What can you do with space data?

These examples are already being used, a NewSpace has the potential to scale them up by enabling greater connectivity, and near real-time information.

Communication for emergency services

Emergency services require access to high speed communication tools to deal with emergency situations. Project HYDRA by Avanti is a high speed (60Mbps download and 20Mbps upload), secure 4G LTE mobile network backhauled through satellites for UK's emergency services. Terrestrial networks can get overloaded or may not have coverage, or can be installed permanently (e.g. as a network extension) for areas where additional capacity is frequently required. The network can be deployed immediately over a radius of 2 km, or an area of 12.5km^2 where needed.

Monitor air quality

EarthSense is a spinoff company from the University of Leicester. The Air Quality Hotspot Mapper is system that uses Copernicus MACC II and other data sources to deliver near real time pollution monitoring over urban areas (Public.io, 2019).

Carbon monitoring

Create reliable carbon stock baselines and improve land cover maps. For example, the UAE Space Agency and EXOLAUNCH are looking to launch MeznSat by the end of 2019. MeznSat will operate using a shortwave infrared spectrometer to measure the abundance and distribution of methane and carbon dioxide in UAE's atmosphere (Spacewatch Global, 2019).

Disaster event monitoring

Monitor refugee movements and infrastructure development in conflict areas to aid humanitarian efforts. Also, SatCBRN is exploring the use of satellite services for surveillance and hazard management of incidents involving the release of chemical, biological, radiological or nuclear threat agents.

Agriculture health monitoring

Monitor crop health and forecast crop yields with timely sub-meter imagery. This could also include identifying pest infestation and planning irrigation levels to augment precision agriculture techniques.

Ship performance

DHI Global Seas is already allowing customers to reduce fuel consumption and to improve vessel performance by utilising satellite data enriched with ocean current, wave and wind data.

National flood warning and mitigation

Ambiental and Telespazio VEGA UK Ltd developed a system that augments current national capabilities by providing unique real-time urban flood mapping and targeted risk identification. This was designed to improve the capability of local authorities through the lifecycle of flood events. The potential value of more efficient flood defence allocation has been estimated at benefits of £2.8m per annum (London Economics, 2018).

Fishing surveillance

Satellite imagery and AIS data can be used to monitor the whereabouts of fishing vessels and identify illegal activity that can be acted upon by coastguards and other surface vessels. The UK Satellite Applications Catapult have developed a prototype of the Information Analysis Platform designed to use freely available satellite data in combination with cross-country vessel datasets.

This allows the automation of fishery surveillance to detect Illegal, Unreported and Unregulated fishing (IUU) in real time, alerting nearby authorities and regulators to take action. A study of French authorities' use of Earth Observation satellite data to monitor its exclusive economic zones in the South Indian Ocean found that within one year, illegal fishing in that area was reduced by 90%, with none reported two years later. IUU fishing is a worldwide problem that depletes fish stocks and costs the global economy an estimated £15.2 billion every year.

Mobile medical screening

UK Space for Smarter Government Programme supported DEOS Consultancy to design and develop satellite-connected mobile breast screening vehicles to replace isolated screening vehicles that previously relied on resource intensive paper-based systems.

