ESCAP Technical Paper
Information and Communications Technology and
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Using Space-based Applications and Information Available through the ESCAP-established Regional Cooperation Mechanisms for Improving Disaster Risk Management

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Abbreviations

ADB	Asian Development Bank
ADPC	Asian Disaster Preparedness Center
ADRC	Asian Disaster Reduction Center
AIT	Asian Institute of Technology
UN-APCICT	United Nations Asian and Pacific Training Centre for Information and Communication Technology for Development
APRSAF	Asia-Pacific Regional Space Agency Forum
APSCO	Asia-Pacific Space Cooperation Organization
ASEAN	Association of Southeast Asian Nations
BAKOSURTANAL	Badan Koordinasi Survei dan Pemetaan Nasional (National Coordinator for Survey and Mapping Agency, Indonesia)
CCD	Commissioner Central Division in Fiji
CNES	Centre national d'études spatiales
CNSA	China National Space Administration
CONAE	Comisión Nacional de Actividades Espaciales
CSA	Canadian Space Agency
CSSTEAP	Center for Space Science and Technology Education in Asia and the Pacific
DANs	data analysis nodes
DPNs	data provider nodes
DRM	Disaster Risk Management
DRR	Disaster Risk Reduction
EMCI	Emergency Management Cook Islands
EO	Earth Observation
ESA	European Space Agency
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
FAO	Food and Agriculture Organization of the United Nations
FGISC	Fiji Geospatial Information Support Centre
Geo-DRM	Geo-referenced information systems for Disaster Risk Management and Sustainable Development
GEOSS	Global Earth Observation System of Systems
GIS	Geographic Information Systems
GOS	Global Observing System
GSD	Geoscience Division
GVCs	Global Value Chains
ICI	Infrastructure Cook Islands
ICT	information and communications technology
DIMS	Nepal Disaster Information Management System
INPE	National Institute for Space Research
IPCC	Intergovernmental Panel on Climate Change
ISC	International Seismological Centre
ISRO	Indian Space Research Organisation
JAXA	Japan Aerospace Exploration Agency
KARI	Korea Aerospace Research Institute
LDCs	Least Developed Countries

LLDCs	Land-Locked Developing Countries
NDMO	National Disaster Management Office
NEMA	Mongolia National Emergency Management Authority
NOAA	National Oceanic and Atmospheric Administration
RESAP	Regional Space Applications Programme for Sustainable Development
Rio +20	United Nations Conference on Sustainable Development
SAARC	South Asian Association for Regional Cooperation
SAFE	Space Applications for Environment
SDGs	Sustainable Development Goals
SIDS	small island developing States
SPC	Secretariat of the Pacific Community
SSOPs	Synergized Standard Operating
TC	ESCAP/WMO Typhoon Committee
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNESCAP	United Nations Social and Economic Commission for Asia and the Pacific
UNESCO	United Nations Educational, Scientific and Cultural Organization
UN-GGIM	United Nations Committee of Experts on Global Geospatial Information Management
UNISDR	United Nations Office for Disaster Risk Reduction
UNITAR	United Nations Institute for Training and Research
UN OCHA	United Nations Office for the Coordination of Humanitarian Affairs
UNOOSA	United Nations Office for Outer Space Affairs
UNOSAT	United Nations Institute for Training and Research (UNITAR) Operational Satellite Applications Programme
UN-SPIDER	United Nations Platform for Space-based Information for Disaster Management and Emergency Response
USGS	United States Geological Survey
WCDRR	World Conference on Disaster Risk Reduction
WMO	World Meteorological Organization

Table of Contents

List of figures

List of Tables

1. Introduction

The Asia-Pacific region is one of the most disaster-prone regions in the world. Natural disasters such as typhoons, floods, droughts and earthquakes have led to the loss of countless lives and property. Given the inter-regional nature of natural disasters, the Sendai Framework for Disaster Risk Reduction has highlighted the need for countries to work together. There is a need for increasing regional cooperation in Disaster Management. Space technology and GIS applications have been demonstrated to be effective tools in post-disaster relief and pre-disaster capacity building. As such, international cooperation in promoting regional space technology applications is a crucial task for countries to achieve sustainable development. The United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) has, over the past decades, promoted the regional exchange and capacity building in the effective use of these innovative technologies in disaster management. This report provides an overview on the various agreements on international cooperation in space technology applications for disaster management. This includes regional mechanisms specific to Asia-Pacific, many of which were led by ESCAP initiatives.

1.1 Impacts of natural disasters

The Asia-Pacific region has long been regarded as one of the most disaster prone in the world. The region is characterized by numerous active tectonic plate movements in South Asia, the Pacific and Indian Oceans, which has led to numerous devastating disaster events including the earthquakes in Afghanistan in October, 2015 and the Nepal Earthquakes in April and May, 2015. Many Asia-Pacific countries are exposed to various disaster events and their social-economic development are vulnerable to disaster impacts. Floods, tropical cyclones and droughts have led to severe economic and social impacts to many developing countries and have pushed back development progress (ESCAP, 2015b). The recent Cyclone Pam in Vanuatu has affected more than 60 per cent of the population, destroyed more than 17,000 houses and 95 per cent of the agriculture sector (ESCAP, 2015a). Nepal’s devastating earthquakes in April 2015 has led to close to 9,000 casualties and more than 22,000 injuries. It has resulted in severe economic damage and pushed back the country’s development progress. More than 2.5 per cent of Nepalese, around 700,000 people, were pushed into poverty due to impacts of the earthquake (ESCAP, 2015a).

