission as sensitive indicator of the stress distribution in the medium and PS36 as multichannel array. The construction of images of deep noise sources reduces to the analysis of the spatial distribution of their intensity. The method reduces to the estimation of the energy of weak coherent radiation from various points of the medium. For the reconstruction of microseismic emission field, we estimated the measure of the similarity of

seismic signals (Semblace) as a ratio of the signals summarized over all sensors of the group to the sum of the energies of each sensor separately calculated for each sampling point covered by array. To eliminate storm microseisms and local high-frequency surface interferences, band-pass filtering of 2-6 Hz was applied. The most intense anomaly is connected with the position of the Nachikinsky hydrothermal field, corresponded to most fractured zones of rocks. Our results are in good correlation with geological data, magnetotelluric and deep seismic sounding.

POSTER PRESENTATIONS:

T1-P1. Tsunami numerical simulation applied to tsunami early warning system along Sumatra region

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Western Sumatra region is tectonically active region that often lead to catastrophic earthquakes and tsunamis. Disaster is a complicated issue that concerned the community, as happened all of a sudden. In some cases the earthquake that occurred among potential tsunami. Sumatra is an area that often experience a major earthquake recurrence. Historical data shows this region experienced a major earthquake every 200 years. It could be argued that in this period Sumatra region has been in the last cycles, and in the near future will have a potentially major earthquake cause a tsunami. To answer these concerns have developed software to model the tsunami, so that regard when the tsunami disaster will occur and how big run-ups and expansion of the resulting tsunami inundation, could be the arrival time calculation and simulation, it is done by creating a scenarios tsunami modeling before the real tsunami occurs. The scenarios was made as much as possible into a database of tsunami modeling. To generate a tsunami modeling in large quantities will require a variety of mechanisms fault scenarios, subsequently scenarios variations are grouped in segments taken in areas prone to tsunamis, so that the database does not widen. This scenarios is based on the values of fault parameters and modified in such a way as to produce the type of fault models with historical data approach the mechanism of fault conditions in that segment. As another reference to estimate the location of disturbances in these segments, done by observing the deformation history of geological processes and the relative movement of the earth's crust, and in complex cases such as the movement of the double-couple on the plate obtained through the method of calculation analysis. Then do as well the validity of the calculation results with historical data and the results of a survey on the same segment.

T1-P2. Seismic hazard assessment for Zambia and surrounding areas

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Seismic hazard potential for Zambia and surrounding areas was estimated by applying the probabilistic seismic hazard analysis with hazard computed for peak ground acceleration (PGA) in gals for a 10% probability of exceedence for periods of 50 and 100 years. The hazard was computed for grid sites with a grid cell size of 0.25° by 0.25° using Donovan's global attenuation relation and McGuire's EQRISK (1976) hazard computation program. The area covered is bounded by latitudes 6°S-20°S and longitudes 20°E-36°E with seismic data derived from the Eastern and Southern Africa Regional Seismological Database (ESARS-DB).
The results, which have been presented as seismic hazard contour maps, show that high PGA values are associated with seismically active areas of the Kariba dam area and the well defined rift zones of Tanganyika, Rukwa, Malawi, Shire, Urema Trough and the southern extremity of the Eastern Branch of the Eastern and Southern Africa Rift System (EARS). The low to intermediate PGAs correspond to the rest of the study area, the areas of insipient rifting and the regions adjacent to the seismically active areas mentioned above. Within Zambia, the regions adjacent to the seismically active areas have intermediate PGA values. The range of PGA values, from the low around the centre of the Bangweulu Block to the highest around Kariba, is 170-290 and 220-370 gals for the 50 and 100 year periods, respectively. This suggests that Zambia and the surrounding areas are potentially vulnerable to seismic hazard, especially those regions adjacent to and within the seismically active areas. In geological terms, the low PGA values correspond to the stable cratonic nuclei while the intermediate to high PGA values are associated with the mobile belts within the region.

T1-P3. Evidence for infragravity wave-tide resonance in deep oceans

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Ocean tide refers to the oscillatory motion of seawater forced by the gravitational attraction of the Moon and Sun with periods of a half to a day and wavelengths of the semi-Pacific to Pacific scale. Ocean infragravity waves are sea-surface gravity waves with periods of several minutes and wavelengths of several dozen kilometres. We report the first evidence of the resonance between these two ubiquitous phenomena in deep oceans mutually very different in period and wavelength. The evidence comes from long-term, large-scale observations with arrays of broadband ocean-bottom seismometers located at depths of more than 4000 m in the Pacific Ocean. This observational evidence is substantiated by a theoretical argument that infragravity waves and the tide can resonantly couple and that such coupling occurs over unexpectedly wide areas of the Pacific Ocean. Through this resonant coupling, some of ocean tidal energy is transferred in deep oceans to infragravity wave energy.

T1-P4. Hydro-tremors and incidence of ground rupturing in the northern parts of India: A plausible model

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Phenomena of hydro- seismicity caused by the hydrologic triggering of earthquake activity on critically stressed faults have been observed in many regions of the world. Although, such tectonic earthquakes may be small in magnitude but enough to cause considerable ground rupturing, subsidence and developments of cracks in the building, etc. The hydro-tremors have been explained by a mechanism that takes into account the entrapped air/gas in pore spaces of soil above water table which gets compressed maximum due to the actual pore-fluid pressure following heavy rainfall, and upon relaxation of pore-fluid pressure i.e. due to the horizontal diffusion of near surface water, the pressure of the compressed air/gas oscillates, and this causes hydro-tremors to generate. Sudden relaxation of compressive pore-fluid pressure causes effective stress to develop along the horizontal direction and escape from the capillary channels through the soil to the surface, rupturing the ground surface. The incidences of ground rupturing have been found in areas, experiencing depleted amount of rainfall over the years coupled with withdrawal of subsurface water, and have been reported from many parts of the northern states of India. A notional model has been presented to study the causative effects.

T1-P5. Shallow structure study using gravity data

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The LUSI mud volcanoe blast that occurred on May 29, 2006 has had a prolonged impact, even up until now (early 2011). One of the consequences can be viewed geologically: subsidence is causing houses to suffer cracks. BMKG, in-cooperation with PT. Lapindo Brantas has conducted a survey of gravity around the location of LUSI in 2008. The author tried to analyse the structure using gravity data measured on 5-12 July 2008.
Gravity measurements carried out around LUSI included as many as 171 points. To separate the anomaly the author used the spectral analysis of the bouguer anomalies and the second vertical derivative method. Spectrum analysis showed that the source of some regional anomalies lie at a depth average of 1800 m, and other regional anomalies at a depth average of 130 m. Based on the forward modeling method with a 2D structure we can identify the structure that caused LUSI to experience many new cracks and also caused the subsidence in the area around LUSI.

T1-P6. Analysis spatial and temporal b-value variability seismicity north of Sulawesi

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The changes of b-value was inversed proportionate to the level of stress an area. A high stress level stress in an area likely reflected of low the b-value. In this research, it was used an earthquakes database from NEIC catalog at the North Sulawesi and its surrounding areas included Latitude:7oLU - 1oLS and Longitude: 118oBT - 130oBT with the depth 0 - 675 km in the period 1973 - 2009. For temporal and spatial analysis, the research was divided into grid to grid to map the b-value and a value. b-value calculation was done on each grid point in the

constant distance 110 km containing a number of earthquake occurrence. In this method, the distance varied density of the earthquake in the area of research. Grid size can be vary, in this research, it was chosen the processing of data grid 0.2o x 0.2o and the number of seismic events N = 10. The result showed the minimum of b-value was around 0.6 and its maximum around 2.3, the minimum of a-value around 3.7 and the maximum avalue around 13.2. It also can be identified by qualitative approach through return period with the earthquake magnitudo 5 in the area of research in the period of about 0.3 to 1.6 year, magnitudo 6 about 6 to 13 years and magnitudo 7 about 25 to 115 years.

