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Geophysical Monitoring and Evaluation Criteria of Climate Change

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Abstract

The global climate change indicates increasing geophysical incidences, earthquakes, cyclones, melting of glaciers, floods, and drought etc. These incidences are the impacts of global climate change indicating to serious inter-related problems in spatial dimensions–four dimensional space length, width, height and time. The vertical geophysical analysis is made by selecting the locations on the basis of sensivity of geophysical conditions indicated by temperature, humidity, precipitation and the physical, chemical processes of five elements of environment- air, physical materials, water, energy (temperature) and space. The energy or material fields have been explained by Eienstein in theory of relativity and unified field theory, indicating to a process of impact of changes on the other spatial dimensions.

The system theory explains that any physical change affects the biological and human systems. The analysis of the processes is made in dynamic system theory of input-output changes between the systems and sub-systems by scoping of the dimensions and resolution levels.

Due to increased human activities and large scale material use in industrialization and globalization processes, the geophysical structure and attributes have undergone serious changes as an induced effect of the natural geophysical processes. The monitoring of geophysical conditions in spatial dimensions indicates to the threat of life because of intermittent and cumulative induction process following the law of thermodynamics, fluvial processes and structural changes.

This paper examines the geophysical conditions and changes in time and space to indicate to the human activities in industrial civilization and threat to life on earth. It also provides regulatory mechanisms of sub-systems in geophysical space which regulates life cycle and human activities.

Keywords: Vertical monitoring; Spatial dimension; Climate change; Geothermal landscape

Introductory Remarks

Monitoring and evaluation of environmental condition and development has become one of the important method for monitoring, evaluation and prediction of change. This monitoring process is undertaken by selecting the locations in geophysical space on the basis of the geographical incidences of hazards, disasters, etc. observed on the earth surface. The vulnerable zones and the elements are identified to examine the process of changes in the geophysical elements. The geophysical incidences of Tsunami, earthquakes, cyclones, forest fires, rising of sea levels, floods, drought, are observed as induced natural hazards and disasters on the earth surface having serious implications in life and economies.

The monitoring of climate change has been continued by recording temperature, humidity, and rainfall to identify the geographical and temporal monitoring of changes. Nevertheless, the increasing carbon di oxide emission in atmosphere due to fossil fuels use for economic activities is attributed to increasing atmospheric temperature. In Indian condition and most of the developing countries, the CO_2 emission is not that much but continued exploitation of minerals and forest have resulted in the imbalances in environmental elements-land, water, air, temperature and space and needs to be monitored in spatial dimensions to understand the structural composition and processes as impacts in space such as the influence on earthquakes, floods, cyclones, drought etc.

This paper examines the vertical spatial process of temperature in atmosphere, earth surface and subsurface depth as monitoring device in vertical spatial dimensions by selecting the locations of sensivity and spatial dimensions of vulnerability. Another aspect of monitoring is in geographical landscape for identifying the impacts of mining and deforestation on climate change effects in India as result of change from adaptive development process to exploitative resource use in industrialization periods [1-5].

The criteria of monitoring and evaluation have been made at the level of geophysical, ecological, and life cycles impact. Hence, the increasing threat of life has focused attention to environmental conservation and management aspects along with sustainable development. Increasing global climate has created panic for reducing temperature by 2°C by reducing carbon emission at the global level. This would require shift from fossil fuel use to alternative energy sources, restoration of forest cover for environmental balance in degraded areas, sustainable growth of resource use for organic development in land use pattern etc. But, the public policy are not integrated in geographical areas and the development programmes are sectoral not properly integrated in geographical spaces creating

ecological, socio-economic and environment imbalances in space [6,7]. There is failure of sustainable development policies due to lack of capacities for mitigation, management, safety of environment and life in vulnerable zones etc.

Vertical Monitoring of Climate Change

The climate changes at sample sensivity zones are monitored at surface and subsurface levels to ascertain the relationship and interactions between the surface and subsurface temperature. It is observed that the temperature observed in different regions of India has increased at average 0.86°C recorded highest in east coast at 1.65°C followed by north central (1.61°C) north east (1.48°C), north west (1.20°C) and interior peninsula (0.83°C). The observed data indicates rising surface temperature in all the regions (Figure 1 and Table 1).

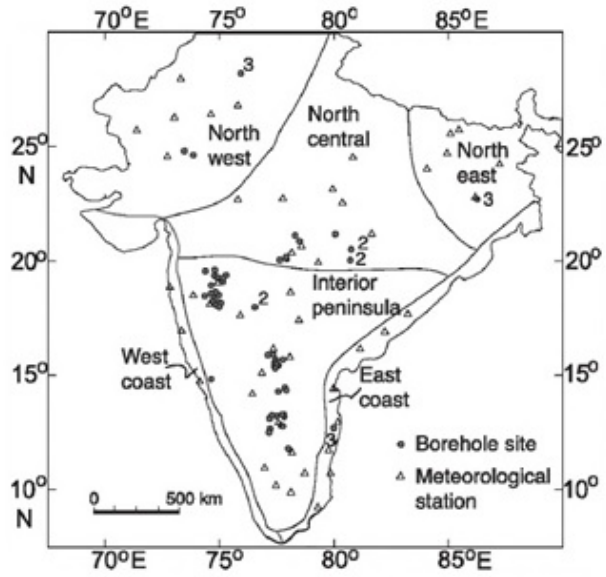

Figure 1: Changes in surface air temperature.