In the past 45 years, more than 5000 disaster events have been recorded. Around 6 billion people were affected and required immediate assistance, this was over 85% of the global figure (ESCAP: 2015b). Total fatalities were more than half (56%) of the world total, representing more than 2 million people killed. Geophysical disasters including earthquakes and tsunamis accounted for the most deaths and hydrometeorological disasters such as droughts, floods and storms affected the most people. Looking at economic losses, in parallel with rapidly developing Asian economies, the damage of natural disasters has been steadily increasing. In the 1970s, disasters in Asia and the Pacific only accounted for around 28% of the global total. The same figure for the past decade is around 40% (ESCAP, 2015b). As countries in the region commit themselves to fostering economic growth, natural disasters pose a threat to this goal.

Natural disasters do not respect political boundaries. Large scale natural disasters are often trans-boundary in nature. Earthquakes occur along active fault lines and can affect all countries in its proximity. Many of the region’s most populous cities such as Jakarta, Katmandu and Islamabad are situated in seismic active areas and they are all at risk from earthquakes. Hydrometeorological disasters such as floods and tropical cyclones often hit multiple countries. Snowmelt and glacial lake outburst flood (GLOFs) in the high mountains has been a major cause of flooding events in countries near the Himalayan region including Bangladesh and Pakistan. Coastlines of ocean basins in Cambodia, China, Democratic People's Republic of Korea, Guam and Pacific island countries including Palau, Samoa and Cook Islands are constantly under the threat of tropical cyclones and typhoons.

Moreover, as regions engage in Global Value Chains (GVCs) and financial market developments, impacts of exogenous shocks in one country will likely ripple out to neighboring countries and trade partners. A prominent example of this is the Thailand floods of 2011, where Japanese companies with production plants situated in flood-affected areas experienced significant disruptions. Moreover, the supply of intermediate goods were adversely affected globally, with major automobile plants such as Toyota and Nissan having to suspend production because essential parts were not arriving on time (ESCAP, 2015a). Impacts of natural disasters need to be dealt with at a regional scale. Countries have an incentive to work together in the sharing of information, technology, skills and experience to provide timely and accurate. This not only helps assess exposure and vulnerability before disaster occurrence, but it can also offer rapid damage estimations and help with emergency relief.

Alongside the adoption of the Sustainable Development Goals (SDGs), which highlights the need for poverty eradication and sustainable economic growth, the recent Sendai Framework for Disaster Risk Reduction (SFDRR), outlined in the 3rd United Nations World Conference on Disaster Risk Reduction (WCDRR), has emphasized the need for regional cooperation and information exchange. More specifically, the framework outlined that "transboundary cooperation remains pivotal in supporting the efforts of member States as well as communities and businesses to reduce disaster risk". To achieve this goal, one of the priorities is to boost efforts to understand disaster risk and strengthen disaster risk management. The same goals were highlighted in the recent United Nations Conference on Sustainable Development (Rio +20) in 2012, which set the agenda for SDGs. The role of space technology applications to this goal is pivotal. Countries are encouraged to promote real-time access to reliable data including GIS, remote sensing tools, climate observation infrastructure and information and communication technology (ICT) innovations. They are also requested to engage in international cooperation in technology transfer, in the goal of regional sharing of data and information relevant to disaster management.

At the moment, there are still significant hurdles in capacity building and information sharing among developing countries. In many countries the necessary technology infrastructure, personnel training and technical know-how are lacking. The main goal of ESCAP is to act as a regional platform for countries, organizations and research centers to come together and share information, technology innovations and experiences. ESCAP is actively involved in the development of regional, intergovernmental capacity building programmes, with the aim of fostering technical development, good-practices and evidence-based policymaking. This includes both those formed in Asia-Pacific and global partnerships that works in the Asia-Pacific region. These cooperative agreements have had unique development paths and lessons can be drawn from each of their experiences.

1.2 Opportunities for space applications in DRM

Geo-spatial and space-based applications have numerous applications in disaster risk reduction, disaster relief and reconstruction. There are numerous tools used to provide location-based data through geo-referenced information systems. A good geo-reference tool for disaster risk management captures the hazard, vulnerability and exposure characteristics (ESCAP, 2014b). Therefore, full utilization of these tools will involve combining socialeconomic data in identifying high risk areas and important sectors.

The main space technology tool for remote sensing are Earth Observation (EO) satellites. EO satellites are satellites designed for observing earth information from orbit. They have a wide variety of uses, including environmental monitoring, meteorology and map making. At the moment, there are more than 40 nations that with EO satellites, more than 100 satellites are in operation at any given time around the world (CEOS and ESA, 2015). These satellites carry a variety of sensors that enable a diverse range of measurements from space. Compared to traditional disaster monitoring methods, EO satellites have several advantages:

- The infrastructure (the satellite) is less vulnerable to natural disasters. This makes it a robust and stable candidate in providing accurate and timely data even in times of catastrophic disasters.
- Recent innovations in EO technology means that EO satellites have the capacity to collect information on a variety of scales, from regional, national to the district level. Users can collect detailed information of specific areas.
- Landscape inaccessible or hazardous to monitor or collect data on the ground can be sensed from space, greatly lowering the risk and cost involved in collecting comprehensive data for DRR.

In a pre-disaster context, EO satellites are useful tools in early warning and risk identification. The satellites can help track a range of hydrometeorological disasters such as tropical cyclones, droughts and floods. Moreover, information such as land cover, social-economic data, hazard damage and risky areas can all be extracted from satellite data. They help in identifying critical infrastructure, transport networks and vital public service facilities. Looking at their distribution and structural characteristics, analysis can be made on their resilience and this is factored in to formulate the risk a region faces. This is crucial in highlighting vulnerable clusters and allocating resources for disaster risk reduction (DRR) among different regions.