From the desk of the Editor-in-Chief…

The present issue of the JOURNAL OF GEOINTERFACE (A Publication on the Earth System Science) Dec. 2022 welcomes the esteemed authors who have contributed the most relevant articles for the greater benefit of researchers and the geo-community. The publication encompasses broad spectra of the earth, climate, planetary and environmental sciences. A great share of responsibilities and herculean effort lie with the human community, geoscientific bodies, and related entities either individually or collectively to solve the gigantic problems of mother earth.

Earth System Science organisations of India

Several geoscientific, oceanographic, space and research organizations like Geological Survey of India, CSIR-National Geophysical Research Institute (NGRI), CSIR-Institute of Minerals and Materials Technology (IMMT) previously called RRL, Indian Bureau of Mines (IBM), Atomic mineral Division (AMD) Wadia Institute of Himalayan Geology (WIHG), Birbal Sahni Institute of Palaeosciences (BSIP), Indian Institute of Geomagnetism (IIG), National Remote Sensing Agency (NRSA), National Institute of Oceanography (NIO), National Centre for Antarctic and Ocean Research (NCAOR), state level Remote Sensing Centres, Physical Research Laboratory (PRL),Federation of Indian Geological Associations (FIGA), Indian Space Research Organisation (ISRO), Space Application Centre (SAC), Indian Institute of Tropical Meteorology (IITM), research centres of Indian Institutes of Technology (IIT)s, universities and autonomous bodies are engaged to find out solutions to multifarious problems and assignments related to Earth System Science. Each although has its own specified field or subfield of work, has been contributing to the progress of Earth System Science in totality and being responsible for overall analyses and syntheses. The Earth System Science in India gains from their intelligent collectivity of data and interpretations.

Challenges and mitigations in Earth System Science

Rush for raw materials, water resources, energy, climate change geological risks: this special issue intends to establish a benchmark on the major geological issues of the 21st century. Prof. Valerio Acocella, Dipartimento di Scienze, Università Roma Tre, Roma, Italy has expressed great concern and mitigation of Earth System Science problems in his article “Grand Challenges of Earth Science: Research Towards a Sustainable Environment in 2015. The expert is mentioned below Earth Science is a broad term referring to the fields of science dealing with our planet. It involves studies on the lithosphere (including geology, geophysics, geochemistry, and geography), the hydrosphere (including hydrology and marine, ocean, and cryospheric sciences), and the atmosphere (including meteorology and climatology). As such, Earth science consists of a broad spectrum of interconnected physical, chemical, and biological disciplines dealing with processes which have been occurring on our world for billions of years, from the subatomic to the planetary scale. The stature of Earth science has grown with each new decade, defining the history of life, unveiling the evolution of the planetary surface, quantifying natural hazards, locating mineral and energy resources, and characterizing the climate system. This, supported by continuing technical and theoretical improvements, has allowed reaching an unprecedented understanding of countless processes. The capabilities of the Earth science sub-disciplines have advanced to document the geological record of terrestrial changes, understand how life evolved, observe active processes from the core to the surface, make more realistic simulations of complex dynamic processes and start forecasting. Many important discoveries, for example, the plate tectonics theory or the definition of the hydrological cycle, have been achieved gradually, from the merging of several important and independent studies. This progression has also brought to the recognition and verification of the need to establish broad connections and integrations between different sub-disciplines, a major advance in Earth science, especially over the past decade. Consider

for example the potential of studies exploring the intimate relationships between climate, surface processes (including hydrology, physical and chemical denudation, sedimentary deposition, flooding), and tectonics (from the evolution of mountain ranges to earthquakes). Or the research at the intersection of geomorphology, hydrology and ecology, which delivers new insights into the mechanisms of landscape-ecosystem interactions, including the rates of soil formation or denudation in given landscapes. This multidisciplinary point out to an innovative, first-order level of research and understanding, where the Earth is considered as a single system, with properties and behaviour that are characteristic of the system as a whole, including critical thresholds, nonlinearities, teleconnection, and unresolvable uncertainties.

