International Charter

Space & Major Disasters

Annual Report 2015

CONTENTS

1 Introduction

1.1 Purpose and scope of this document

This document describes the 2015 activities of the International Charter “Space & Major Disasters”.

1.2 Structure of the report

This report is based on the following input:

– Working documents, notes and actions of the Charter’s Executive Secretariat and Board
– Input from the Charter’s Communication Group
– Input from each Charter member concerning EO resources and publications
– Project Managers’ reports for each activation
– Data, statistics and reports from EM-DAT and other reports on disasters prepared by Insurance companies (e.g. Munich RE and Swiss RE).

This report follows the following structure:

Chapter 1 - Introduction

Chapter 2 - The International Charter Space and Major Disasters; overview and lead agencies of the Charter in 2015

Chapter 3 - Charter operations; depicts internal business concerned with operations, resource consumption and technical updates (in particular the development of COS-2).

Chapter 4 - External relations; explains the integration of new members, the Universal Access, progress, external relationships and Cooperating Bodies.

Chapter 5 - Communication; reports on all communication activities undertaken throughout the reporting period.

Chapter 6 - Assessment of the Charter operations; provides an assessment of the overall impact of the Charter as a service in supporting disaster response, of system performance, products and services, user appraisal and communication.

Chapter 7 - Conclusions; outlines the significant achievements and conclusions throughout the reporting period.

1.3 Applicable documents

[AD1] Text of the Charter “Space and Major Disasters” - http://www.disasterscharter.org

[AD2] Charter Implementation Plan, RSCSA-PL0098

[AD3] Project Manager Procedure, RSCSA-PR0419

[AD4] Emergency On-Call Officer Procedure, RSCSA-PR0418

1.4 List of acronyms

ABAE	Bolivarian Agency for Space Activities
AOI	Area of Interest
ADRC	Asian Disaster Reduction Centre
AIT	Asian Institute of Technology
APRSAF	Asia-Pacific Regional Space Agency Forum
APSCO	Asia-Pacific Space Cooperation Organization
ASEAN	Association of South-East Asian Nations
AU	Authorised User (of the Charter)
BNGRC	Bureau National de Gestion des Risques et des Catastrophes
BBPT	Agency for the Assessment and Application of Technology (Indonesia)
CATHALAC	Centro del Agua del Trópico Húmedo para América Latina y El Caribe (Panama)
CENAD	Centro Nacional de Gerenciamento de Riscos e Desastres (Brazil)
CEOS	Committee on Earth Observation Satellites
Charter	The International Charter Space & Major Disasters
CMA	China Meteorological Administration
CNES	Centre National d'Etudes Spatiales
CNSA	China National Space Administration
COGIC	Centre Opérationnel de Gestion Interministérielle des Crises (France)
CONAE	Comisión Nacional de Actividades Espaciales (Argentina)
COS-2	Charter Operational System-2
CRED	Centre for Research on the Epidemiology of Disasters
CRESDA	China Centre for Resources Satellite Data and Application
CSA	Canadian Space Agency
CVO	Centre for Volcanology and Geological Hazard Mitigation
DLR	Deutsches Zentrum für Luft und Raumfahrt (German Aerospace Center)
DLR/ZKI	DLR Zentrum für Satellitengestützte Kriseninformation (Center for Satellite Based Crisis Information)
DMC	Disaster Management Constellation
DMCii	Disaster Management Constellation International Imaging
DRM	Disaster Risk Management
ECO	Emergency On-Call Officer (of the Charter)
EM-DAT	Emergency Events Database
EMERCOM	Ministry of Russian Federation for Civil Defense, Emergencies and Elimination of Consequences of Natural Disasters (Russia)
EO	Earth Observation
EOR	Emergency Observation Request
ERS	Emergency Response Service
ESA	European Space Agency
ESRIN	ESA Centre for Earth Observation
EUMETSAT	European Organisation for the Exploitation of Meteorological Satellites
EUSC	European Union Satellite Centre
GDACS	Global Disaster Alert and Coordination System
GEO	Group on Earth Observations
GEONETCast	global network of satellite-based data dissemination systems
GEOSS	Global Earth Observation System of Systems, GEO
GIO	GMES Initial Operations
GMES	Global Monitoring for Environment and Security
HDDS	(USGS) Hazards Data Distribution System
HR	High Resolution
INPE	National Institute for Space Research (Brazil)
ISRO	Indian Space Research Organization
ISS	International Space Station

JAXA	Japan Aerospace Exploration Agency
JPTM	Sentinel Asia Joint Project Team Meeting
KARI	Korea Aerospace Research Institute
LAPAN	National Institute of Aeronautics and Space (Indonesia)
MALHE	Ministry of Agriculture, Land, Housing and the Environment (Montserrat)
MO	Manila Observatory (the Philippines)
MR	Medium Resolution
MVO	Montserrat Volcano Observatory
NatCatSERVICE	Natural catastrophe know-how for risk management and research
NDRCC	National Disaster Reduction Centre of China
NFP	National Focal Point
NOAA	National Oceanic and Atmospheric Administration
NRSC	National Remote Sensing Centre (India)
NSMC	National Satellite Meteorological Centre
ODO	On-Duty Operator
OFDA	Office of U.S. Foreign Disaster Assistance (USA)
ONEMI	Officia Nacional de Emergencia del Ministerio del Interior (Chile)
PA	Partner Agency
PDC	Pacific Disaster Center (Hawai, USA)
PM	Project Manager (of the Charter)
ROSCOSMOS	Russian Federal Space Agency
SA	Sentinel Asia
SARE	Semi Annual Refresher Exercise
SELPER	Remote Sensing Society of Bolivia
SERTIT	Service Régional de Traitement d'Image et de Télédétection (France)
SIFEM-DNPC	Sistema Federal de Emergencias - Dirección Nacional de Protección Civil (Argentina)
SIRL	Satellite Information Research Laboratory (SIRL), South Korea
UA	Universal Access
UKSA	United Kingdom Space Agency
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNITAR/UNOSAT	United Nations Institute for Training and Research/ United Nations Operational Satellite Applications Programme
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
UNOOSA	United Nations Office for Outer Space Affairs
UN-SPIDER	United Nations Platform for Space-based Information for Disaster Management and Emergency Response
URF	User Request Form
USAID/OFDA	United States Agency for International Development's Office of Foreign Disaster Assistance
USGS	United States Geological Survey
VAR	Value Added Reseller
VAP	Value-Added Provider
VHR	Very High Resolution
VHRO	Very High Resolution Optical
WCDRR	World Conference on Disaster Risk Reduction
WFP	World Food Programme