T1-P7. Seismic anisotropy from IDC data

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This study focuses on constraints on seismic anisotropy within the Earth that data from the CTBTO network can provide. We also discuss how that information can be used to improve detection and localization capabilities of the network.
Seismic anisotropy is of considerable interest to the Earth science community, since it allows constraining in-situ deformation within the Earth using surface observations. The CTBTO network is of particular interest, since it extends over otherwise sparsely instrumented areas. There is thus potential for better understanding seismic anisotropy in the Earth's interior. On the other hand, anisotropy has characteristic effects of various kinds on seismic waves, and understanding these effects can improve network performance. One of these effects is to modify the polarization orientation of P-waves, another is to split shear-waves into multiple, orthogonally polarized waves. Techniques for detection and localization may be hindered by anisotropy, and we will address remedies. If available, we will show examples and results from the virtual Data Exploitation Centre (vDEC).

T1-P8. The RN50 station of the International Monitoring System (IMS) as a reference station to the airborne particles pollution in Panama City

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The 3M filter with airborne particles from the Snow White at the RN50 Station of the IMS is weighed daily to know the amount of μg/m3 of the collected particles, as an indicator of airborne particles pollution in the covered area of Panama City. This data, which covers 6 years (2005-2010), indicates that the pollution is more severe during the dry season (without rain and winds) in correlation with the activities of the weekdays. In the rainy season (a lot of rain and little wind) there is less pollution without correlation with the activities of the weekdays. By Mössbauer Spectroscopy, we saw superparamagnetism indicating the presence of nanoparticles (the most hazardous to health) in the air during both the dry season and the rainy season, but with a larger percentage of particles of this size during the rainy season. The intense building construction in Panama City shows that it contributes to the pollution of the environment by the presence of elements such as Ca, Mg, Fe, Cu, Zn, which were analyzed by Inductively Coupled Plasma – Optical Emission Spectroscopy, ICP- OES. The Station RN50 of the IMS is then, in addition to its contribution as part of the monitoring network to detect nuclear explosions (IMS) and to monitor the background radiation near the Panama Canal locks, a reference station to the airborne particles pollution in Panama City.

T1-P9. Observations of acoustic-gravity waves in the Czech Republic

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A measurement system has been installed in the Czech Republic that allows us to monitor wave activity in the lower and upper atmosphere. In this paper, we focus on observations of infrasound and short period gravity waves. The measuring system consists of five microbarographs located at three sites (one triplet and two single sensors) situated in central, north, and western Bohemia; distances between the sites are of the order 60-170 km. A differential microbarograph (model type ISGM03) with an operational frequency range from 0.001 to 10 Hz were installed at each site. Doppler frequency shift measurements allowed us to monitor wave activity at ionospheric heights. The sounding system consists of five transmitters, one permanent receiver and one mobile receiver used for measurements in the field. This arrangement of sensors provides even coverage of the western part of the Czech Republic. A sounding frequency of 3.59 MHz was used in this exercise. Here we present observations of infrasound produced by weak earthquakes during earthquake swarms in Western Bohemia in October 2008. Infrasound was detected by microbarographs located close to the earthquake epicenter. Meteorological processes in the troposphere are one of the efficient source mechanisms of atmospheric waves.

Over the long term we have been monitoring the ionospheric response to various meteorological phenomena using our Doppler sounding system. The ionosphere is, however, sensitive to many external sources in the geospatial environment, such as oscillations of the geomagnetic field. By comparing the Doppler shift measurements with local geomagnetic field fluctuations we are able to distinguish ionospheric oscillations induced by the geomagnetic field.

T1-P10. Detection and identification of low-magnitude seismic events near Bala, central Turkey

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Belbasi Seismic Station is composed of two seismic arrays. One is a medium-period borehole seismic array with a radius of about 45 km located in Ankara, and the second is a short-period borehole seismic array with a radius of about 3 km located in Keskin. Both arrays consist of seven elements. Each array has a broadband seismometer located at the middle element of the circular array. Bala earthquake occurred on December 20, 2007 had produced many aftershocks that were monitored extensively by the Keskin array. In this study, Keskin SP array detection capability of the local earthquakes occurred in middle part of Anatolia has been analyzed using aftershocks data. Array based waveform correlation and STA/LTA methods are applied to the aftershock data set and detection capability results are compared both with the National Earthquake Monitoring Center (NEMC) and The Scientific and Technological Research Council of Turkey (TUBITAK) network. During 20-31 December 2007, 1.132 aftershocks within 0.8–5.0 magnitude range were detected using STA/LTA method, whereas the number of detected earthquakes was 1.401 within 0.5–5.0 magnitude range when using waveform correlation method. The results clearly indicate that array stations have much higher detection capability when compared to single stations, especially at the lower magnitude levels when using waveform correlation method.

T1-P11. Source effects vs. site effects of Vrancea earthquakes recorded in Romania

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Bucharest is one of the most affected cities by earthquakes in Europe. Situated at about 150 km epicentral distance from Vrancea seismic area, Bucharest had suffered many damages due to high energy Vrancea intermediate-depth earthquakes. Different studies focused on the Vrancea subcrustal source of earthquakes pointed out the strong lateral inhomogeneous distribution of the seismic radiation. This implies characteristic macroseismic distributions, extremely elongated along NE-SW direction, and sharply restraint toward NW. Many authors ascribed this particular radiation to the predominant focal mechanism noticed for the major Vrancea shocks (Enescu, 1997). However, a few recent papers showed that the lateral variation in the subcrustal region seems to be more important (e.g., Popa et al., 2005; Radulian et al., 2006). We plan in this paper to asses the importance of the source and path of the Vrancea earthquakes on the ground motion parameters in the area of Bucharest. The fault plane solutions of most Vrancea earthquakes indicate a nearly pure thrust mechanism with the B-axis striking NE, which is typical for the strongest events. We analyze the influence of focal mechanism radiation and source frequency content on the ground motion parameters in Bucharest area. After analyzing all the potential factors, we show that these important variations cannot be explained by local site effects alone. The level of the site effects as well as the frequency content of the seismic waves are strongly influenced by deep tectonic structure in the area at the crustal and subcrustal levels.

T1-P12. Geophysical investigation for lake level rise

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Geophysical methods provide the tools for solving various geological problems. In this research, vertical electrical sounding (VES) and magnetic methods are carried out in the vicinity of Lake Beseka. The site is situated at about 200km east of Addis Ababa in the main Ethiopia Rift valley. Considerable changes have been taking place for many years, which resulted in an increase of the surface area of the lake originally from 3.3 km2 to about 45 km2. The study is performed to obtain the subsurface information that has been contributing to the lake level rise. The variation of resistivity with depth is studied by a progressive increase of the Schlumberger current electrode configuration. In order to get reasonable subsurface information, the apparent resistivity curve plotted in the field had been compared with a set of theoretically calculated master curves. The layer parameters, resistivity and thickness, obtained by iteration process were used to construct the geoelectric sections for each profile to show different lithological units in the vertical direction. The results of the vertical electrical sounding surveys show that the resistivity of the different aquifer systems is low in the vicinity of the lake and increases

away because of the intrusion of the saline lake water. It has been found that no input of water to the lake is possible from the adjacent farm lands, as the water table gets deeper as one goes away from the lake. In addition to VES, magnetic survey was carried out using scintrix made proton precession magnetometer and monitored with a selected base station for diurnal correction. The magnetic survey is applied to delineate subsurface structures (faults/shear zones), which have been created due to the tectonic activities taking place in the area. The total field magnetic map of the study shows that the northwestern part of the lake is characterized by exposed or shallow depth volcanic rocks. But, the northeastern part of the lake is generally seems to be magnetically quite. The NNW and SSE inferred fault may intersect the NNESSW trending fault, which the thermal springs apparent in the area may come to the surface.

