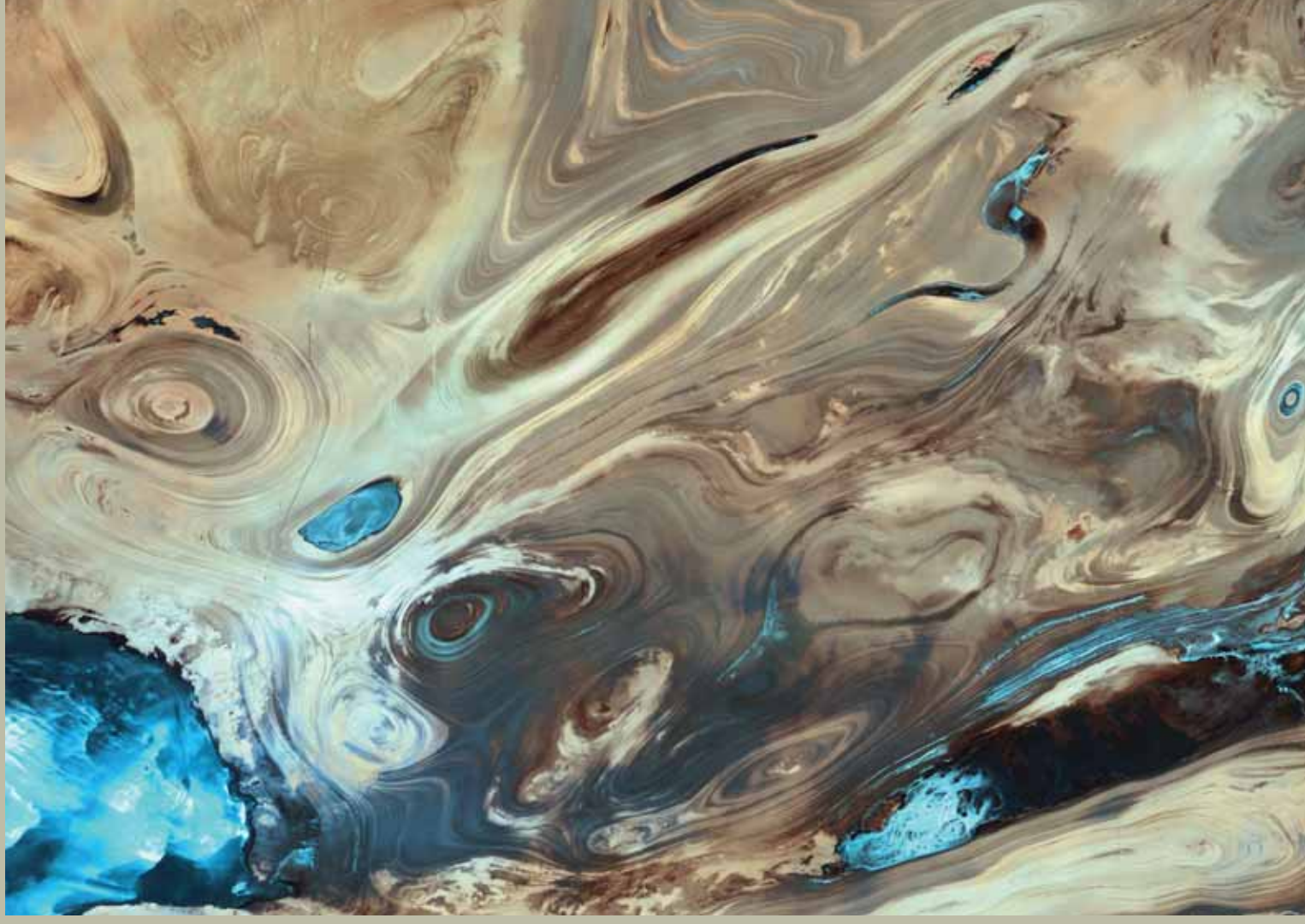


NASA Earth Observatory

FROM IMAGE TO SUBSTANCE

PARVIZ TARIKHI REPORTS ON IRAN'S USE OF REMOTE SENSING TECHNIQUES TO MITIGATE NATURAL DISASTERS AND PROMOTE SUSTAINABLE DEVELOPMENT

The importance of space science and technology to mankind - not least its potential to mitigate natural disasters and support sustainable development - is undeniable.