1.5 Authors of the report

The report has been prepared by ESA (Philippe Bally, Monique Viel, and Theodora Papadopoulou) based on contributions by all the Charter members.

This report is dedicated to the late Monique Viel who has been a major contributor to this work over the last eight years.

2 The International Charter Space and Major Disasters

2.1 Overview

The Charter is an international collaboration amongst space agencies – the Charter members. Initiated by the European Space Agency (ESA), the French Space Agency (CNES) and the Canadian Space Agency (CSA) in 2000, 12 other space agencies joined between 2000 and 2013, namely (in chronological order):

- US National Oceanic and Atmospheric Administration, NOAA
- Comisión Nacional de Actividades Espaciales, Argentina, CONAE
- Indian Space Research Organization, ISRO
- Japan Aerospace Exploration Agency, JAXA
- United States Geological Survey, USGS
- UK Space Agency, UKSA/ Disaster Monitoring Constellation, DMC
- China National Space Administration, CNSA
- German Aerospace Center, DLR
- Korea Aerospace Research Institute, KARI
- Instituto Nacional de Pesquisas Espaciais, Brazil, INPE
- European Organisation for the Exploitation of Meteorological Satellites, EUMETSAT
- Russian Federal Space Agency, ROSCOSMOS

The lead function rotates among all Charter members on a six-month basis. The Lead Agency has the overall responsibility of the implementation of the Charter to oversee and coordinate its operations, administration, communications and external relations. Additionally, at the start of each lead period, the new lead agency hosts the meetings of the Charter Board and Executive Secretariat.

The founding agreement of the Charter is intentionally limited in scope and thus not intended to serve the entire disaster management cycle (mitigation, preparedness, response and recovery). The Charter provides a mechanism for the rapid tasking of satellites for immediate response after sudden major disasters, such as floods, earthquakes, tropical storms etc. Long-term monitoring of severe environmental hazards such as droughts and non-environment-related humanitarian emergencies (e.g. acts of war, refugee crises etc.) are not covered. Free satellite-based information is provided to national disaster management authorities and humanitarian organizations in order to support the immediate response to major natural or man-made disasters.

The Charter has been activated for 480 disasters (as of the end of 2015), in 118 countries, since its inception in 2000. In 2015 alone, the Charter was activated 37 times for disasters in 27 countries. These accomplishments are possible in part because of its narrowly defined scope.

The Charter gives access to a virtual constellation of satellites equipped with radar and optical sensors. In 2015, active satellites included (Table 2-1):

- Radar (high resolution and very high resolution sensors): Risat-1, RADARSAT-2, TerraSAR-X, TanDEM-X, Sentinel-1A and ALOS-2.
- Optical (high resolution and very high resolution sensors): UK-DMC 2, Landsat 7 and 8, SPOT-5 (decommissioned in March 2015), SPOT-6, SPOT-7, PLEIADES 1A and 1B,

PROBA 1, SJ-9A, CBERS-4, KOMPSAT-2, KOMPSAT-3, KOMPSAT-3A, IRS-P5 (Cartosat-1), Cartosat-2, Resourcesat-2, Oceansat-2, RapidEye, Kanopus-V and Resurs-P.

- Optical (medium and low resolution sensors): POES, GOES, Metop series, Meteosat first and second generation and Meteor-M.

In 2015, the following satellites were launched and have been made available to the Charter:

- Sentinel-2A was launched by ESA on 23rd June 2015. After the calibration and validation phase, the satellite will provide data to the Charter (first quarterly of 2016)
- First "DAICHI-2" ALOS-2 data were provided to the Charter in March 2015 to support the volcanic eruption of Turrialba in Costa Rica.
- KOMPSAT-3A was launched in March 2015 and some images were made available.

Specific agreements with other entities allow the Charter to access additional products (both high and very high resolution) from satellites such as, Formosat, GeoEye, IKONOS (decommissioned in March 2015), QuickBird, and WorldView.