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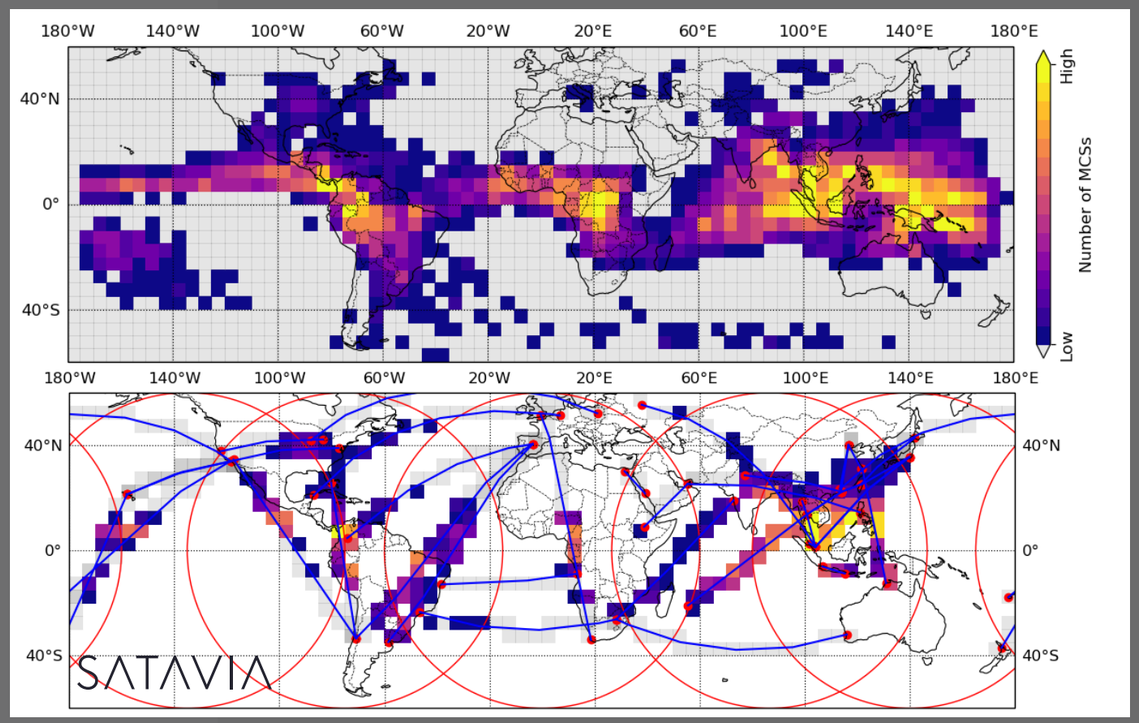
Proof-of-concept SATAVIA

Commercial jet engine aircraft occasionally experience uncontrolled power loss and turbine engine damage while flying at high altitudes in and around areas of deep convective clouds in the Tropics. Deep updraft cores reaching from the lower troposphere into the stratosphere can produce localised regions of High Ice Water Content (HIWC) at commercial aircraft cruise altitudes. This can lead to turbine blade damage in the engines caused by ice accretion and shedding following flight into high level ice crystal clouds.

For example, on 1st June 2019, Air France Flight 447 encountered a Mesoscale Convective System (MCS) and icing conditions over the Atlantic Ocean while at cruise altitude. The aircraft's pitot tubes which measure speed became obstructed by ice crystals, which eventually led to an aerodynamic stall. The aircraft did not recover.

As part of an Aerospace Technology Institute industry project, SATAVIA are building a global climatology of MCS using geostationary satellite data, and analysing city-pair routes to understand the likelihood of encountering an MSC. For example, 'hotspot' regions are located in Central and South America, Central Africa, and Southeast Asia *(top map)*. Flight routes can also be mapped and profiled for 'storminess' *(bottom map and table)*.



SATAVIA's proprietary software platform DECISIONX combines best-in-class technology from atmospheric science, software engineering, data science, and aerospace engineering. This capability is available now, and could be augmented using NewSpace cubesats offer the potential to provide near-real time Earth observation data, which could be used to improve weather forecasting and flight planning, and offer hazard alerting to in-flight aircraft.

Top 5 'stormiest' routes	Bottom 5 'stormiest' routes
Bangkok (Thailand) → Sainte-Marie (La Réunion)	Cairo (Egypt) → Jeddah (Saudi Arabia)
Singapore (Singapore) → Tokyo (Japan)	Dubai (UAE) → Addis Ababa (Ethiopia)
Moscow (Russia) → Singapore (Singapore)	Los Angeles (USA) → Honolulu (USA)
Dubai (UAE) → Manila (Philippines)	Perth (Australia) → Johannesburg (South Africa)
Darwin (Australia) → Shanghai (China)	Shanghai (China) → Beijing (China)