In this issue

AI and Machine Learning

In earth system sciences

Data on various aspects of the earth – earthquakes, land use, rainfall, temperature, atmospheric circulation, cyclones, soil parameters, groundwater, satellite images, etc. – have been growing at an exponential rate. Most such data are easily available to researchers. But the sheer volume of data, the number of parameters involved in these phenomena as well as the lack of clarity on the interconnectedness between the parameters and the physics involved, make it difficult to convert the data into knowledge – knowledge necessary to plan agricultural activities, to anticipate hazards, to mitigate disasters...

Meanwhile, the field of machine learning and artificial intelligence has also been growing rapidly – especially in recent years. Which type of machine learning and artificial intelligence algorithms can be used by earth system sciences? What are the tools that are already available? What type of problems can be tackled? What are the opportunities for earth scientists to learn the skills necessary to tackle the problems? What are the research areas emerging due to the marriage of artificial intelligence, machine learning and earth system sciences?

The Review Article on **page 1019**, which deals with these issues, is a must-read for earth system scientists and for innovators in digital technologies and artificial intelligence. Researchers in other fields who seek the excitement of scientific progress will also enjoy the article.

Improving Soft Soils

Pervious concrete column

When oil storage tanks, embankments and rigid foundations are to be constructed on soft soils, to improve the load-bearing capacity of the soil, a network of stone compacted columns is created. The columns not only act as drainage points, but they also enhance slope stability and prevent liquefaction by increasing the soil's shear strength.

But, in soft clay soils, granular material penetrates the soft clay, and the soft clay enters the column. This creates lateral bulges and the technique often fails to provide the desired results.

A Research Article in this issue considers pervious concrete columns as an alternative to stone columns. Using three-dimensional numerical analyses, the researchers show that the performance of the pervious concrete column is much better than that of the stone column.

The lateral bulge in the case of the stone column is minimal beyond about 2.5 metres. So, even creating a composite by topping up a stone column with a pervious concrete column of appropriate length can also overcome the problem of stone column failure, argues the Research Article on **page 1044** in this issue.

Dehydrating Medicinal Leaves

Open sun or solar dryer?

Green leaves, like mint, tulsi, stevia and neem, used for medicinal purposes, have to be dried to preserve, store and transport them. This can be done by using energy from biomass, fuel or electricity and solar drying. But these methods consume energy and produce pollution. So farmers dry the leaves under the open sun. Solar drying can speed up the process and make it more efficient. But by how much?

Researchers from the B.M.S. College of Engineering, Bengaluru rigged up a system: an aluminum frame, covered by glass into which a black coated tray can be slid. The dryer allowed air to flow and to remove the moisture emanating from the leaves in the tray.

The researchers used mint leaves, with a high water content of about 80%, for their experiments. To compare the efficacy of their contraption with that of open sun drying, they also dried mint leaves on a thick polythene sheet under the open sun. Both methods had thin layers of mint leaves.

In ten hours of drying, the moisture content in the leaves in the solar dryer went down to about 8% whereas, under the open sun, leaves still had more than 26% moisture. While the polythene sheet attained a maximum of 39°C during drying experiments, the black tray in the solar dryer went up to 65 degrees. The researchers also provide models for the kinetics of drying under both methods in the Research Article on **page 1066**.

Central Godavari Delta

Groundwater exploration

The Central Godavari delta region is facing high groundwater extraction. In some areas in the region, this can lead to a lowering of the water table, while, in some others, it may lead to saline water intrusion, making the water unfit for drinking and irrigation. There was a need to identify fresh groundwater areas in the region.

Researchers from the Central Groundwater Board and the Adikavi Nannaya University used an integrated approach while undertaking the task. They used geomorphology, land use/land cover and groundwater quality and geophysical data to make a comprehensive assessment of groundwater in the region.

Only 35% of the nearly 380 square kilometre area has freshwater underground. In the north-western part of the area, they found palaeochannels. The central parts had isolated pockets of freshwater. The southeast and southwest corners of the area had saline water unsuitable for agriculture.

The Research Article on **page 1051** in this issue provides data required for evidence-based planning for sustainable groundwater extraction in the region.

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