Agency	Satellite (operational)
CNES	PLEIADES 1A and 1B
	SPOT-5 , SPOT-6, SPOT-7
	FORMOSAT-2
CSA	RADARSAT-2
CNSA	SJ-9A, CBERS-4
DLR	TerraSAR-X
	TanDEM-X
	RapidEye
DMCii	UK-DMC2
	Deimos-1
	NigeriaSat-2
	NigeriaSat-X
ESA	Sentinel-1A*
	PROBA CHRIS
EUMETSAT	Metop Series
	Meteosat MSG
	Meteosat MFG
INPE	CBERS-4

Agency	Satellite (operational)
ISRO	Oceansat-2
	Resourcesat-2
	RISAT-1
	Cartosat-1 (IRS P5)
	Cartosat-2
JAXA	ALOS-2
KARI	KOMPSAT-2, KOMPSAT-3, KOMPSAT-3A
NOAA	POES
	GOES
ROSCOSMOS	Kanopus-V
	Meteor-M
	Resurs-P
USGS	Landsat 7 and 8
	QuickBird
	WorldView-1, 2 & 3
	GeoEye-1

***** *operated by ESA in the frame of the European Union Copernicus Programme*

Table 2-1. List of Charter operational satellites [optical (in grey) and radar (in light blue)]

Archived data from inactive satellites (ALOS, ENVISAT, ERS, CBERS-2, IRS-1C,1D, IRS P4, P6, IMS-1, RADARSAT-1, SAC-C, AlSat-1, UK-DMC 1, Landsat, NigeriaSat, IKONOS) remain available for use in Charter activations (Table 2-2).

Agency	Satellite (archive only)
CNSA	CBERS-2
CSA	RADARSAT-1
CONAE	SAC-C
DMCii	AlSat-1, UK-DMC 1
ESA	ERS-1, ERS-2
	ENVISAT MERIS
	ENVISAT ASAR
INPE	CBERS-2
ISRO	IMS-1, IRS P4,P6; IRS-1C, 1D
JAXA	ALOS (PRISM, AVNIR-2)
	ALOS Palsar
USGS	Landsat-5
	IKONOS

Table 2-2. List of satellites archives available for the Charter [optical (in grey) and radar (in light blue)]

2.2 Lead agencies of the Charter in 2015

During this period, the lead agencies on a six monthly rotational basis have been the Korean Aerospace Research Institute, KARI (October 2014 – April 2015), the Indian Space Research Organisation, ISRO (April 2015 – October 2015), and the United States Geological Survey, USGS (October 2015 – April 2016).

Figure 2-1. 33rd Charter Board and Executive Secretariat members in Hyderabad, India, April 2015.

Figure 2-2. 34th Charter Board and Executive Secretariat members in Sioux Falls, USA, October 2015 (celebrating the Charter's 15th anniversary with special T-shirts).

3 Charter operations

3.1 Charter activations

In 2015, the Charter was activated 37 times, covering disasters in 27 countries (35 natural disasters, and 2 technological ones: aircraft crash in Egypt and dam collapse in Brazil). In absolute terms, there were 38 activations, but one of them (activation 451, see p. 15) was withdrawn by the user. Several activations (9) were requested by new Authorized Users (AUs) from Chile, Malawi, and Australia that became AUs thanks to the Universal Access process (compare chapter 4.2).

The Charter was trigged for the major earthquake in Nepal on 25th April 2015. Besides India, China and UN, several other Charter AUs (i.e. from France, German, Korea, Russia, UK, US) requested to receive the Charter products in order to assist their aid teams send to Nepal. Moreover, besides ISRO, several organizations provided value-added products (e.g. UNITAR/UNOSAT, SERTIT, ROSCOSMOS, DLR/ZKI, University of Tokyo and AIT, and the British Geological Survey). The International Charter has provided to the end-users, reference mapping and damage mapping: e.g. destruction impacts on structures (houses, buildings, roads, bridges, etc.), maps of landslides triggered by the earthquake. In addition, maps showing distribution of emergency camps set up by rescue teams and NGOs on the ground to provide shelters were disseminated.

Since 2007, the annual number of activations has oscillated between 30 and 50. The Charter has effectively managed about 40 activations per year thanks to its distributed operational capacities and human resources (Figure 3-1).

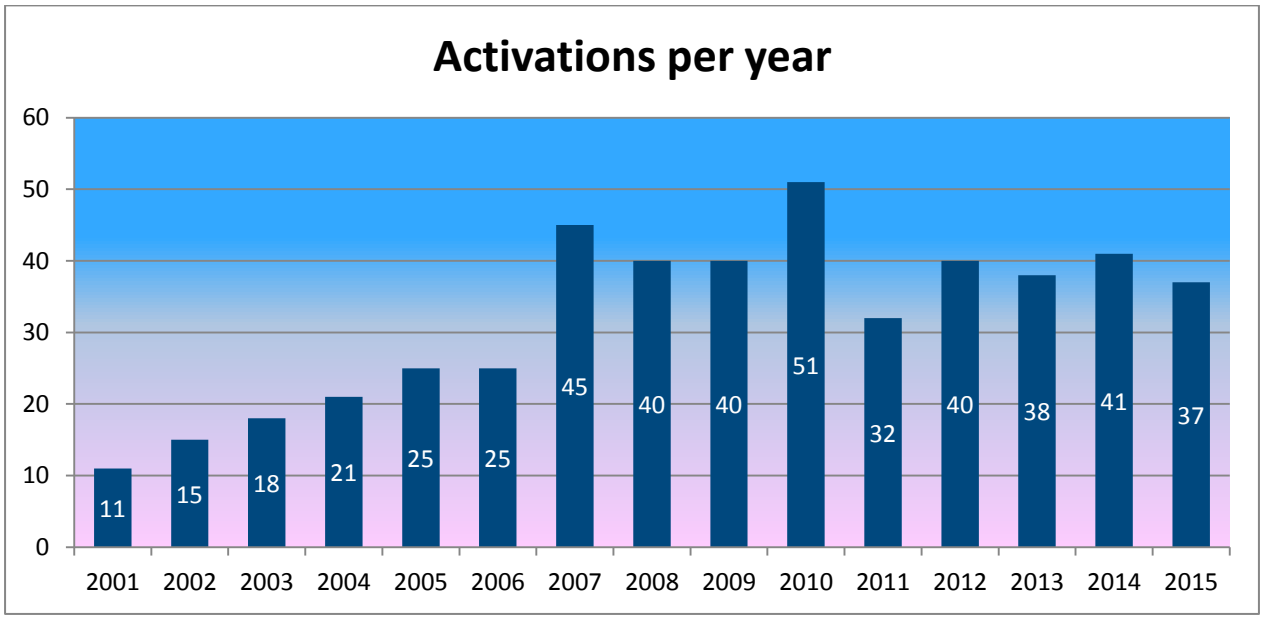


Figure 3-1. Number of Charter activations per year (2000- 2015)

By the end of 2015, the Charter had been triggered for 480 disasters in 118 countries since 2000 (Figure 3-2 a,b).