T1-P13. Atmospheric transport processes over the Kathmandu valley, Nepal.

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The air mass transport characteristics over the Kathmandu valley have been studied to assess the spatial and temporal distributions of decoupling of valley's air mass with the regional flows. The study has been carried out with the applications of Mesoscale Meteorological Model (MM5), Weather Research and Forecast (WRF) and a Chemical Transport Models. The model predictions have been compared with observed data. The study reveals that Kathmandu valley typically shows a plateau-basin dual nature. The nighttime near surface air mass remains largely calm. However, the intermittent downslope winds organize a weak flow system that often develops valley wide anticlockwise circulation at about 150 m above the floor, which slowly but effectively induces mass exchange in the lower layer of cold air mass during the nighttime. Two very gentle wind systems, southwesterly and northwesterly, composed of regional scale deep upslope and plain-to-plateau winds regularly intrude into the Kathmandu valley close to noontime and continue till the late evening. Upper air from more than 3 km above the mean sea level comes down and sweeps across the valley floor in the afternoon. Spring season of Kathmandu appears to be relatively windy compared to winter. No strong decoupling of valley's air mass with the regional air flows appear to persist for more than 24 hours or so in and around the valley. The surrounding mountaintops, particularly, the eastern and southeastern mountain tops appear to be the most suitable sites for regional background aerosol concentration measurements.

T1-P14. 1-D Velocity model for use by the SANSN in earthquake location

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Knowledge of the velocity model of an area is essential both for earthquake location and tectonic implication. Locating earthquakes using an unreliable model contributes in part to the uncertainties of active fault mapping and unexplained scatter of seismic locations. Given that we strive to continually improve our location abilities, it is necessary to always improve on the model used in the location process. The travel time inversion method was used to estimate a 1 - D velocity model that can be utilised by the South African National Seismic Network (SANSN) in seismic data analysis. It should be noted that the velocities obtained are approximately equal to the average velocity of the 3D structure within the same depth range that has been sampled by the data. In order to test the new model, it was used to relocate a sample of well recorded data from the SANSN database and results compared to previous data analyses. The new model VM1 was found to provide improved locations compared to the previously published CGS locations especially when considering the clustering of events in the mining areas as well as the observed reduction in location errors. Station corrections were calculated and showed strong lateral variations across the region. The velocity model will continue to be improved with time as more seismic stations are installed throughout the country especially in the southern part and thus more data are collected.

T1-P15. Determining of the contrast zones based on the analysis of microseismic noise

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The techniques developed for determining the epicenters of the contrast zones and for estimating their spatial distribution. The detection of underground contrast heterogeneity is based on areal measurements of the microseismic fluctuations. As it's shown by the studies, an underground heterogeneity causes an increased contribution of high-frequency components in the total energy of microseismic noise in the epicentre zone. The relation of the horizontal amplitude component to the vertical one is the most stable characteristic of microseismic noise. Different relation values for different sites of the crust reveal their structural difference. The ratio of horizontal to vertical components is higher at close distances to the heterogeneity. The maximal values are observed in the epicenter. The study of microseismic features in the epicentre zone shows that the occurrence of an underground contrast area sometimes modifies quasi-harmonic components of the noise spectra. These components appear in spectra as peaks of different amplitudes. The analysis has shown that quasi-harmonic components are present in all microseismic records. These quasi-harmonic components can be divided into two types by the origin: man-caused and natural-resonance. It is shown that in the absence of amplitude modulation of microseismic background as a whole, an external disturbance coming from the environment, such as the tidal force causes responses of different rock massifs in the form of modulation of background microtremors in different frequency intervals. Thus the maximal change of spectral density amplitude is detected for quasi-harmonic fluctuations. The obtained results can be used in additional to classic OSI methods.

T1-P16. Tectonic stress field and recent movements of the earth's crust in the Manila subduction zone and adjacent faults

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In this paper, 4 models of average stress states have been calculated on the base of focal mechanism data and 25 focal mechanisms of the largest earthquakes belong to different segments of Manila subduction zone and adjacent faults are chosen. In order to identify the recent movement pattern in the studied fault systems, some consent criteria of classifying focal mechanisms and average stress states have been drawn out. Based on comparative analysis of the special correlation between the stress distribution patterns with kinematic-geometric parameters of faults, characteristics of average tectonic stress field and recent tectonic movements have been defined for the systems/or segments of the active faults in the studied region.

T1-P17. Sensitivity analysis of infrasound based source verification: influences of atmospheric conditions and surface orography

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The detection and verification of natural or anthropogenic signatures using the infrasound technique is based on propagation modeling between source and receiver. Atmospheric background conditions as well as orography significantly influence the propagation path of infrasound signals and may therefore permit or prohibit signal detection.
Infrasound propagation modeling is performed at the German Aerospace Center (DLR) using the improved 3d ray-tracing model HARPA/DLR. Case studies of infrasound propagation are presented with respect to different atmospheric temperature and wind fields using climatological, weather forecast and satellite data. Furthermore, influences of reflection by uneven surface orography on infrasound propagation are described using advanced German Aerospace Center (DLR) terrain models.
A sensitivity analysis of atmospheric/orographic influences on infrasound propagation will be presented quantifying the differences in propagation paths and emphasizing the importance for source verification.

T1-P18. Detection, location and screening of seismic, hydroacoustic, infrasound and tsunami waveforms associated with May 29, 2010 S-Sarigan submarine volcano eruption, Marianas islands

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On May 29, 2010 a strong submarine volcanic eruption occurred in the Marianas Islands. The energetic phase was brief and sent an ash and gas cloud as high as 12,000 m. This event was detected by its infrasound waves and by seismic and hydroacoustic phases all over the world. Two small local tsunamis were also recorded by a neighbouring tide gauge. The source was accurately relocated using all the recorded phases and placed on a bathymetric map. The geophysical dat were correlated with witnesses' reports. From the analysis of these different data, a credible scenario of crisis development was deduced.

T1-P19. Dissipated energy by S-Sarigan paroxysmic eruption and explosive discrimination on hydroacoustic waveforms

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The submarine volcanic eruption of a vent south of Sarigan island, Mariana, on May 29, 2010, generated an explosion comparable in energy to a medium-size nuclear explosion. The event phases were used to estimate by different empirical and theoretical methods the dissipated energy in ground, water and atmosphere. The discrimination criteria were applied to the hydroacoustic phases to confirm the explosive mechanism.

