Sustainable water resource management in Eastern Punjab using remote sensing and GIS to demarcate water potential zones

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Water is a fluctuating resource making it difficult to measure in time and in space. To demonstrate the efficiency of the geographic information system (GIS) for groundwater management, information on the parameters controlling groundwater such as lithology, geomorphology, soil type, land use and land cover and lineament analysis were analyzed. IRS LISS-III and Landsat satellite data of the area was used to infer information on the geologic lineaments and geomorphology. To identify linear features i. e lineament enhancement and directional filtering was performed on single bands of Landsat images. Thematic maps for geology, slope, soil, geomorphology and lineament were prepared and integrated in GIS by assigning the weights and ranking to various parameters controlling the occurrence of groundwater to generate the groundwater potential map for the study area. The results indicate that the floodplain of river and its adjoining areas have very good groundwater potential, whereas the steeply sloping area in the northern part having high relief and slope possesses poor groundwater potential. The groundwater potential zones were obtained by weighted overlay method using the spatial analysis module in ArcGIS 9.0. The southern part of the study area showed highest decline in water level in last 3 decades. Thus a holistic water resource management strategy needs to be developed for this part of the district. The floodplain of the river in the area holds potential for further groundwater development as these areas belong to good class in GPI map.

Toward a self-consistent pressure scale: Elastic moduli and equation of state of MgO and Ringwoodite by simultaneous X-ray density and Brillouin sound velocity measurements at high-P and high-T

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Accurate phase diagrams and PVT equations of state (EOS) of materials strongly depend on the PVT calibrations of standard materials (e.g. MgO, NaCl, Au, Pt), which currently do not predict identical pressures at the same experimental conditions. MgO is one of the simplest and most studied materials and is a common pressure standard, although its accurate high-PT EOS is still uncertain. The direct way of obtaining a self consistent pressure scale is by measuring acoustic velocities (Vp and Vs) and density simultaneously. Such P-V-T-Vp-Vs measurements allow one to determine the pressure directly, without resort to a separate calibration standard.

Recently, as part of a major COMPRES initiative, we have constructed a Brillouin spectrometer at GSECARS, APS, which allows accurate simultaneous sound velocity and lattice parameter measurements at high P and high T. Such measurements were performed on single crystal MgO in diamond cells. At each PT we measured the unit cell parameters and the acoustic velocities in several crystallographic directions, and directly obtained all three single crystal, and isotropic adiabatic bulk (Ks) and shear (μ) elastic moduli.

In addition we demonstrate that successful P-V-T-Vp-Vs measurements can be performed on certain polycrystalline materials, e.g. Ringwoodite (gamma-Mg_2SiO_4). The results of these experiments and implications for a self consistent P-V-T (-Vp-Vs) pressure scale will be presented and discussed.