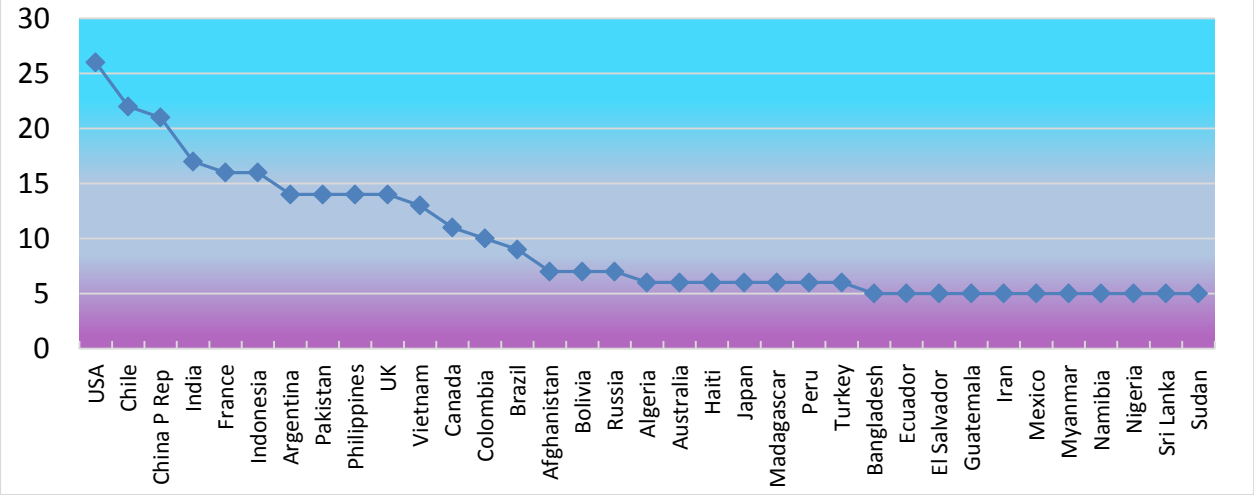


Figure 3-2 a) 2000-2015 breakdown of Charter activations by country

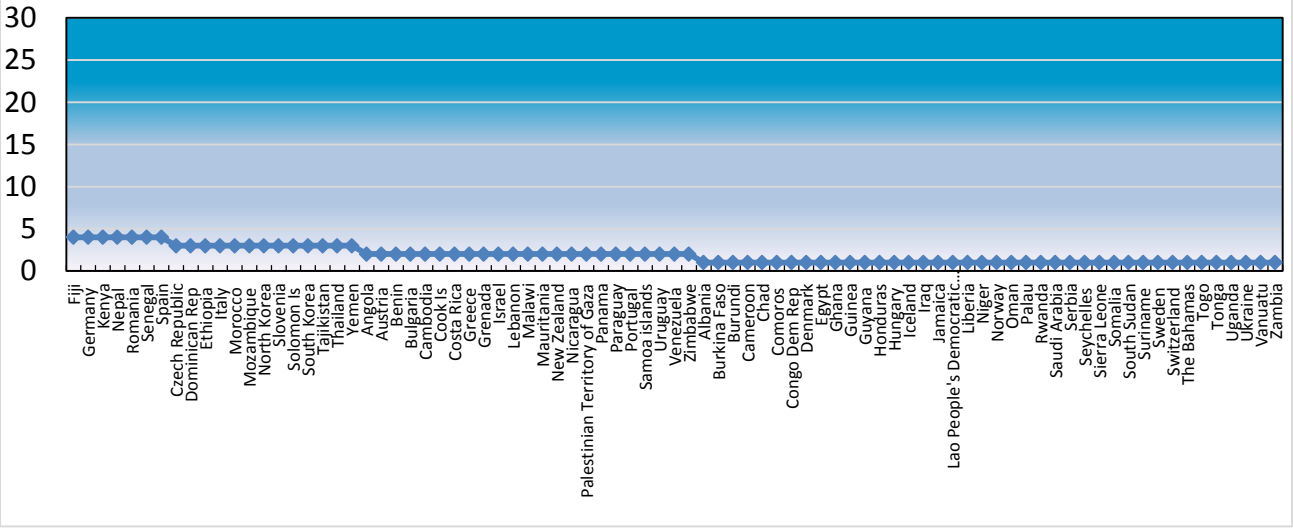


Figure 3-2 b) Continuation of Figure 3-2 a) 2000-2015 breakdown of Charter activations by country

118 Countries around the world have benefited from the International Charter since 2000.

USA, China, Chile, France, Indonesia, India, Pakistan, Philippines, UK, Argentina, Vietnam and Canada are the hazard affected countries for which the Charter was activated most often (>10) to cover major disaster events during these 15 years, but 70 % of countries requested less often the Charter (1 to 4 activations in 15 years).