T1-P20. Infrasound studies of some local and regional events detected by I33MG

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Sixty infrasound stations are installed around the world within the framework of the International Monitoring System (IMS). The purpose of these stations is the detection of a nuclear test of more than 1 kiloton, but they can also detect infrasound signals from many geophysical phenomena such as ocean tides, cyclones, lightning, and volcanoes. Data collected since 2001 from IMS station I33MG located in Madagascar and from surrounding stations allowed us to study 3 natural event types: volcanic eruptions, tropical cyclones and lightning. In this analysis the PMCC method was used for the data processing and the tau-p method, using the HWM and MSIS climatology models, for the ray tracing. Volcanic eruptions from Karthala (Comoros) and Piton de la Fournaise (Reunion) provide high frequency records. Two types of pattern are observed in these records: those with continuous, and those with sporadic signals. Every year several tropical cyclones form over the South-Western part of the Indian Ocean, theses cyclones generate infrasound in the microbarom frequency band when they occur over deep ocean. Lightning records are observed during the rainy season from September to March and they dominate the high frequency signal detections recorded at I33MG. Propagation of signals through the atmosphere is dependent on temperature and wind.

T1-P21.Acoustic observations of stratospheric solar tides: Examples from the eruption of Eyjafjallajökull, Iceland, April-May 2010

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The summit eruption of Eyjafjallajökull, Iceland, between 2010 April 14th and May 20th was recorded across at least 14 microbarograph arrays located in mainland Europe, north Africa and north-west Greenland, at ranges between 1740 and 3670km. Four of these arrays (IS18, IS26, IS43, IS48) are part of the International Monitoring System that is being constructed as one of the verification measures for a Comprehensive Nuclear-Test-Ban (CTBT). Within the detection timeseries diurnal variations in infrasound signal characteristics (signal amplitude, arrival azimuth, apparent speed and frequency content) have been identified, associated with infrasound propagating along stratospheric propagation paths from the volcano. As the signal detection time series were noisy and unevenly sampled, periodicities within the data were identified using a Lomb-Scargle periodogram analysis and a CLEAN sampling function deconvolution. The results of infrasound propagation modelling through state-of-the-art meteorological profiles suggest that stratospheric wind variations generated by solar tides may explain the diurnal structure of the observations. Analyses which rely on accurate understanding of the acoustic travel path will be affected by solar tidal wind variations (e.g., network detection capability studies,

source location, and source size characterization), many of which are of concern for CTBT verification monitoring. Solar tidal wind variations present a challenge for propagation modelling because the effects act over timescales and lengthscales comparable to those encountered in long-range (1000's km) infrasound propagation. However, the study of infrasound from continuous sources such as volcanoes shows promise as a tool for identifying and analysing tidal structure within the stratosphere and upper atmosphere.

T1-P22. Adaptively parameterized surface wave tomography: Methodology and a global model of the upper mantle

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Observations of seismic surface waves are a very powerful tool to constrain the lateral structure of the Earth's upper mantle, including its anisotropy, because they sample this region with an almost constant sensitivity along the raypath. Like all global seismic databases, the set of surface-wave data available to us has a geographically inhomogeneous coverage, which leads to difficulties, particularly in the appropriate choice of model parameterization. On a global scale most tomography models today are still parameterized uniformly. No consideration is given to the inhomogeneous data coverage and resulting inhomogeneous model resolution due to under- or overparameterization of many areas. If the local resolving power of seismic data is not taken into account when parameterizing the model, features will be smeared in the final model, with subsequent misinterpretation. Parameterization density has to change locally, for models to be robustly constrained without losing any of the accurate information available in the best sampled regions. We have implemented a new algorithm for upper-mantle surface-wave tomography, based on adaptivevoxel parameterization. High resolution is achieved in regions with dense data coverage, while lower resolution is kept in regions where data coverage is poorer. This way, parameterization is everywhere tuned to optimal resolution, minmizing both the computational costs, and the nonuniqueness of the solution. We illustrate our method, including appropriate regularization operators, and numerical shortcuts to keep computational costs at a minimum. The latter could be potentially enormous since the spacing of our global grid is locally as small as ~50 km. We apply our method to the derivation of a global model, with resolution particularly enhanced in the european lithosphere and upper mantle. Our results are in agreement with large-scale features which have already been observed in earlier studies, inlcuding e.g. the Trans-European Suture Zone, the Panonian Basin, opening of the Aegean and Western Mediterranean, possible smallscale upwellings under Iberia and Massif Central, subduction under the Aegean arc. The very deep cratonic root underneath southern Finland is a particularly robust feature of our maps.

T1-P23. Unexpected high seismic activity observing near the Ulaanbaatar area, capital city of Mongolia: Improved relocation by using array-based earthquake location technique

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Important seismic activity has been taking place near and within Ulaanbaatar area since 2005 and it is still active up to today. This area, which could be one of most seismic active zone around Ulaanbaatar, dramatically increases the seismic hazard of the capital of Mongolia where is concentrated about of 1/3 of the Mongolia population and the majority of industries of the country. The number of earthquakes occurred between 1970 and 2010 contains totally more than 2500 events, 900 events recorded during 1970 - 2004 and 1340 events occurred from 2005 to 2009. There were 508 earthquakes corresponds only for 2009, and 310 events were already occurred beginning of 2010. Distribution of these swarms, with more than 2000 events with magnitude between 0.5 and 4.2, has interconnected the major active structures in Ulaanbaatar area by a steeply dipping fault surface striking East-West Hustai and North to South Emeelt fault. The 2005/2009 swarm mostly occupied the Emeelt fault and shows increasing number of events of extreme site of this structure. The Hustai fault area activated by the 2009/2010 swarm, however, is shows probably main potential structure which could produce large earthquakes, starts to be break and moving. In addition to the complexity of the tectonics context, the lack of large magnitude earthquake in this area conjugated with the recent triggered high seismic, which has been well monitored by local digital seismic network, makes the study of this earthquake activity fundamental for the estimation of Ulaanbaatar seismic hazard.
In this presentation, we will present and discuss array-based earthquake location technique estimates resulting from PS25 array signal in order to improve the location accuracy of seismic activity around Ulaanbaatar area.

T1-P24. Vp/Vs ratio and seismic activity at active structure of Ulaanbaatar area, the capital city of Mongolia

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Variations in seismic velocities and Vp/Vs ratio can be used to identify precursory activity which may precede large earthquakes and as well as volcanic eruptions. The observation of such variations before large earthquakes has been observed several month or years prior to before large earthquakes. Anomalously high seismic activity occurs around the Ulaanbaatar, capital city of Mongolia since 2005. This area, which could be one of most seismic active zone around Ulaanbaatar, dramatically increases the seismic hazard of the capital of Mongolia where is concentrated about of 1/3 of the Mongolia population and the majority of industries of the country. Since the beginning of this high seismic activity in middle of 2005, more than 3000 earthquakes with magnitude between 0.5 and 4.2 have been observed by our network through this area. Since 1994, we have a better detection and location of the seismic activity around Ulaanbaatar when a seismic network has been installed around the capital in collaboration with DASE France. Later on it was upgraded by PS25 seismic array which is located on the area of main structure (Hustai Fault) reactivating, in frame of CTBTO activities. Therefore, it gives unique chance to us to control evaluation of clustering and spatial distribution of these seismic activities in real time. We analyzed seismic velocity variations of earthquakes recorded at the permanent stations of the Ulaanbaatar Network, which is located just above the seismic activity. Beside this, we investigated data from quarry blasts located around Ulaanbaatar city waiting 5- 300 km away. We present result of study Vp/Vs variations with related seismic events and clusters area as well as methods that we used.