Over recent decades the Islamic Republic of Iran has conducted intense activity in this field by establishing research centers and several aerospace institutes at academic level. In late 2003, this culminated in a new national body for space affairs ... one whose focus on the peaceful uses of space science and technology was reinforced by desire to co-operate at the international level.

Today, that body - the Iranian Space Agency (ISA) (http://isa.ir/en/rs/) - both spearheads and supports all such activity under the leadership of a Supreme Council of Space chaired by the Iranian President, Mahmoud Ahmadinejad.

For its day-to-day task of implementing the strategies set by the Supreme Council of Space, ISA is affiliated to the Ministry of Communications & Information Technology. Some examples of the work undertaken by the agency to mitigate environmental problems and promote sustainable development in Iran are outlined below.

Drought mitigation

Due to its negative economic and societal impacts, drought mitigation is accorded a high priority in Iran. During the most recent extended period of drought (1998 to 2002), a number of studies involving remote sensing were conducted by a team of specialists from ISA (then the Iranian Remote Sensing Center). To assess the impact of these dry years, NOAA data and NDVI methods were utilised to detect changes in vegetation cover over the entire country and the results exploited as a tool for informed decision-making (Fig. 1).

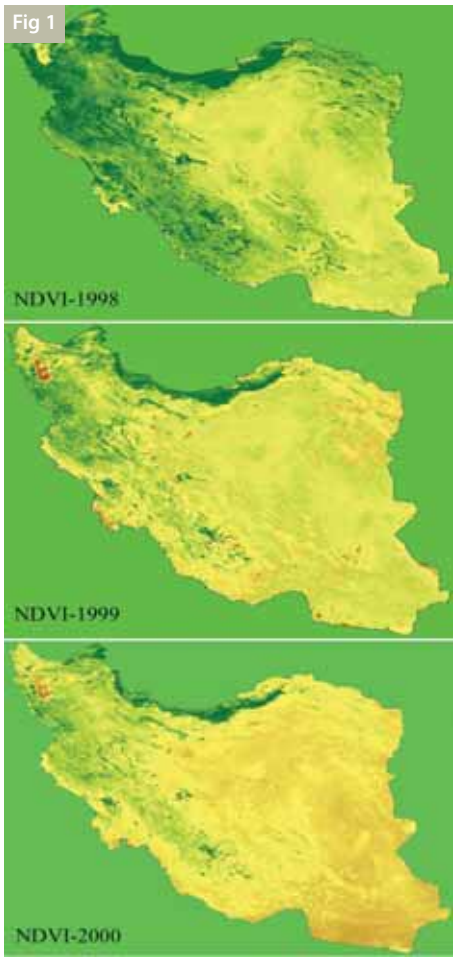
The secondary impact of this extended period of drought was observed in Iran's wetlands, the largest of which were the subject of joint Iranian-United Nations Development Program (UNDP) study involving the use of Landsat MSS, TM and ETM+ imagery. These assisted in gathering valuable multi-temporal information for a GIS-based databank and for the generation of Digital Elevation Models (DEMs).