Looking forward to the next decade and beyond, the role of Earth science studies for the development of our planet will expand substantially. Earth science will become increasingly prominent as humanity confronts daunting challenges in finding natural resources to sustain Earth's burgeoning population, mitigating natural hazards that impact life and infrastructures, and, more in general, achieving sustainable environmental stewardship (NAP, 2012). Earth science research will have to improve the management of natural resources (water, raw materials, and energy) and hazards, supporting prosperous and secure societies and developing new industries for economic growth. Earth science is the foundation of the exploration and the responsible use of our natural resources through an understanding of the surface and subsurface. Much of the energy sector depends on understanding processes and monitoring in the subsurface, including the extraction of coal, oil, gas, shale gas, and geothermal fluids, as well as carbon capture and storage and nuclear waste storage. The management of natural resources should be also accompanied by the forecast and management of natural hazards (earthquakes, tsunamis, cyclones, floods, sea level rise, eruptions, drought), increasingly exposing the growing population and infrastructures. While hazards are inevitable, the worst of their consequences are not loss of life and infrastructure can be minimized through monitoring and modelling, in the frame of adequate longer-term prevention and shorter-term forecast. While the frequency of natural hazards (and the related amount of exposed population) has increased in the last century, the death toll has significantly decreased, highlighting the impact of prevention in mitigating risk.

Problems and catastrophe

Students of the Geological History of planet Earth are not unaware of the cataclysms and reconstruction cycles, which the globe faced in its 4.6 billion years of known time accountability but the real concern gets focused to the current few centuries, when modern man has gone to unfathomable heights and depths of perfection in multiple directions, many of them at the cost of the primary safety of the very Earth where we now live in. The human community are in the amidst of critical and alarming problems due to global warming, overexploitation of groundwater, environmental hazards like air, water, soil and sea pollution which are caused by various anthropogenic activities. Due to increase in the population, demand for energy is increasing; and the existing natural resources are depleting to cope-up growing need for energy. Prediction of Indian Monsoon Systems and climate changes associated with global warming are in the frontline, among the challenges. They lead to variable rainfall, sea level rise, glacial melting, frequency of cyclones and hurricanes etc. In the recent past, earth has been battered with frequent natural and man-made disasters like, volcanism, earthquakes, super-heavy electrical lightening/thunders, tsunamis, floods, cyclones, droughts, landslides, gas disasters and other, environmental pollutions; nuclear threats like explosions, implosions and waste disposal which have threatened the existence of our lives and the biosphere as a whole. Thus, ten front-page themes of the planet earth addressing societal needs are:

a. Groundwater: reservoir for a thirsty planet;
b. Hazards: minimizing risks, maximizing awareness;
c. Earth and Health: Building a safer environment;

d. Climate change: The 'stone' tape;
e. Resources: towards sustainable use;
f. Megacities: our global urban future;
g. Deep Earth: from crust to core
h. Ocean: abyss of time
i. Soil: Earth's living skin;
j. Earth and life: origin of diversity.

The **central theme** of **"Earth System Science for Society"** has been initiated by **Dr. Eduardo. F.J.De. Mulde**, his team member of different countries with much enthusiasm and seriousness various activities in the form of projects all over the world such as, seminars/symposia/workshops/colloquia, people awareness, etc. are in full swing since the International Year of Planet Earth (IYPE) in which we are also included members. The ultimate objective of such activities is to save this society from some dangerous consequences, to create awareness on the conservation of resources, as also to adopt procedures so as to reduce carbon emissions and greenhouse gases, bereft of any vigorous compromise on the quality of human life or of the biota, at large.