T1-P25. Investigating body wave energy in ambient seismic noise

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The microseismic frequency band contains a large amount of coherent energy, which has generated much interest recently because of its use in surface wave tomography as well as its apparent link to temporal changes in ocean wave behavior. Although the dominant component of this energy travels as surface waves, body waves also contribute a significant portion at slightly higher frequencies. The surface wave noise appears to be generated by ocean wave interaction along the coastline, however, several studies have indicated that the body wave energy may originate from the deep ocean suggesting the possibility of different mechanisms for the generation of surface and body wave noise. Further exploration of the nature of body wave noise is necessary to better understand how and where it is generated, and what additional information we might gain from it. We investigate source locations of this body wave noise generation using a back-projection technique and data from the small aperture seismic arrays of the International Monitoring System. Array analysis using this data provides a powerful tool for placing constraints on the direction and mode of incoming coherent energy. By simultaneously utilizing information from several arrays around the Pacific Ocean we can place tighter constraints on noise generation located there. Preliminary results project one month of noise from January 2009 to an area in the middle of the Northern Pacific, consistent with independent results from a traditional frequency-wavenumber analysis and supportive of the possibility of a persistent deep ocean generation for microseismic P-waves.

T1-P26. Characterization of the Carancas meteor fall from infrasound signals

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The use of the Infrasound Monitoring System to study bolide sources is now well documented.
Analyzing a meteor's entry through its infrasound signal has proved effective in determining crucial characteristics of a meteor fall. For the case of the meteor fall in Carancas (Peru) in 2007, some authors have argued that the dominant process of the sound generation was from fragmentation. These conclusions are strongly dependent on the processing of the recorded signals and do not substantially rely on existing analytic models within the field of meteor physics.
In our goal of offering an alternative explanation, we have begun analyzing the possible N-wave signal created from a single-body source. A stochastic source model has been developed in order to determine the resultant shock wave. Once weak shock levels are obtained, Whitham's nonlinearization method is used to determine how the propagation front evolves over the remaining distance to the station.
In our initial model, various unknowns were assigned random variables and a statistical analysis of all possible outcomes was considered. This included deriving the probability of obtaining a given signal and how the random diameter affected this probability. This model has now been extended to incorporate a random atmosphere through the use of stochastic processes. Through comparison of our results to recorded infrasound data, we aim to show that it is possible that an N-wave type signal could have originated from the Carancas meteor scenario, hence that the meteorite did not fragment upon entry.

T1-P27. The OGS local virtual seismic network in South-Central Europe as an array: exploiting depth phases to locate upper mantle discontinuities

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The Centro di Ricerche Sismologiche (CRS, Seismological Research Center) of the Istituto Nazionale di Oceanografia e di Geofisica Sperimentale (OGS, Italian National Institute for Oceanography and Experimental Geophysics) in Udine (Italy) after the strong earthquake of magnitude Mw=6.4 occurred in 1976 in the Italian Friuli-Venezia Giulia region, started to operate the North-eastern Italy (NI) Seismic Network: it currently consists of 13 very sensitive broad band and 21 simpler short period seismic stations, all telemetered to and acquired in real time at the OGSCRS data center in Udine. Real time data exchange agreements in place with neighbouring Italian, Slovenian, Austrian and Swiss seismological institutes lead to a total number of 94 seismic stations acquired in real time, which makes the OGS the reference institute for seismic monitoring of Northeastern Italy.
In this study we use P, pP, S and sS phases from global events recorded by the OGS local virtual seismic network in South-Central Europe to study upper mantle discontinuities above earthquakes in the subducted Pacific Plate. We use the time lag between the surface-reflected depth phase and a precursor to determine the discontinuity depth. Accurate estimation of reflector depth depends on a velocity model of the source-side mantle structure. In contrast to typical one-dimensional velocity models, our source-side structure is oceanic, with a shallow Moho and thin crust overlain with water. The time lag between the direct P and pP or S and sS arrivals without accounting for source structure can be as large as 5 s when compared to a purely continental model like iasp91 or ak135.
We identify upper mantle discontinuities using slant stacking and depth-migrated standardized waveforms. The processing shows S-to-P arrivals from the 660 km discontinuity, the 410 km discontinuity, and shallower upper mantle ones of uncertain origin.

T1-P28. Observations of atmospheric radionuclide cycles: The benefit for global paleoclimate studies

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Paleo-records of cosmogenic radionuclides provide important clues on their past production rate and related solar and geomagnetic activity. More precisely, 14C stored in tree rings/sediment and 10Be archived in polar ice cores are currently the only possible tools to extend our knowledge of solar activity to the past. However, while efforts in production rate reconstructions of both radionuclides agree fairly well in view of decadal to centennial variability, they systematically deviate, for unknown reasons, on the millennial time scale. This finding calls for investigating the controlling hand-over of the atmospheric production signal into the climate archives. In case of aerosol-borne 10Be, atmospheric transport and deposition might convert the atmospheric production signal and necessitates a thorough understanding of the global atmospheric 10Be cycle. Depending on aerosol lifetime only, radionuclide ratios – like 10Be/7Be – are valuable tools to examine the radionuclides' cycles and we report in this respect on findings of our longterm monitoring at Neumayer Station in coastal Antarctica. However, while on the one hand atmospheric measurements of 10Be (or 22Na, which basically carries the same information) are rare, a proper understanding of the global atmospheric 10Be cycle might require a large set of globally distributed, longterm measurements. Finally, we address the CTBTO radionuclide network as being unique in contributing to this kind of research on the global scale. In this context, also network related side effects are discussed as the potential of these natural radionuclides to provide an independent quality control tool through their strongly constrained spatio-temporal source distribution.

T1-P29. Effect of anisotropic inhomogeneities in the atmosphere on long-range sound propagation from explosions

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The model of the formation of anisotropic fluctuations in wind velocity and air temperature in a stably stratified atmosphere is described. This model takes into account the scattering effects of anisotropic-inhomogeneities of

effective sound speed on the propagation of acoustic waves in the atmosphere. Experimental detections of stratospheric, mesospheric and thermospheric arrivals from explosions (from both surface-based explosions and volcanic eruptions) in acoustic shadow zones are explained by the results of calculations of the scattered acoustic field using the parabolic-equation method. Calculated acoustic signals with a fine structure of wind velocity and air temperature taken into account were compared with signals recorded in the region of an acoustic (geometric) shadow. Thus, the possibility of acoustically sounding the fine structure within the middle and upper atmosphere is being considered.

T1-P30. Comparison of recurrence curves from the IDC and ISC catalogs

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The well-known linear relationship between magnitude and cumulative number of earthquakes has a slope (-b) which is close to unity for magnitudes above which the record is complete. Although this linearity is often used to estimate the magnitude threshold of completeness, the situation is complicated by the mixing of event populations for which the b-value is different, and by the fact that the completeness threshold itself depends upon location. One way to mitigate this is to compute b value separately for different geographic regions.
Therefore, we have calculated and compared frequency/magnitude distributions for 50 seismic regions defined at the IDC using the IDC and ISC seismic event catalogs. Relevant measurements of body wave magnitude, mb, cover various periods, including the IDC operation one between 2001 and 2011. Bulletin completeness was roughly estimated for several seismic regions with appropriate number of events.

