
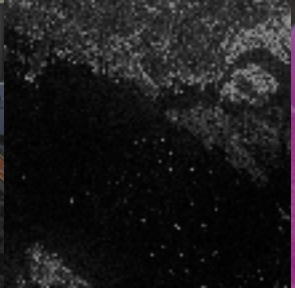


Singapore

Population *(millions)*: 4.3 (ranked 118th)	**Area:** 93 km^2
PPP GDP *(millions)*: $104,042	**PPP GDP per capita:** $24,196
Internet Users *(per 1,000 people)*: 505.4	**HDI:** 0.902
Major Cities: *Singapore*	
Agriculture: negligible • **Industry:** 32.2% • **Services:** 67.8%	
National Space Agency: n/a	
Remote Sensing Agency: Centre for Remote Imaging, Sensing and Processing (CRISP) • www.crisp.nus.edu.sg	
EO Satellites under operation: n/a **EO Satellites under development:** *X-Sat*	
Major EO partners: Japan, US, ESA	
Other EO organizations: Centre for Research in Satellite Technologies, Defense Science Organisation, Nanyang Technological University, SPOT Asia	
Main EO applications Forests, operational fire monitoring, ocean studies, oil spills **Main EO hurdles** Lack of user awareness of Earth observation applications **Main EO opportunities** Land use monitoring, operational fire monitoring and maritime surveillance	

A small island nation with over 4 million inhabitants, Singapore is a major player in regional remote sensing. Its efforts are channeled through the Centre for Remote Imaging, Sensing and Processing (CRISP), a part of the National University of Singapore. It is funded through the Agency for Science, Technology and Research. CRISP's ground station can service many of the surrounding countries. CRISP receives data from a number of satellites including Terra and Aqua (MODIS), Ikonos, EROS-A1, SPOT-2, 4 and 5, SeaWIFS, NOAA and FengYun-1C, RADARSAT-1 and ERS-2.

User awareness of applications and value added products remain a challenge in Singapore. Moreover, the end-user community is discovering that optical imagery is not sufficient by itself; persistent cloud cover necessitates an understanding of SAR and other Earth observation technologies. Awareness of the usefulness of Earth observation was heightened in response to the regional fires of 1997/1998. These fires caused major economic losses, physical losses in the area of biodiversity and adverse health effects due to constant smoke haze. CRISP, in collaboration with the Ministry of the Environment and Water Resources, put in place daily fire monitoring using data from SPOT, ERS and RADARSAT satellites. CRISP has developed image processing systems that allow near real-time fire detection within 10 minutes of a SPOT satellite pass. CRISP was also a major supplier of data during the Indian Ocean tsunami in 2004. Its station reception covered most of the afflicted zones, although the country itself was not affected. Further applications for remotely-sensed data are flood monitoring, environmental evaluation, oil pollution detection (SAR imagery has been used in Singapore courts to prosecute polluters) and ocean tide studies. CRISP also conducts research into very high spatial resolution imagery, hyperspectral data and multiple polarization SAR.

Singapore began developing its first Earth observation microsatellite, X-sat, in 2000. The Centre for Research in Satellite Technologies was established for X-Sat development as a joint venture of Nanyang Technological University and the Defense Science Organisation of Singapore. To improve mission performance for small satellites, X-sat will demonstrate technologies that support high-resolution imaging capabilities and analyze onboard parallel processing algorithms. The mission includes a 10m resolution multispectral instrument. The main applications are forest fire monitoring and algae bloom (red tide) research. The engineering firm, Satrec Initiative of Korea, was selected for collaborative development of the imager.

CRISP maintains active links with JAXA, NASA and ESA. SPOT Asia has an office in Singapore, which services the Southeast Asian market.