



High resolution 3D mapping in Nepal



'RESEARCH IN EDUCATION'
A SERIES.



Project Overview

Scientists and students at the University of Leeds use IMAGINE Photogrammetry* to generate high resolution elevation models with stereo and tri-stereo satellite imagery. This case study will include 2 example applications of high-resolution mapping, covering the analysis of glaciers around Mount Everest and urban disaster risk reduction in cities such as Kathmandu (Nepal).

*The latest updates to ERDAS IMAGINE greatly expand the photogrammetric operators in Spatial Modeler and there is a new DSM Extractor module which features advanced SGM (semi-global matching) algorithms for faster, denser, and more accurate surface generation from stereo imagery.

Eyes on Everest

Glaciers are disappearing across much the Himalaya, which has profound environmental and social implications. Over a billion people depend on downstream water availability from the Himalaya, including for food production and energy generation. Climate change is increasingly affecting the magnitude and seasonality of these water flows, which is threatening livelihoods and socio-economic development. Glacier melt is a hallmark of climate change and is long studied in the Everest region of Nepal, where glaciers hundreds of metres thick lock away vast quantities of water. Much of the glacier ice is covered by a veneer of rock and sediment, which protects it from solar radiation on the one hand, but promotes the accumulation of meltwater on the surface on the other. Water bodies hundreds of

metres across and tens of metres deep are now forming on Khumbu Glacier, which is home to Everest basecamp in Nepal. These

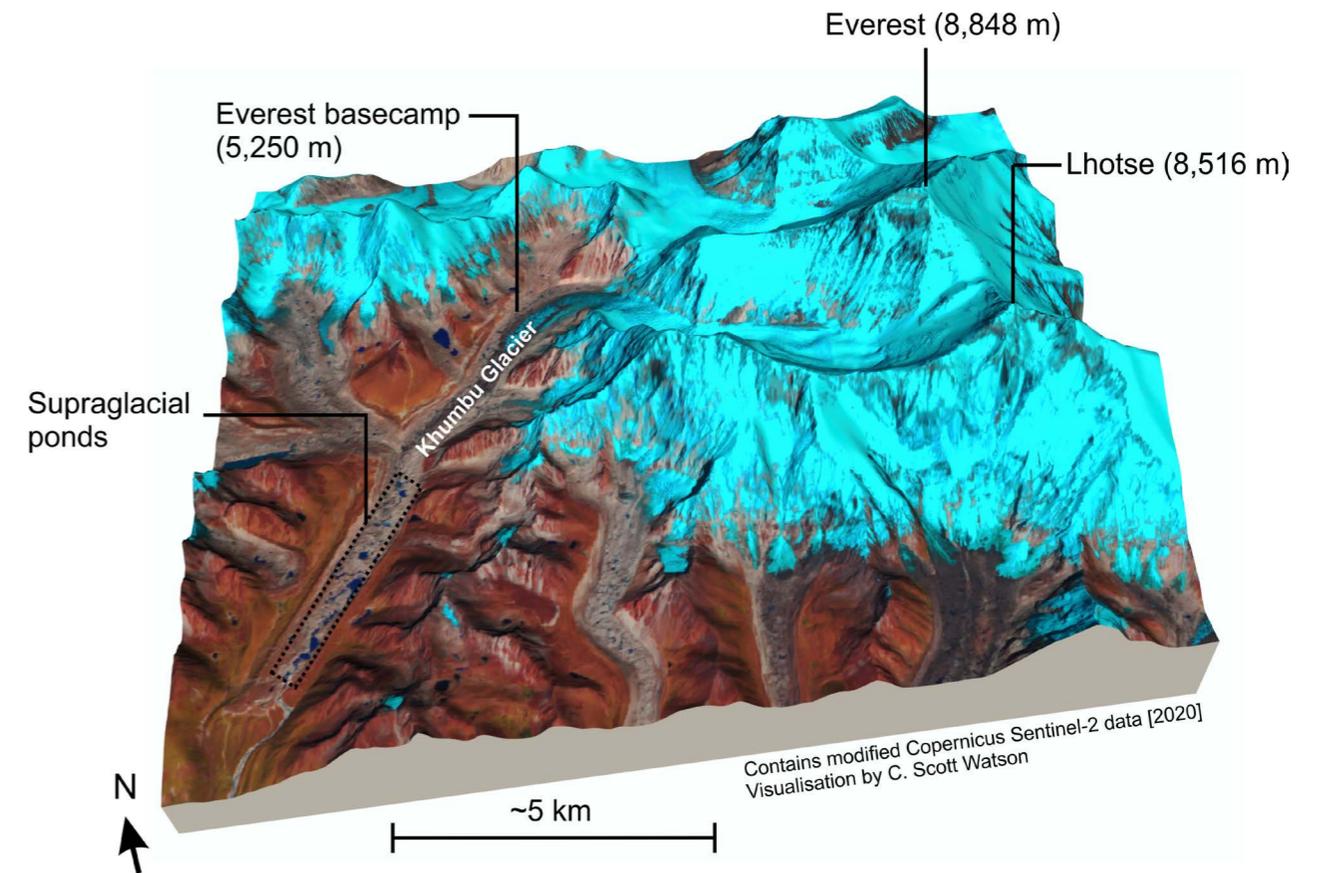
“WATER BODIES HUNDREDS OF METRES ACROSS AND TENS OF METRES DEEP ARE NOW FORMING ON KHUMBU GLACIER...”