T1-P31. Inverse modelling of the 2010 Eyjafjallajökull eruption and comparison with infrasound signals

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In April and May 2010, an eruption of the Eyjafjallajökull volcano in Iceland, lasting several weeks, emitted large amounts of ash into the atmosphere, causing widespread disruption of the air traffic over Europe. Inverse modelling has been done to derive the time- and height-dependent emission of ash from atmospheric transport modelling and ash total colum values derived from SEVIRI and IASI satellite observations (Stohl et al., 2011). This eruption has been observed by a number of infrasound arrays in Europe and on Greenland at distances on the order of 2000 km (Matoza et al., 2011). We are presenting an overview of the inverse modeling methodology and the main results. The time series of the ash mass flux and the corresponding plume top heights, mostly varying between 5 and 10 km, will be compared with the time series of the infrasound signals at selected locations. Specifically, we shall compare the onset and decay of ash emission and infrasound. As surveillance of volcanoes has been suggested as a possible civilian application of the IMS infrasound network, this contribution will help to better understand possibilities and limitations of this approach. Acknowledgment: A part of this work is financed by the European Space Agency (ESA) through the SAVAA project.

T1-P32. Using the International Monitoring System infrasound network to study large-scale atmospheric waves

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The majority of the operational IMS infrasound stations use absolute pressure sensors that measure pressure fluctuations with frequencies ranging from DC to tens of Hertz. This frequency range encompasses the entire domain of infrasounds as well as that of gravity waves and meteorological processes. A recent study, which has demonstrated the accuracy of the IMS pressure measurements up to 24 hour period, has opened the way to the study of gravity waves from IMS pressure measurements.
Among gravity waves, atmospheric tides are waves with periods corresponding to integral fractions of a solar day (primarily diurnal and semidiurnal). They are produced by the atmospheric solar heating combined with upward eddy conduction of heat from the ground. Their importance is high as they regularly cause oscillations in atmospheric wind, temperature and pressure fields. The seasonal variations of the diurnal (S1) and semidiurnal (S2) pressure oscillations are studied from IMS pressure measurements. The results are in good agreement with previous modelling and observations. However, strong variations in S1's amplitude - not predicted by global modelling – are also observed during short time-period on continental stations. These variations are not only detected by IMS infrasound sensors but also by the absolute pressure sensors part of IMS meteorological stations. The study of these phenomena is of high importance since it can modify atmospheric wind profiles and influence the propagation of infrasonic waves.

T1-P33. Remote monitoring of volcanic eruptions using the International Monitoring System infrasound network

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Many volcanoes in remote locations are not monitored individually but can still pose a threat, especially to aviation. Explosive volcanic eruptions are known to produce infrasound which can propagate over distances of thousands of kilometres within the atmosphere, and together with the growing International Monitoring System (IMS) network of infrasound stations could present an opportunity to monitor these remote volcanoes. In this work a dataset including 120 eruptive events at 40 volcanoes has been investigated to assess the capability of the IMS network for use in global volcano monitoring. Detected events range from Strombolian activity at Mount Erebus (Antarctica) recorded at a range of 25 km distance, to the Plinian eruption of Manam Volcano (Papua New Guinea) recorded at ranges of over 10,000 km distance. Despite complications inherent in such a global study (e.g. propagation effects and variable noise levels) relationships between infrasound and eruption characteristics are emerging from the data. In general signals with lower frequencies, higher amplitudes and greater acoustic power are generated by eruptions with higher plume heights, and are detectable at greater distances. This work adds weight to the idea that a global network of infrasound stations such as the IMS could be used to remotely monitor volcanoes.

T1-P34. Infrasound propagation in the atmosphere

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The infrasound wave propagation in the Earth's atmosphere are investigated. The results of calculations of linearized kinetic equations were obtained by the relaxation collision model of Stubbe. The generalized polytropic coefficient were considered for the plane wave. The graphics of the dependance damping coefficient of the infrasound wave from frequency and from collision frequency.

T1-P35. Explosion of crater lake in the "Cameroon line" area: seismic contribution

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In the Gulf of Guinea (Africa), the "Cameroon volcanic line" is geologically unusual in extending through both the ocean and the continental crust. In the inland, there are crater lakes, both of them have already exploded in a limnic eruption which resulted in the release of a large amount of a carbon dioxide coming from volcanic

activity: - The Lake Nyos, in the Oku volcanic plain suddenly exploded on August 21, 1986, and emitted a large cloud of CO2, which suffocated 1,700 people and 3,500 livestock in nearby villages. - Lake Monoun lies in the Oku Volcanic Field, it exploded and released of a large amount of carbon dioxide that killed 37 people." The paper describes the tectonic evolution and seismicity of "Cameroun line" together with the explosions of crater lakes. We notice that many of the tectonic phenomena follow the previous structural lines and different clusters of epicenters are identified. Although the area is one of relatively low seismicity, the implication of earthquake is considerable in the occurrence of lake explosions; specially, shaking the crater lakes which explode and release the gas. By these natural events, we want to make known the area of Cameroon line which is propitious site to the diversion.

T1-P36. Computation of pressure change in the sea from acoustic and tsunami waves excited by a sub-oceanic earthquake with a finite-difference scheme for seismic waves

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Pressure sensors in the sea are very useful for monitoring tsunami waves generated by earthquakes under the sea floor. In this study we propose a modelling method of acoustic and tsunami waves as well as seismic waves based on the elastodynamic equation for a gravitating flat earth model with a sea layer. We here simplify the equation by adopting the Cowling approximation which retains the initial acceleration of gravity and by assuming the acceleration of gravity to be uniform over the computational region. We formulate the equation into a velocity-stress form (i.e, a set of the first-order equations) to apply a staggered-grid finite-difference time-domain (FDTD) method which is often employed for earthquake ground motion simulations. This scheme can simultaneously model all of the seismic waves in the solid earth and acoustic and tsunamis waves in sea from sub-oceanic earthquakes. This can calculate pressure changes in the sea due to acoustic and tsunami waves, which may be extracted from the pressure sensor records in the sea. In this presentation we will show numerical scheme and some computational examples.

T1-P37. Environmental impact of the nuclear tests in Argentina

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A statistical procedure was used to analyze the temporary variation of the 90Sr and 137Cs concentrations. The obtained results allowed to assess the environmental impact of the radioactive fallout in South America the due to past nuclear explosions. The objective of this research is to increase the knowledge of the contamination caused by the atmospheric nuclear weapon tests in the South Pacific.
Samples of deposition and fresh milk have been taken in the city of Buenos Aires and the surroundings since 1960. Radioactive fall-out from the stratosphere and troposphere generated important peaks in 1964, 1965 and 1966. A secondary peak of tropospheric fallout came from the South Pacific in 1970, 1971 and 1972.
In the results from the mentioned investigation in Buenos Aires, two sets of data are clearly distinguished, one before and one after the nuclear weapon tests. The maximum concentrations of 90Sr in deposit and milk were registered in 1964. Concentrations of 90Sr activity in deposit and milk were 83.6 MBq/km2 and 240.8 mBq/liter. Today, the corresponding concentrations are less than 0,02 MBq/km2 and 10 mBq/liter respectively. In the case of 137Cs, the maximum concentration values in deposit and milk were measured in 1966 and were 95 MBq/km2 and 944 mBq/liter, respectively. Today, these values are less than 0.60 MBq/km2 in deposit and 4.7 mBq/liter in milk. The results show that the environmental concentration has been decreasing during the past decades, although at a slower rate in recent years. This effect is only observable because of the long term sampling carried out. Nowadays, the radioactivity concentrations are very low and close to reaching stability and the observed oscillations are due to re-suspension phenomenon.