All 2015 activations are listed in Table 3-1. The Call-ID is the unique number assigned by the Charter's On-Duty Operator (ODO) to any User Request Form (URF) received. The number of the activation ('Activation 'ID') differs from the Call-ID as some Calls are not processed (rejection mechanism) and others are merged.

In total, 41 requests were received in 2015:

- two calls were respectively merged with Call 517 as activation 447, and 530 as activation 449 since the request was made for the same disaster event:
    - Calls 517 and 518 were requested for an ocean storm and a flood, respectively, in Australia by the same AU.
    - Calls 530 and 531 were requested for the large earthquake in Nepal in April by ISRO and by UNITAR/UNOSAT on behalf of UNICEF.
- Call 552 for a flood in India was withdrawn by ADRC, since the request by ISRO for the same event was previously made and accepted by the Charter.

No calls were denied in 2015 but some of them were rapidly withdrawn by the caller:

- Call 544/Activation 444 for wind storm in Malawi: the activation is counted, as before it was withdrawn, a Project Manager (PM) was nominated. For this activation no products were provided;
- Call 522/Activation 451 for oil spill in Vietnam: is not a Charter activation, since it was withdrawn before a PM was identified and nominated.

Activation Number	Disaster type	Country	Activation date
444	Wind Storm	Malawi	2015-01-04
445	Flood	Malawi	2015-01-08
446	Flood	Madagascar	2015-01-18
447	Flood	Australia	2015-02-20
448	Flood	Bolivia	2015-02-25
449	Flood	Brazil	2015-02-27
450	Volcano	Chile	2015-03-03
452	Ocean Storm	Vanuatu	2015-03-13
453	Wildfire	Chile	2015-03-12
454	Volcano	Costa Rica	2015-03-12
455	Flood	Chile	2015-03-25
456	Flood and Landslide	India	2015-03-30
457	Volcano	Chile	2015-04-23
458	Earthquake	China P Rep	2015-04-25
459	Earthquake and Landslide	Nepal	2015-04-25
460	Ocean Storm	USA (Guam Island)	2015-05-15
461	Slide	Colombia	2015-05-20
462	Flood	Brazil	2015-06-11
463	Volcano	Grenada	2015-07-24
464	Flood	Vietnam	2015-07-30
465	Flood	Myanmar	2015-08-05
466	Flood and landslide	Chile	2015-08-09
467	Flood	Argentina	2015-08-12
468	Wildfire	Russia	2015-08-13
469	Flood and landslide	Turkey	2015-08-26
470	Flood	Bangladesh	2015-09-07
471	Earthquake and tsunami	Chile	2015-09-17
472	Ocean Storm	The Bahamas	2015-10-06
473	Landslide	Guatemala	2015-10-07
474	Earthquake	Afghanistan	2015-10-26
475	Other (air crash)	Egypt	2015-10-31
476	Ocean Storm	Yemen	2015-11-03
477	Other (dam collapse)	Brazil	2015-11-05
478	Flood	Iraq	2015-11-05
479	Flood	India	2015-12-02
480	Earthquake	Tajikistan	2015-12-07
481	Flood	Argentina	2015-12-28

Table 3-1. List of 2015 Activations

3.1.1 Monthly activations

During 2015, the monthly average of activations was 3.1. Figure 3-3 shows the monthly distribution of activations throughout 2015. The highest number of activations occurred in March, August, and October corresponding to 42 % of the total number. The remaining months of 2015 saw a number of activations that varied from 0 to 3.