Climatic Division	Number of Stations	Average Trend, °C/100 Years
Northwest (NW)	6	0.3
North central (NC)	9	1.0
Northeast (NE)	6	0.5
East coast (EC)	8	0.6
West coast (WC)	3	0.7
Interior peninsula (IP)	16	0.4
All sites	48	0.5

Table 1: Average SAT trends for the different climatic provinces.

The Surface Air Temperature (SAT), Surface Ground Temperature (SGT) and subsurface temperature are found to be inter-related and change in surface ground temperature affects the subsurface temperature and result in perturbation of the subsurface temperature.

The above analysis indicates that any change in surface air temperature affects the surface ground temperature and subsurface temperature in interactive process for thermodynamic principles.

Criteria and Indicators of Climate Change

Increasing climate change has resulted in diverse environment hazards and disaster threat in life and properties. That is why environmental, ecological, economic, human and biotic criteria are used for monitoring, evaluation, forecasting, management and planning for environmental conservation and sustainable development objectives. These criteria are used for restoration of environmental quality suitable human life and to regulate human behavior and capacity for sustainable growth and preserving and biological life cycle. That is why geophysical monitoring is made along with bio monitors and the ecological indicators etc. for restoration and management and sustainable growth.

In space the environmental systems and life systems are correlated and physical, environmental, ecological, social, economic and political sub systems are correlated. Whereas geophysical indicators include temperature, humidity, and wind direction and velocity etc. it also include types of composition of land rock material properties, slope etc. which helps in analysis of geophysical structure and dynamic processes and change for structural and fluvial analysis. Temperature and pressure alter physical structure and induce geophysical processes in relation to other physical variables [8-10].

The bio-monitors are used to indicate sensitivity of bio-species as a result of climate change, habitat and population change and are being widely used for conservation and sustainable development. The economic monitoring is being made for sustainable development of the economies which are seriously affects by the environmental degradation and depletion (Table 2).

Climatic Division	Number of Sites	Average ΔT, °C	Average t*, years	Average Trend, °C/100 years
All sites	70	0.86 (0.06)	149 (20)	0.58 (0.1)
Northwest (NW)	5	1.20 (0.23)	142 (49)	0.87 (0.34)
North central (NC)	10	1.61 (0.22)	158 (37)	1.02 (0.27)
North east (NE)	3	1.48 (0.31)	252 (110)	0.58 (0.28)
East coast (EC)	3	1.65 (0.09)	287 (33)	0.57 (0.1)
Interior peninsula (IP)	49	0.63 (0.06)	107 (16)	0.59 (0.1)
°ΔT-ramp amplitude; t*-ramp duration: numbers within parentheses indicate 95% confidence limits.				

Table 2: Results of simultaneous inversion of reduced temperature profiles.

The human development monitoring are being made adapting sustainable development values to reduce the problems and devising methods for including increasing per capita income, literacy and

longevity. Environmental indicators are soil, land, water, air, temperature and space which are used for quantitative and qualitative evaluation for structural analysis and change detection.

The policy indicators are used as method of response analysis by the government and the people to react in response to a negative change in the system for improvement in system and sub systems.

Spatial Processes and Pattern Identification in Climate Change

The geographical landscape approaches to climate change identify the relationship between various geophysical subsystems with other systems and changes in space and time. The ecological and environmental degradation have been identified as result of mining, industrialization, urbanization etc. it is necessary to adopt the following steps for restoring environmental quality.

1. Restoration of environmental balance and quality in geophysical spatial structure.
2. Planning and management for sustainability of development and environmental quality.
3. Sensivity and vulnerability analysis of the process and pattern.

Spatial Dimension of Climate Change

Spatial systems are multi-dimensional and hence can be analyzed in system theory approach by identifying the scope and resolution levels the use of laboratory method in closed environmental condition and the system interaction between different indicators of environment and satellite monitored remotely sense data of the geophysical and other structure are being used for change detection of systems and subsystem in time and space.

These processes are analyzed as exogenous impacts of global climate change on regional and local climate change and impact of endogenous systems on the environment.

Concluding Remarks

Indian micro geographical conditions have been seriously degraded during colonial and post-colonial periods due continued mining and deforestation in almost all the region's leading to increased soil erosion, wasteland creation and threat to life cycles in geographical landscape due to climate change and resource depletion and degradation. Restoration of environmental balance geographical landscape would require monitoring of physical, biotic, economic, social, policy indicators to regulate the environment and development conditions in system dynamic framework both in space and time.

The policy frameworks for reduction of climate change effects are not much effective because of dominating public and private partnership in privatization of mining, large dam construction, faster migration from rural areas and increasing urbanization indicate to over powering public and private institutions for creating unsustainability of environment and development. Geographical monitoring requires both landscape approach and temporal monitoring processes to make the region environment and ecosystem sustainable. The flood and droughts are inter-related phenomena resulting due to climate change. These problems in India could be resolved through extensive afforestation programme along with water conservation and development programmes for environmental conservation and sustainable development in geographical landscape along with drought and flood mitigation programmes. Inter-basin water transfer and international water treaty would also resolve the problems of floods and droughts in geographical landscapes in India.

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