T1-P38. Evaluating 238U/235U in U-bearing accessory minerals

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U-daughter geochronology and nuclear forensics utilise the absolute value of the present day 238U/235U ratio. For decades this value has been assumed to be invariant and equal to 137.88, but recent experiments indicate that there is potential for per mil level variation in 238U/235U in natural materials, hypothesized to be the result of redox reactions. These studies have largely focused on materials formed in low-temperature environments and U ore deposits. At present there is no published high-precision high-accuracy 238U/235U data for U-bearing accessory minerals commonly used for U-Pb geochronology.
We present accurate and precise 238U/235U determinations (absolute uncertainties of ~200 ppm) for a suite of common U-bearing accessory minerals from a variety of geological environments and ages. Measurements have been made by multi-collector TIMS and ICPMS, accurately correcting for mass fractionation using the IRMM 3636 233U-236U double spike. These results indicate that accessory mineral 238U/235U ratios are lower than the 'consensus' value of 137.88 and record limited but resolvable variation. Systematic discordance has been observed in closed-system minerals and used to reassess the relative decay constants of 238U and 235U. These studies derive λ235U relative to λ238U by assuming equivalence between 238U-206Pb and 235U-207Pb dates and using assumed values (i.e. 137.88 or 137.80) for the present-day 238U/235U ratio. Our new determination of coupled 238U/206Pb, 235U/207Pb and 238U/235U measurements on the same closed system zircons permits further refinement of λ238U/λ235U estimates using parameters whose values and uncertainties are all traceable to SI units.

T1-P39. Time series analysis of the seismic events worldwide

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A time series analysis with the seismic events occurred worldwide from February 2000 to February 2011 was carried out. This analysis was done with the REB events recorded in the IMS network of CTBTO. As a whole, 301,723 events have occurred in this period and the number of REB events published by CTBTO is about 75 events each day. The numbers of events per year has been slightly increased recently, but this can be regarded as due to the newly installed IMS stations in the world. The number of large earthquakes whose magnitude is more than or equal to 6.0 and the value of energy released by the events have stayed relatively constant. The released energy value is relatively high in 2004, when the earthquake and tsunami occurred off the coast of Northern Sumatera on 24 December. During this 11 year period, no additional trend was found. Data collected over a longer time period may yield different results.

T1-P40. Phase velocity and attenuation parameters in the Iranian Plateau

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Regarding to the development of regional seismic discrimination methods, we will introduce information related to the seismic propagation as well as associated to geologic-tectonic and geophysical data. The shape of the attenuation curves and spatial variation of seismic phase velocities are established for the Southern and Northwestern of Iranian Plateau from empirical data. The data set comprised Parsian Seismograph Karkheh, Seimareh, Siahbisheh, Karun local dam dense networks which recorded earthquakes near to Iran and Pakistan Border like 7.2 Mw (2011/01/18).
Distribution of our stations allows us to compare seismic velocities in the Iranian Plateau minus Zagros region with Iranian Plateau with Zagros region path. We found an unusual seismic velocity beneath the Zagros region.
The findings support the hypothesis that postcritical reflections from the Moho discontinuity play an important role in determining the shape of the attenuation. Moreover, we have compared our results with coefficient of anelastic attenuation which has been obtained for this region before. One of the studies has been done by Nuttli (1980) on different seismic phases by World Wide Standard Seismograph Network (WWSSN) in Shiraz, Tabriz and Mashhad. Moreover, Shoja-Taheri et al (2007) have determined the coefficient with strong motion data records by National Strong Motion Network of Iran recently. Comparison between our average Q factor and Nuttli's value, illustrates a good correlation in contrast with the study of Shoja-Taheri et al.

T1-P41. Do triggered earthquake patterns depend on trigger faulting style?

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Aftershocks normally occur in the fault zone of the mainshock, where coulomb stress changes is positive. The number of aftershocks depends on pre-stress conditions and mainshock stress drop. But recently Schorlemmer (2005) and Narteau (2009) show that b-value and c-value depend on faulting style. We have performed the similar type of analysis for aftershock sequences, using global data. We show that the aftershock rate(R), which is tested for different time windows shows that R(normal)>R(thrust)>R(strike-slip). The K*-value, which is independently calculated using the Ogata (1983) technique also shows similar pattern as that of rate, that is: K*(normal)>K*(thrust)>K*(strike-slip). Furthermore, we also show that that p-value is also dependent on fault mechanism, that is: P(normal)>P(strike-slip)>P(thrust) and a positive correlation between p-value and K* shows that our model is consistent to with the Omori law.

T1-P42. The physics of tsunami: basics understanding and its disastrous effects

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The explanation based on physics energy conservation and wave properties have been used to understand this phenomenon of Tsunami generation and its development. It is Series of water waves generated by huge and sudden perturbation e.g. earthquakes, slides, volcanoes, asteroids, having Wave period: 2-200 minutes Run-up heights 10-100 m, (Flooding of shoreline). They can be generated when the sea floor suddenly displaces the overlying water vertically. A tectonic earthquake when they occur beneath the sea, the water above the deformed area is displaced from its equilibrium position. Waves are formed as the displaced water mass, acting under the force of gravity, tries to regain equilibrium. When large areas of the sea floor elevate or subside, a tsunami can be created. The waves sweep across the open ocean at high speed and have caused severe damage to costal areas thousand of miles from the earthquake which generated them. An eye-witnesses of December 26, 2004 accounts in understanding tsunami effects. To understand the mechanism of tsunami propagation and the selection of certain section of coastline for waves of destructive amplitudes it is necessary to recognize the depth dependence of wave velocity which is the feature of shallow water wave. The velocity of this class of wave may be derived by assuming equipartition of the potential and kinetic energies of the wave motion. In the present article quantitative derivation of tsunami speed and its disastrous effect has been discussed. The tsunami's energy flux, being dependent on both its wave speed and wave height, remains nearly constant. As a result, the tsunami's speed decreases as it travels into shallower water and its height increases. When it reaches the coast, it may appear as a rapidly rising or a series of breaking waves. Being human inability to predict earthquakes and since earthquake magnitude does not determine tsunami impact, resulting tsunamis can be detected by seabed monitors and ocean buoys leaving adequate time for evacuation and information dissemination technologies though, is a minor part of the solution and a mechanism needs to be in place to interpret alerts, relay the warning to local communities through awareness and enable them to undertake quick action.

T1-P43. Assessment of tsunami damage using remote sensing and GIS and expected benefits of disaster early warning systems to tsunami vulnerable areas

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The catastrophic tsunami, generated by an earthquake off Banda Ache Sumatra, Indonesia, of magnitude 9.1 on the Richter scale, at 00:58:53 UTC on 26/12/2004 with an epicenter 250km SSE, hit many countries in Asia, severely affecting India, Indonesia, Sri Lanka and Thailand. The Northeastern, Southern and Western provinces of Sri Lanka was severely affected by this tsunami, resulting in a conformed death toll of 30,196 casualties. Additionally, agriculture was affected, destroying 259 km² of paddy area, causing extensive salinisation, sediment deposition, saline intrusion and destruction to irrigation canals. The study assessed the damage caused to civil structures and city infrastructure, agriculture, coastal systems and fisheries in the Galle Municipal Area using high resolution satellite images and differential GPS data. The results indicated that the major livelihood activities including tourism, fisheries and agriculture and were seriously affected. Further, the study emphasises on the usefulness of the application of remote sensing technology in damage detection and the importance of establishing comprehensive Early Warning Systems in tsunami-prone areas. The need for such system was much felt during the two recent earthquakes in Japan and resultant tsunamis, with a magnitude of 8.9 on 11/03/2011 and 7.1 on 07/04/2011respectively. Although these quakes did not directly affect Sri Lanka, they caused panic due to the lack of a sound warning system and awareness on the same. At present, the International Data Centre

provides information on seismic activity only to the Geological Survey and Mines Bureau of Sri Lanka. However, a comprehensive Early Warning System could be established in the country, if this information was permitted to be shared with other relevant agencies, such as the Disaster Management Centre, Metrological Department, National Aquatic Resources Agency and would also lead to detailed research if Universities were permitted to access the said data.