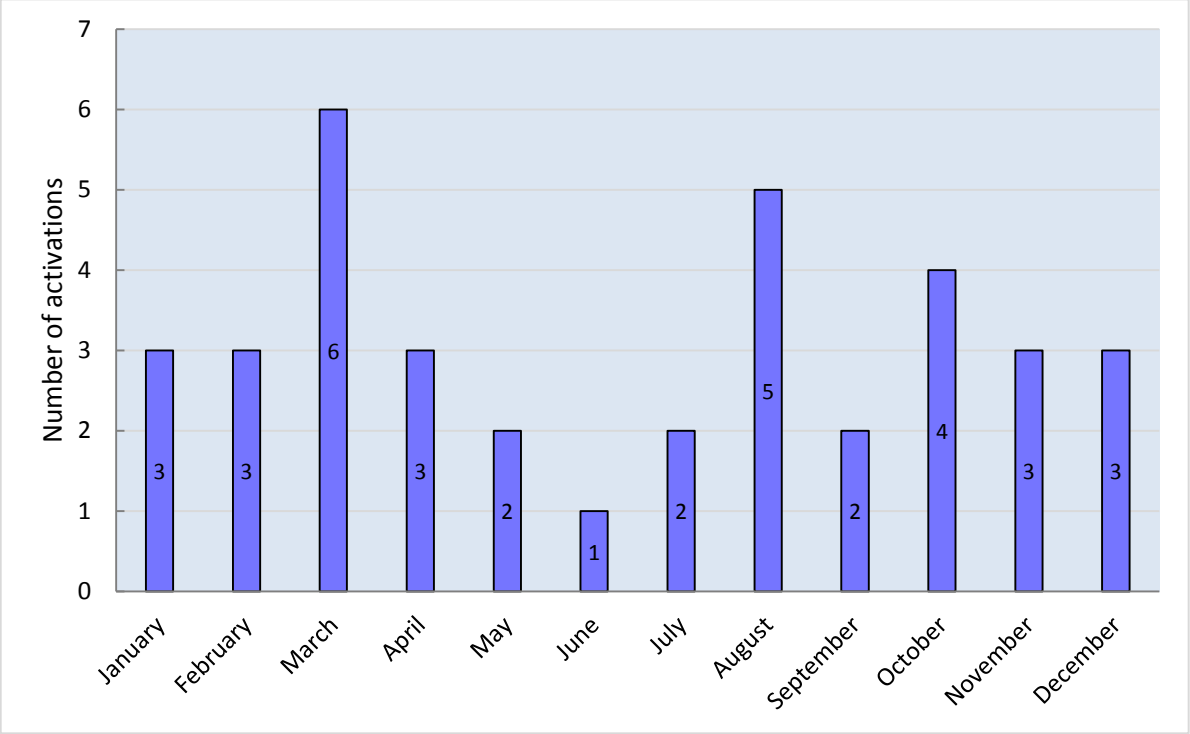


Figure 3-3. Distribution of the Charter activations by month in 2015

Peaks of activations at the end of summer have occurred regularly since 2009 (Figures 3-3 and 3-4). Natural disasters occurring throughout that period of the year are mainly attributable to meteorological events (intense rains; consecutive floods; tropical storms; fire) in Asia and South America. Peak of activations in March 2015 was due to different types of disasters linked to meteorological events (floods in Asia and South America, ocean storm in Oceania and a fire in South America) as well as solid earth movement (volcanic eruptions in Central and South America).

In order to find an overall trend through the years, the following diagram shows the number of activations per month for year 2015 in comparison to the monthly average number of activations for the period 2007-2015. The 2007-2015 diagram clearly shows the peak of activations at the end of summer and in early autumn while the period of January-February is the second time period showing a regular peak of activities. 2015 curve differs from the average one by the highest number of activations in March and the lowest activations in June and September but without great impact on the 2007-2015 trend.

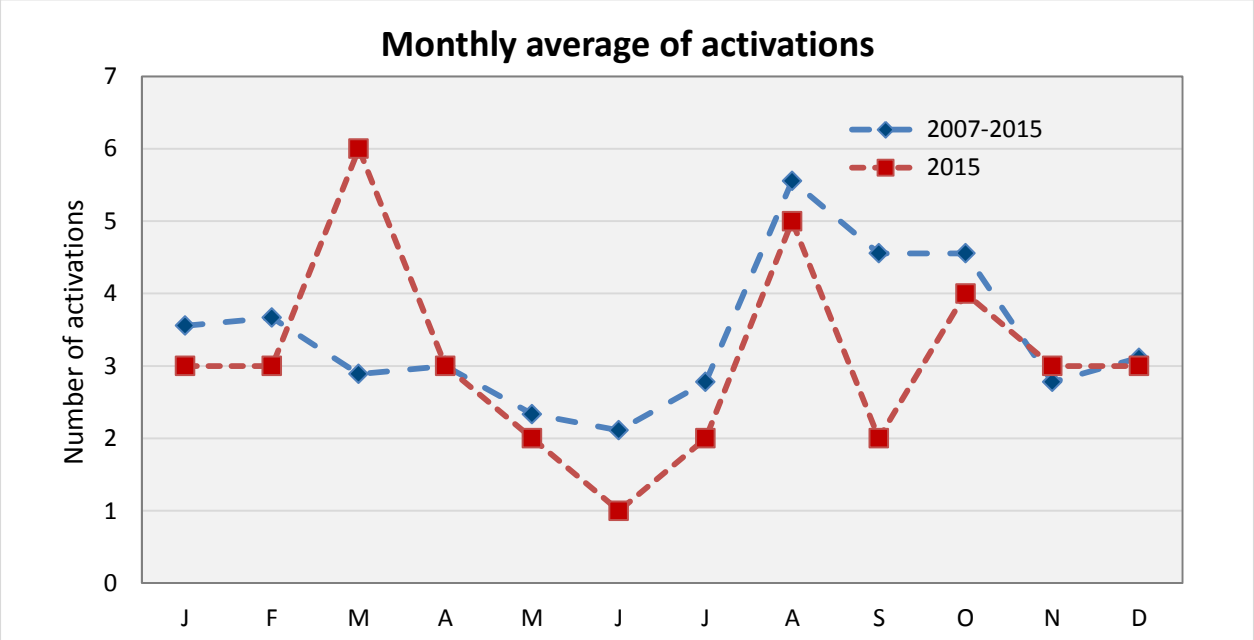


Figure 3-4. Number of 2015 activations per month (in comparison to the average number of activations) for the period 2007-2015