DEM/DSM generation

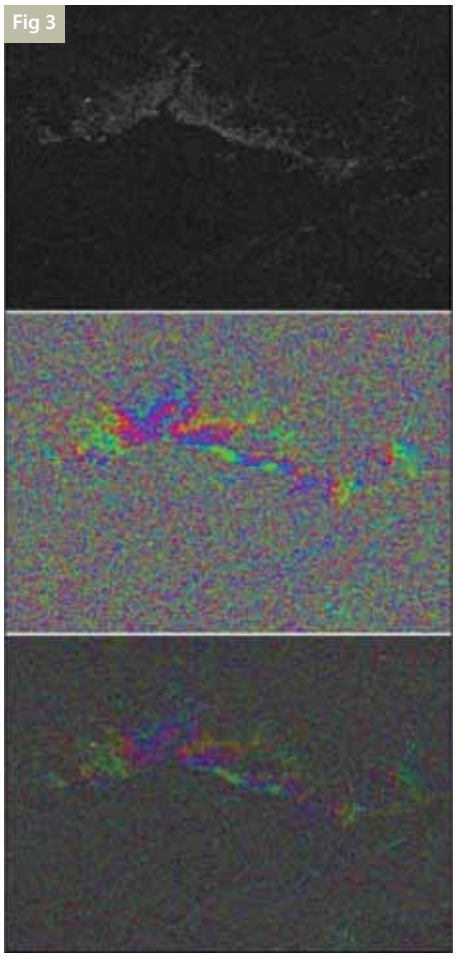
In a project sponsored by the Radio Communications Office of the Ministry of Communications & Information Technology, a team of specialists from ISA's Technology Application Department were commissioned to generate DEMs and DSMs (Digital Surface Models) for the whole country. These would help determine locations for the siting of telecommunication installations and masts that would provide country-wide wireless broadband coverage(Fig. 2). The three-phase project involved:

1. Generating DEMs and DSMs from either 1:25,000-scale topographic maps or SPOT stereo pairs,
2. Providing clutter/land use - morphological maps using interpreted Landsat TM and ETM imagery
3. Generating a DEM of the nation and 400 km beyond its borders by using the 1:250,000 scale topographic maps.

Mosaics of the whole country and major cities from the 1:250,000-scale and 1:25,000 scale mapping respectively were additional deliverables of this successful project.



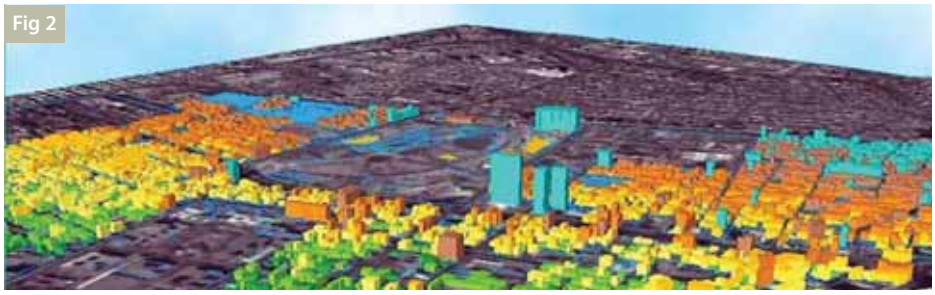
Iranian Space Agency



Iranian Space Agency

FIG. 1: Findings from drought studies for the periods 1998-1999 and 1999-2000 indicate an annual NDVI decrease for Iran of about 14% and 18% respectively

FIG. 3: Top image is the coherence image of Bosporus in Turkey generated from the SLCI ERS2-SAR images of 8 June 1995 and 24 December 1998. The middle image is the phase image generated from the same image pair. Mapping the phase image on the coherence image generates the bottom image. Time interval between image pairs is 1291 days, while the normal baseline of the image pairs is 55.634m and their parallel baseline is 102.390m. According to the fringe number that is countable from the phase image and based on INSAR principles, the tiny displacement of about 1.4-2.5 cm around the Bosporus for 1291 days implies some dynamic activity in the area. This is part of the broad study conducted by ISA's Radar Remote Sensing Group headed by the author.



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Earthquake/landslide mapping

Earthquakes and landslides are some of the most destructive natural hazards whose impacts are rapid and widespread. While current scientific effort is directed towards predicting these phenomena through different approaches, a basic requirement is for maps that define seismic-prone areas and which can be used to reduce the human and economic impacts. Work of this nature, primarily conducted by the Geological Survey of Iran, has utilised varied earth-space data to update existing information and compile a seismic risk map ... one subsequently embodied in Iran's National Spatial Plan.