supraglacial ponds are hot spots of melt and elsewhere have coalesced into large glacial lakes where they occupy the space left by former glaciers.



Elevation models generated using high resolution satellite imagery are used to quantify rates of glacier thinning and measure the development of supraglacial pond and lakes. A broad range of satellite and field data was sourced and used in the work, including Pleiades imagery supplied through an agreement with the European Space Agency. The imagery was processed with IMAGINE Photogrammetry using high accuracy ground control points collected in the field. The

research has demonstrated that Everest's glaciers are stagnating and thinning, which is leading to large ponds forming on their surface. Glacier decline is causing these high mountain environments and downstream areas to become increasingly hazardous, with events such as landslides and floods projected to increase.



3D render of Khumbu Glacier descending from Mount Everest using a Pleiades stereo digital elevation model (DEM). Backdrop is a false colour composite of Sentinel-2 imagery (bands SWIR, NIR, red).

Tomorrow's Cities

Haphazard urbanisation is a global trend that is often associated with increased disaster risk, especially for society's most vulnerable. Reducing disaster risk for 'Tomorrow's Cities' is the aim of the Urban Disaster Risk Hub, which uses interdisciplinary research embedded within local communities and organisations to develop disaster risk resilience. Earth observation data play key role in the hub, helping to assess multi-hazard process chains and the structure of the built environment, whilst also providing city-wide perspectives for local engagement activities and co-production of knowledge.