Destructive manifestations of cataclysmic natural disasters do not discriminate between geographical boundaries of developing and developed countries. During 2022, tropical cyclones formed in seven major bodies of water, commonly known as tropical cyclone basins. Tropical cyclones were named by various weather agencies when they attained maximum sustained winds of 35 knots (65 km/h; 40 mph). During the year, 132 systems formed, of which 86 were named. The strongest storm to form was Typhoon Nanmadol, with maximum 10-minute sustained wind speeds of 195 km/h (120 mph) and a minimum pressure of 910 hPa (26.87 inHg). The deadliest tropical cyclone was Tropical Storm Megi, which caused 214 fatalities in the Philippines (excluding 132 others rendered missing), while the costliest was Hurricane Ian, which had an estimated damage total of at least $50.2 billion (2022 USD) after affecting Trinidad and Tobago, Venezuela, Colombia, the western part of the Greater Antilles and the Southeast United States. Two Category 5 tropical cyclones on the Saffir–Simpson scale (SSHWS) formed during the year. The "Very Severe Cyclonic Storm" **Yaas** (23-28 May,2021), which made landfall in Odisha on Wednesday south of Balasore, tore into the neighbouring states of West Bengal and Odisha before weakening into a cyclonic storm and left a path of devastation down the eastern coast. Four people were killed in Odisha and one in West Bengal, totaling five. According to estimates, as of May 31, 300,000 homes in India had been destroyed or damaged due to swollen rivers and sea waters along the Bengal coast. Additionally, trains were canceled, and airports in Kolkata and Bhubaneshwar were briefly shuttered. Mayurbhanj, Jajpur, Cuttack, Khorda, and Puri in Odisha received an Organe alert from the IMD on May 25, whereas Kendrapara, Jagatsinghpur, Bhadrak, and Balasore received red attention. Cyclone **Tauktae** (14-19 May 2021) initially described as "very severe," made landfall in Gujarat state late on Monday with winds as high as 160 km/h (100mph). Gujarat witnessed severe wind damage that has uprooted trees and power lines in coastal areas. About 200,000 people were evacuated across various states as the hurricane approached, bringing torrential rains and high winds. The cyclone had an impact on Mumbai as well. At 114 km/h, the wind gust that was recorded in the city was the biggest ever (70 mph). Problems with the structural or power losses also occurred on other larger ships. Over 80 persons were reported missing, making a total death toll from the cyclone of at least 174. Tauktae-related losses are pegged at Rs. 15,000 crores ($2.1 billion). Cyclone Gulab 24-28 Sept 2021) has caused at least 20 fatalities and 20 billion (US$269 million) in losses. The IMD raised the state's alert level and activated Odisha's National Disaster Response Force (NDRF) and State Disaster Response Force (SDRF). As a result of the cyclone, more than 30,000 people fled to safety on September 26; as the storm advanced further inland, this figure rose to 46,075. A total of 148 mm (5.8 in) rainfall at Pottangi, 89.4 mm (3.52 in) at Mahendragarh, and 77.2 mm (3.04 in) at Mohana, Gajapati was noted on September 27. There were no reported fatalities. Gulab caused

the Godavari River's water level to rise to the first mark at 43.90 ft on September 30. (13.38 m). As a minor tropical cyclone, Cyclonic Storm Jawad (2-6 Dec. 2021) brought torrential rainfall and strong winds to Andhra Pradesh, Odisha, and West Bengal in India, where it caused significant disruptions.40 millimeters (1.6 inches) of rain fell at Gopalpur, Odisha, between December 4 and 5. In addition to being destroyed and flooded by flooding, several paddy crops and other unrelated crops were also reportedly disrupted by farming. By December 4, West Bengal began to suffer rain brought on by Jawad, which was first concentrated across West and East Midnapore. Twin cyclones (May 2022) originated at the exact longitude and were migrating away, respectively known as cyclone Asani and cyclone Karim. Near the Andaman Sea, Cyclone Asani started to develop. As it grew more robust, it became a powerful cyclone that brought heavy rains and blustery winds to states like West Bengal, Andhra Pradesh, and Odisha. Cyclone Karim, a category two cyclone with winds of 112 kmph and gusting to over 140 kmph, had formed shortly before over the Indian Ocean. Due to the cyclonic storm, the IMD has issued a rainfall and wind alert for West Bengal, Odisha, and Andhra Pradesh. Authorities prohibited tourism-related activities on beaches and coastal areas until May 13. **2022 Assam floods** refers to the significant flood event of the Brahmaputra River in the Indian north-eastern state of Assam and affected over ten million people, claiming the lives of 123 people, with an additional 26 deaths due to landslides, 5474 villages were affected and over one hundred and fifty thousand people found refuge in relief camp. **2022 China flood**, had severely affected large areas of southern China including the Yangtze basin and its tributaries. Rains and floods extended to central and eastern China during July 2022 and were **described as the worst since 1998** as the costliest storm ever recorded in the basin. The floods had affected 63.46 million people and caused a direct economic loss of 178.96 billion CNY, which are 12.7% and 15.5% higher than the 2015-2021 average, respectively. 219 people were found dead or are missing, and 54,000 houses collapsed, The Ministry of Water Resources said that a total of 443 rivers nationwide have been flooded, with 33 of them swelling to the highest levels ever recorded. According to statistics from the National Cultural Heritage Administration (NCHA), 76 key national cultural relics and 187 provincial cultural heritage sites have suffered damage of varying degrees. The **2020 North Indian Ocean cyclone season** is an ongoing event in the annual cycle of tropical cyclone formation. The cyclones tend to form between April and November, with peaks in late April to May and October to November. The **2021 California wildfire season** is a series of ongoing wildfires that are burning across the state of California. The season is a part of the 2020 Western United States wildfire season. As of November 24, 2020, over 9,279 fires have burnt 4,359,517 acres (1,764,234 ha), more than 4% of the state's roughly 100 million acres of land, making 2020 the **largest wildfire season recorded in California's modern history** (according to the California Department of Forestry and Fire Protection), though roughly equivalent to the pre-1800 levels which averaged around 4.4 million acres yearly and up to 12 million in peak years. **The intensity of the fires has been increased by drying and heating from human-induced climate change, as well as decades of poor forest management**. Since the past century, biodiversity has come under a tremendous pressure leading to extinction of a large number of flora & fauna. The endangered wildlife species are increasing day by day causing the disappearance of some important species. It has become a matter of great concern towards the conservation of the same. Some endangered species as per IUCN list, have been highlighted under our Earth and Life Science Panorama section of the present volume, for ready reference.