Commercialisation of radar remote sensing imagery following the launch of the ERS, RADARSAT, JERS and Envisat satellites, has been instrumental in Iran's continued work in this area. The Radar Remote Sensing Group of ISA (headed by the author of this article) was established in 1995 as a bi-disciplinary technical-application group to study and develop different applications of radar remote sensing data. Its work owes much to support received from the European Space Research Institute (ESRIN) affiliated to European Space Agency (ESA). The production of time composites and the refinement of SAR interferometry techniques (fig.3) are just two activities of a Group whose work extends beyond national borders to contribute to the global stock of knowledge on dynamic earth phenomena and the mechanisms involved.

FIG. 2: integration of IKONOS image and 1:25,000 topo-map shows Tehran in 3D perspective. Building detail and proportions are needed for radio mast siting

FIG. 4: Aftermath of a flash flood surge in Golestan Province in northern Iran and southeast of the Caspian Sea

Flood mapping

Almost all the watersheds of Iran's major rivers are threatened by flooding. The southwest of the country is not only one of the most economically important, with rapidly growing industrial, agricultural and urban developments, it is also one of the most flood-prone. Here, considerable information has been extracted from multi-temporal Landsat data to delineate flood-prone areas and prepare flood plain zone maps.

Other parts of Iran also experience flooding, both from precipitation and human activity such as deforestation. The latter is regarded as a key factor in the uncontrolled and devastating floods that have afflicted the northeast of Iran and the southern forests bordering the Caspian in recent years (fig.4). New data acquired by ISA from the Terra satellite MODIS sensor has added new and valuable information to existing knowledge on flooding in these areas.

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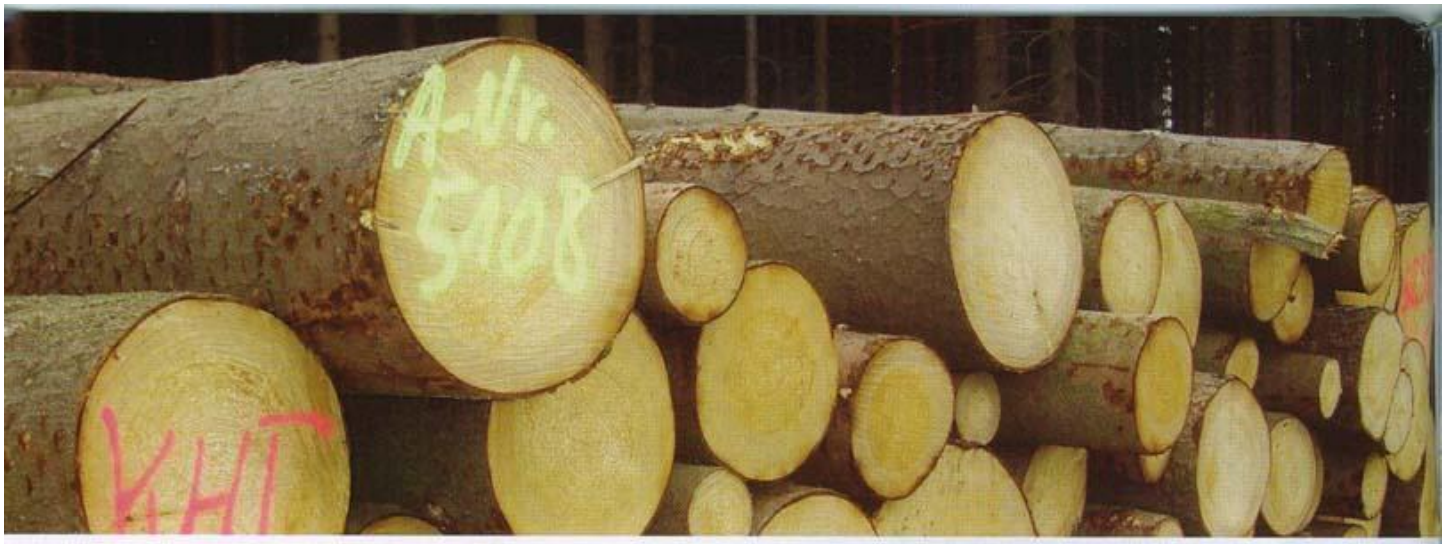

CONTENTS

COVER IMAGE: Forest and agricultural land use and management depend up geospatial data and technologies heavily. This photo shows a timber landing after harvesting 'thinned' trees. Such operations increase growth, thus yield - from the same land base area.