3.1.2 Geographical distribution

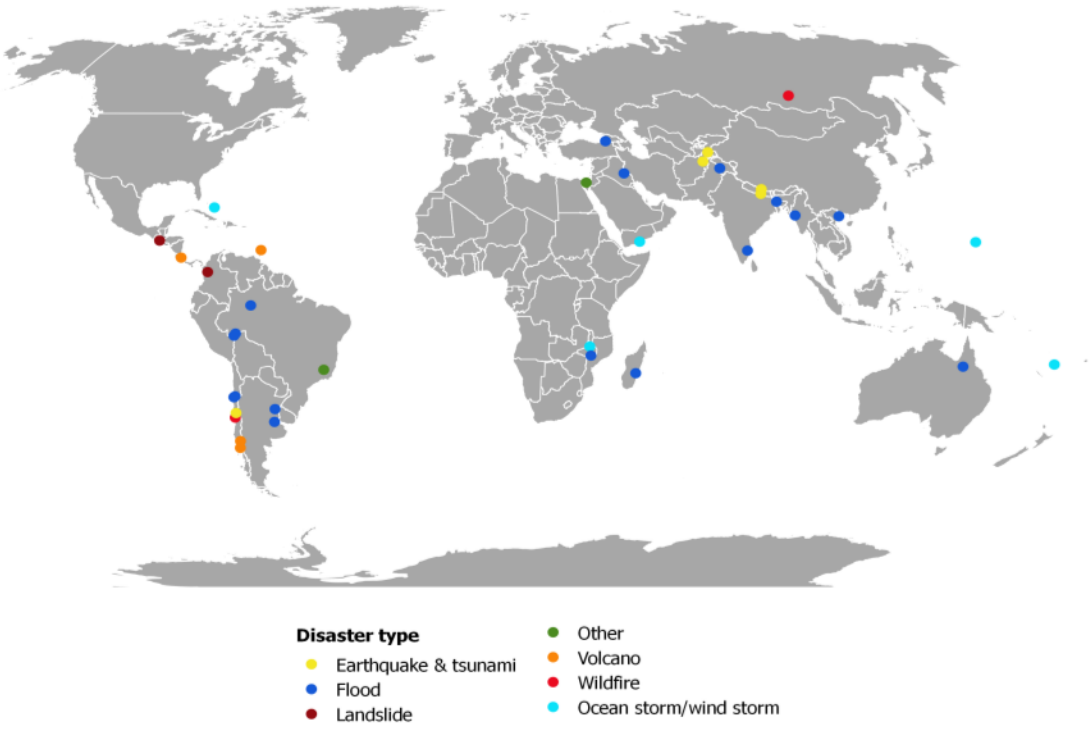


Figure 3-5. Location of the 2015 activations (by hazard type)

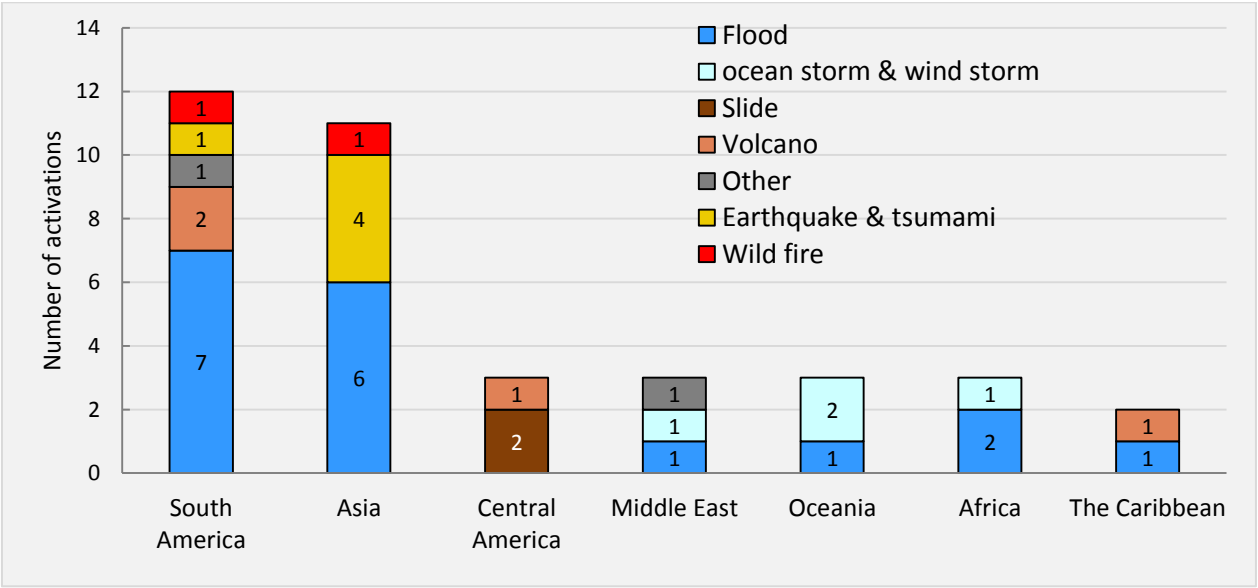


Figure 3-6. 2015 Number of activations by continent/subcontinent and hazard type

In 2015, 12 activations occurred in South America; 11 in Asia; 3 in Central America, in Middle East, in Oceania and in Africa, 2 in the Caribbean (Figures 3-5 & 3-6) with the most frequent

hazard types being floods (49%) and ocean storms (11%) while solid earth-related hazards represented 25% this year (Figure 3-7). However, it should be noted that it is not always a straightforward process to classify Charter activations by disaster types because there are often multi-hazard events, which combine a multitude of sub-hazard events such as floods causing landslides, earthquake causing landslides or tropical/ocean storms resulting in floods and landslides, etc. The tsunami event in Chile has been integrated in the solid earth-related hazard class.