Scientific achievements and Futuristic appraisal

The geotechnological innovations like GIS, GPS, GPR and Remote Sensing Technology, 3-D seismology, helium and radar emanometry, fluid dynamics, numerical modelling, infrastructure construction technology, etc. have revolutionised our geological view for the greater benefit of mankind. The findings of research and academic institutions pave the way to address the Planet-Earth to some extent. Innovative research has led to expand human living conditions and economic growth.

Climatic forecasting model based on the modern "Coupled Ocean-Atmosphere General Circulation" is a prodigious scientific achievement. More concentrated investigation of 'Planet Earth' are needed to advance the quality of life with the least adverse impact on the environment, while achieving our goal of developing and successfully applying to maintain sustaining knowledge for the society. We have to save and conserve a large number of natural resources (mineral fuel, coal and other industrial minerals, soil, water, etc.) by adopting optimization with technology development. A noteworthy and eye-catching activity is the construction of **eco-friendly 7,500 seated gymnasium** of Beijing University of Technology. It is the world's largest suspended dome measuring 93 meters in diameter. Two wells as deep as 2,000m would provide heat for 7,500 spectators in winter and another 12 wells are used for the cooling system during summer with zero emission of greenhouse gas and with 30 percent reduction of energy consumption as per the report of Xinhua agency, China. The 148 optical fiber light pipes are installed, which will meet lighting needs in the night. The 70% water supply shall come from recycled water. It is also able to collect millions of kilolitres of rain water, bath water and waste water from swimming pools annually, to wash the ground, flush toilets, supplement the water supply for the cooling tower and water plants around the venue. The blue bubbling translucent exterior is said to allow more sunlight to heat the swimming pool and to save thermal loss. The ban on using plastic bags, 90% discount on energy-saving lights and making greenery of the major part of metropolis are other remedial measures of Beijing authorities. Thus, the gymnasium of the Beijing University of Technology could become an **eco-friendly model** in the context of global warming. India is undoubtedly emitting less greenhouse gas compared with highly developed countries like the USA and some European countries. That does not mean that we could emit more GHG with a motive of competition. India should rather come forward lessening it as far as possible, so as to be an exemplary model in saving efforts for our PLANET EARTH. The culture of 'stiff collar and smart suits in summer' might be over at the United Nations as it ratchets up thermostat on working days and completely shuts down the air-conditioning during weekends to help in reducing greenhouse gas emissions. Unveiling the '**Cool UN**' initiative, the world body advised diplomats, staff and journalists to wear lighter clothes as the air conditioning temperature would be raised from 22 to 25 ºC. The simple raise in AC temp. of 3º in United Nations Head Quarters at New York and Geneva can reduce a large expanse of greenhouse gas and save 1 million dollars annually.

It is hoped, that a large amount of greenhouse gas emissions may be minimised by adopting simple tips mentioned in detail in the section, **Earth, Planetary and Environmental Science Panorama** of the present issue of the **JOURNAL OF GEOINTERFACE**. This issue is being presented with great expectations and awareness among people to save our planet can be kindled.

Conclusion

The ultimate needs of the hour are awareness, development, strong will power to mitigate worldwide Earth System Science related issues and challenges with individual and group effort with accessible technology, Planting and nourishing trees to create pollution-free environment. Our slogans are 1) Save the Planet Earth–Explore, Share and Care 2) Earth System Sciences for Global community.

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LET US SAVE OUR MOTHER EARTH'S ENVIRONMENT TO GET OURSELVES SAVED.

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