T1-P44. Seismic monitoring in Azerbaijan in aspects of seismic hazard assessment

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Azerbaijan is situated in the active collision zone of Arabian plate with Eurasian and characterized by high seismic activity (Shamaka earthquakes 1667, 1902; Gyandja earthquake, 1167; Mashtaga earthquakes 1842, 1953, Baku earthquakes 1910, 1922, 1935; Caspian earthquakes 1961, 1963, 1986, 2000). The first seismic station was set up in Baku by the Nobel brothers in 1903 to study the seismicity of the Absheron peninsula and to provide the countermeasures against consequences of a potential destructive earthquake (Shamakha, 1902). Currently, 26 digital telemetric seismic stations of Kinemetrics were operating in Azerbaijan at the Republican Center of Seismological Service (RCSS). Since 1996 the Institute of Geology operates telemetric system of seismic monitoring ISS, which consists of 3 stations of South Africa production. The system is situated on the Absheron peninsula and registers the seismic events. ISS system can be effectively used for controlling the landslide situation in Baku city (the capital of Azerbaijan), which is valuable for diminishing the losses of probable future displacements of the large massive of grounds. In 1998, GPS network in Azerbaijan was established by the Institute of Geology at Azerbaijan National Academy of Science in collaboration with Massachusetts Institute of Technology (MIT) and as a result of study, the distribution of horizontal velocity pattern was traced, which contains significant basic physical information for maintaining the prediction of seismic hazard. GPS observations in Azerbaijan (3 constant operational stations on the 31 sites with annual measurements) and surrounding areas of the Caucasus region are providing quantitative constraints of the geometry of active fault systems, and rates of present-day deformation. For controlling seismic events alongside the main oil pipeline Baku-Tbilisi-Ceyhn (BTC), which is one of the strategical regions of the country, seismic station by Guralp Systems Limited was installed in the western part of Azerbaijan (in the Sheki city) operating in an on-line regime. Besides, 5 additional ISS stations were installed on the Kura Depression zone. Azerbaijan National Data Center (Az-NDC) processes, analyzes and stores the data from IDC. On the basis of datasets from RCSS, ISS and Az-NDC it helps to trace the distribution of earthquakes' epicenters, analyze the seismic regime and earthquake re-occurrence and study the interrelation between geodynamic processes with seismic activity in the Caucasus region and Caspian Sea.

T1-P45. The ARISE project

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ARISE is a new European Research Infrastructure project selected by the European commission in April 2011.
ARISE proposes to design a new infrastructure that integrates different station networks in order to provide a new "3D" image of the atmospheric dynamics from the ground up to the mesosphere with unprecedented spatio-temporal resolution. The implied networks are:
- the International infrasound network developed for the verification of the Comprehensive nuclear Test Ban Treaty (CTBT). This system is unique by its quality for infrasound and atmospheric wave observations,
- the Network for the Detection of Atmospheric Composition Changes (NDACC) which uses Lidar to measure stratospheric dynamics,

- the Network for the Detection of Mesopause Changes (NDMC), dedicated to airglow layer measurements in the mesosphere, and additional complementary stations and satellite data. The infrastructure extends across Europe and outlying regions, including polar and equatorial regions.
Atmospheric waves play a key role in atmospheric mixing and global circulation in the stratosphere and mesosphere. Planetary waves can lead to sudden stratospheric warming while gravity waves generate predictable tropical oscillations of mean wind, which can lead to enhanced predictability of climate. Parameterization of gravity waves is needed for accurate simulation of mean climate and variability, but parameters are uncertain due to lack of long-term high-resolution observations.
ARISE expected benefits would be a better description of the atmosphere, leading to an improved accuracy in short and medium range weather forecasts. The measurements will be used to improve the parameterization of gravity waves in the stratosphere to better resolve climate models. Such description is crucial to estimate the impact of stratospheric climate forcing on the troposphere. In the long term, data will be used for monitoring changes in the occurrence of extreme events and trends in the middle atmosphere climate. The benefits also include civil applications related to monitoring of natural hazards as volcanoes.

T1-P46. A report of natural background radiation hazard in southern Tamil Nadu, India and its effect on habitat and environment

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Exposure and quantification of radioactivity has become significant in recent years with the gratitude of the consequence and urgency of environmental/climatic problems around the world. The radioactivity even in minor quantities will build up in human body and subsequently, lead to unknown and erratic health complications in particular those related to sustainable development, agricultural production, habitat, ecosystem and forest. This paper report the detailed radiation exposure rates at closely spaced intervals obtained along the beach sectors from Thengapattanam to Kanyakumari and the surrounding hinterlands regions of Tamil Nadu. High intrinsic radioagenic source, with radiation exposure rate ranging from 500 to 2600 R/h, have been identified in the weathered hillocks around Inayam and Midalam localities. In addition, a very high radiation exposure rate ranging from 1000 to 6000 R/h were found within the rock population of syenite body and in the boulders around Puttetti. Further, the radiation exposure rate along the connected beaches around Midalam, Kurumpanai and Manavalakurichi is observed to be lower than that of hinterlands ranging from 200 to 1600 R/h. Public concerns of radiation exposure of safety in high background areas are of great social and civil relevance. The construction materials used for dwelling purposes from these areas should be avoided from health hazard point of views. Significant radiation doses will certainly enter the human body as most of the people have the habit of sitting and sleeping on the floor. People living in the region are expected to receive significant radiation, which may get accumulated in the human body causing long-term health problem. It is also advisable if the area falls having already natural background radiation hazard must be avoided for the future nuclear power plants/reactors.

T1-P47. Forecast of the earthquakes' aftershocks in the common operations of seismic risk reduction

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The experience of seismological researches in different worldwide areas has shown convincingly that the main strikes of large crustal earthquakes are proceeding by aftershocks within the areas of foci of these major earthquakes. The energy of aftershocks doesn't exceed the energies of their main shocks. The more powerful is the main shock, the more powerful are aftershocks and the longer, according to the Omori-Utsu law, they are continuing. So, major earthquakes can be sequenced by quite strong aftershocks, and as the main shock can lead to catastrophic consequences. Aftershocks are dangerous also by the fact that as a result of strong main earthquake the aftershocks hit and damage buildings already have been weakened. The problem of aftershocks forecast seems much less difficult, because the locations of their occurrence are already known and one knows where to install the monitoring geophysical network. Experience of tectonomagnetic researches in seismic regions of Tajikistan showed that some earthquakes at least with a magnitude above 5 is preceded by anomalies in local geomagnetic field variations up to the first nT with the durations featuring for medium-term earthquake precursors. For example, Kairakkum earthquake on Oct. 13, 1985 was preceded by anomalies of up to 4 nT and after the main shock there were anomalies of about 1 nT 1-3 days before all the aftershocks with magnitudes above 2.5. Detection of anomalies in local geomagnetic field variations before strong aftershocks enables to predict them in principle and provides making relevant decisions during recovery stage after major earthquakes.