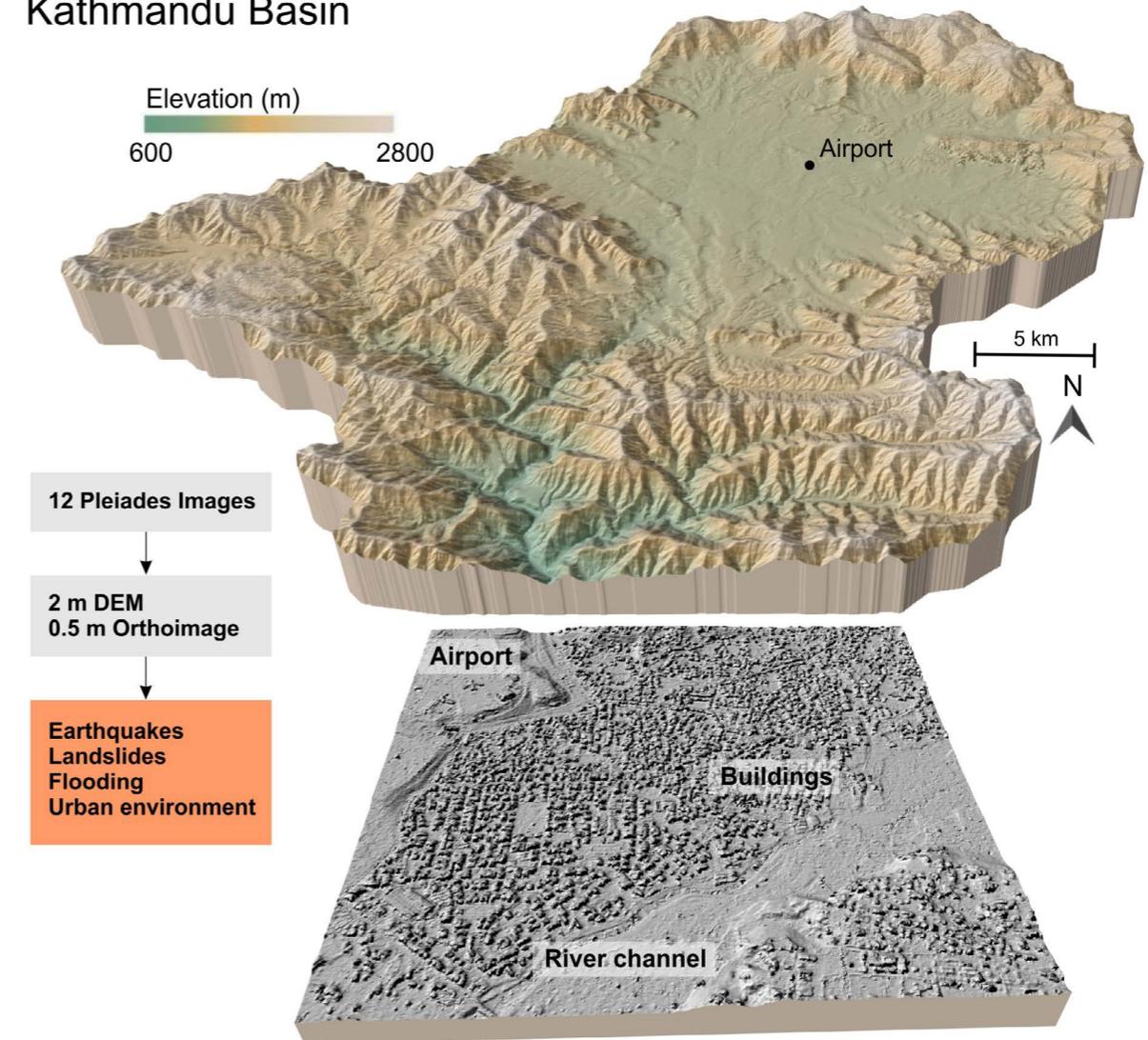
IMAGINE Photogrammetry was used to generate 2m resolution DEMs of the Kathmandu Basin using tri-stereo Pleiades satellite imagery acquired through the Committee of Earth Observing Satellites (CEOS) seismic hazards demonstrator project. The elevation models and orthoimagery serve a broad range of applications including modelling floods and earthquakes. The DEMs and ortho imagery are also used to

assess the structure of the built environment, including building heights and distribution of greenspace around the city. It is only with such high-resolution data that the impact of natural hazard events can be assessed at scales spanning individual livelihoods to whole

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cities, with greatly reduced uncertainties compared to using coarser global DEMs.

Kathmandu Basin



Hillshaded digital elevation model of the Kathmandu Basin and subset showing discernable details.



About Hexagon Geospatial

Hexagon is a global leader in sensor, software and autonomous solutions, analysing data to work to boost efficiency, productivity, and quality across industrial, manufacturing, infrastructure, safety, and mobility applications. Their technologies are shaping urban and production ecosystems to become increasingly connected and autonomous – ensuring a scalable, sustainable future. Their division creates solutions that visualize location intelligence. From the desktop to the browser to the edge, they bridge the divide between the geospatial and the operational worlds.

About Geospatial Insight

Geospatial Insight is Europe's leading provider of independent research and alternative data derived from the analysis of satellite imagery and other aerial sources, combining this intelligence with a range of other data sources to provide in-depth market insight and business analytics to clients in the corporate, financial and insurance sectors.

Established in 2012 and head quartered in the UK, Geospatial Insight provides these unique intelligence services to clients around the world.

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