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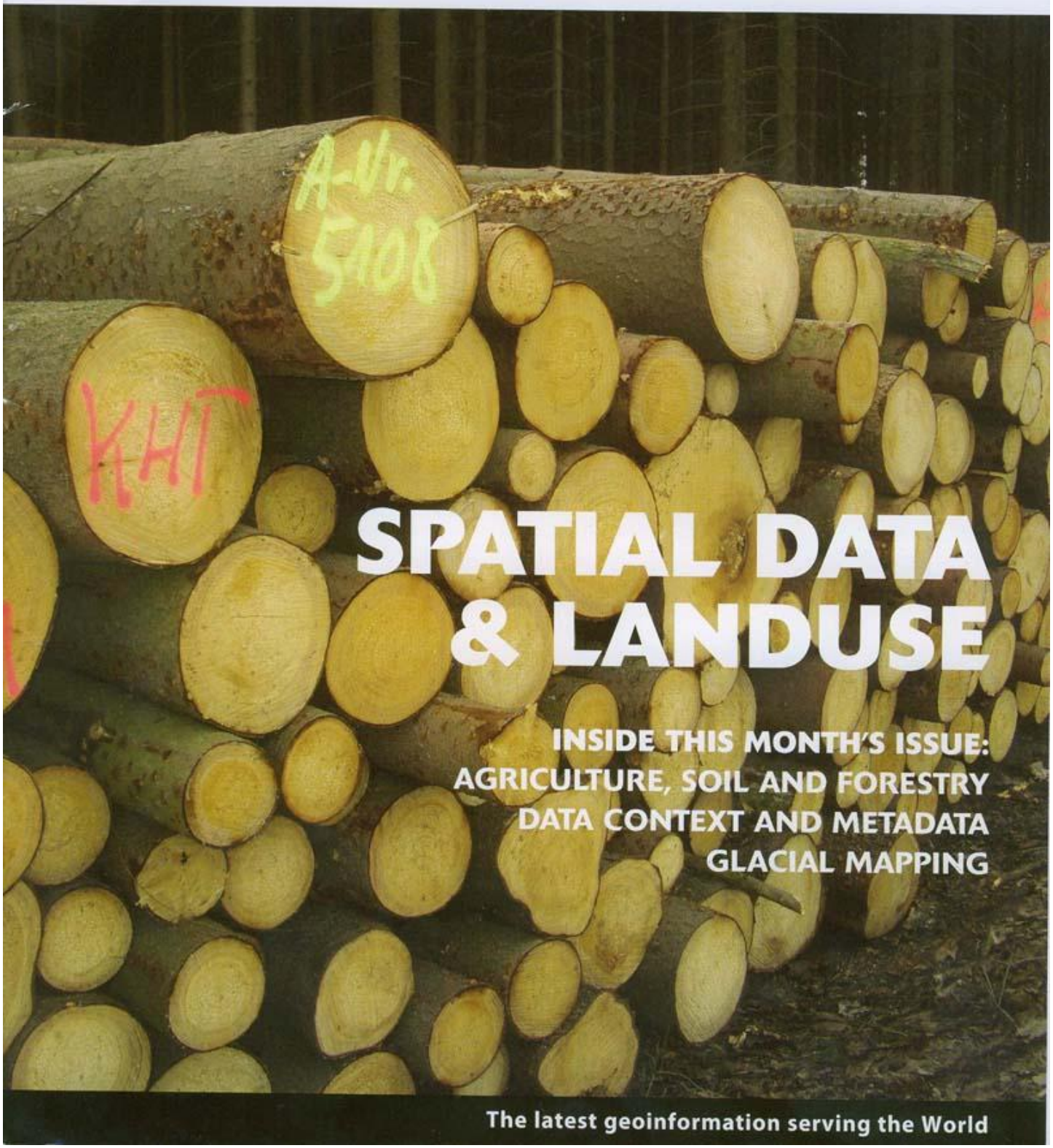

SPATIAL DATA & LANDUSE

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The latest geoinformation serving the World