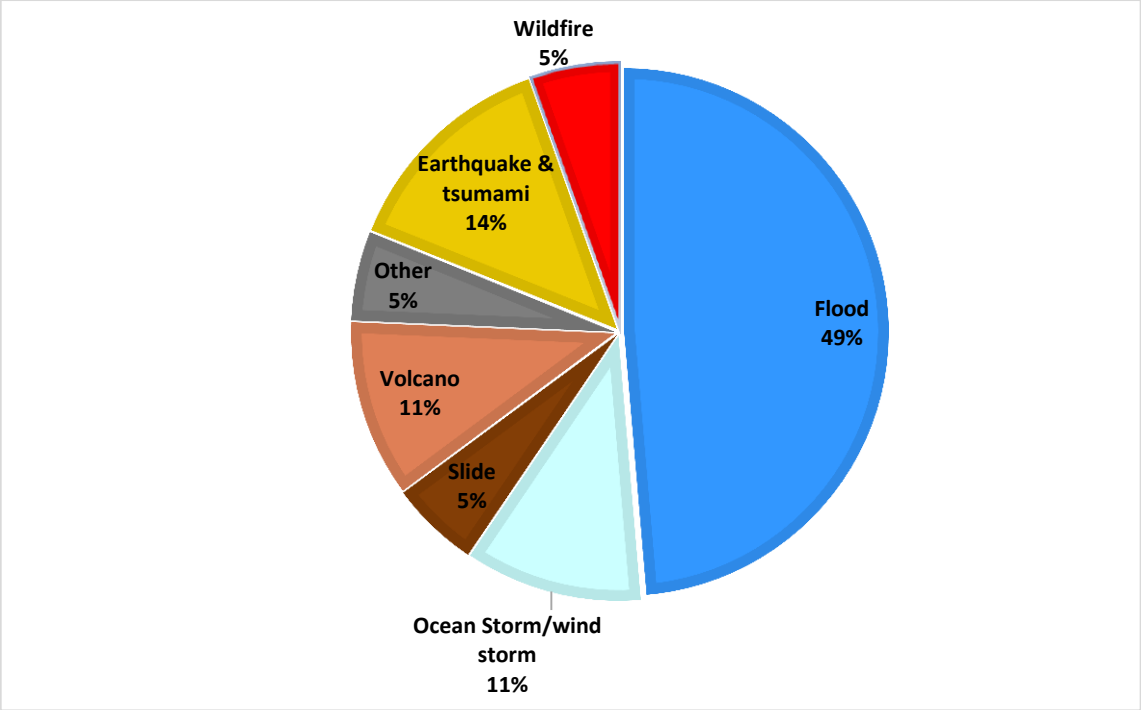


Figure 3-7. 2015 Number of activations by hazard type

As shown in the figure below (Figure 3-8), since 2000 the Charter has been frequently activated for weather-related disasters such as flooding, ocean storms, landslides triggered by heavy rainfall or floods, ice/snow hazard – representing 78% of all Charter activations - while solid earth-related hazards (e.g. earthquakes, volcanic eruptions) represent 17% of all Charter activations. Activations for oil spills and industrial accidents are marginal. See also the maps in figures 3-10 and 3-11 showing the geographical distribution of Charter activations by weather-related hazards and solid earth-related hazards for the 2007-2015 period.

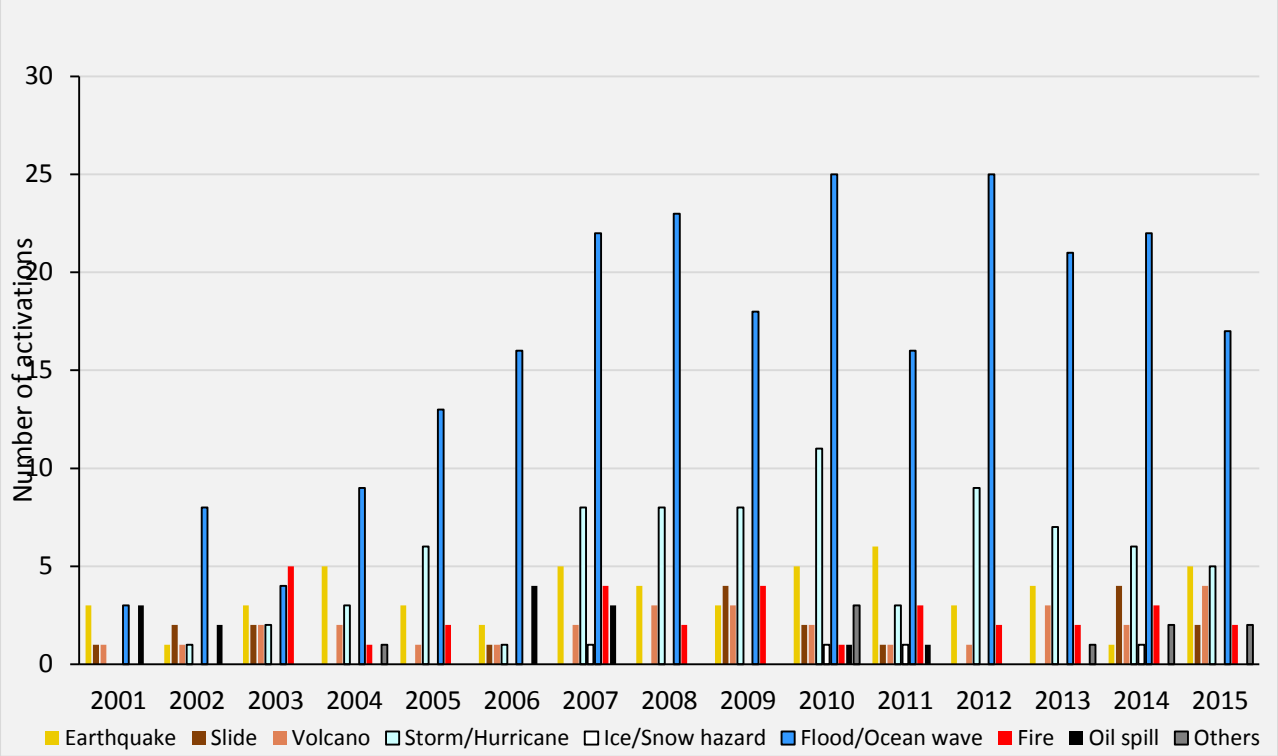


Figure 3-8. 2000-2015 Distribution of activations by hazard type

The following map shows by country the number of Charter activations caused by hydro-meteorological related events for the period of 2007-2015 (298 activations out of 365 activations in total = 82.6 %).

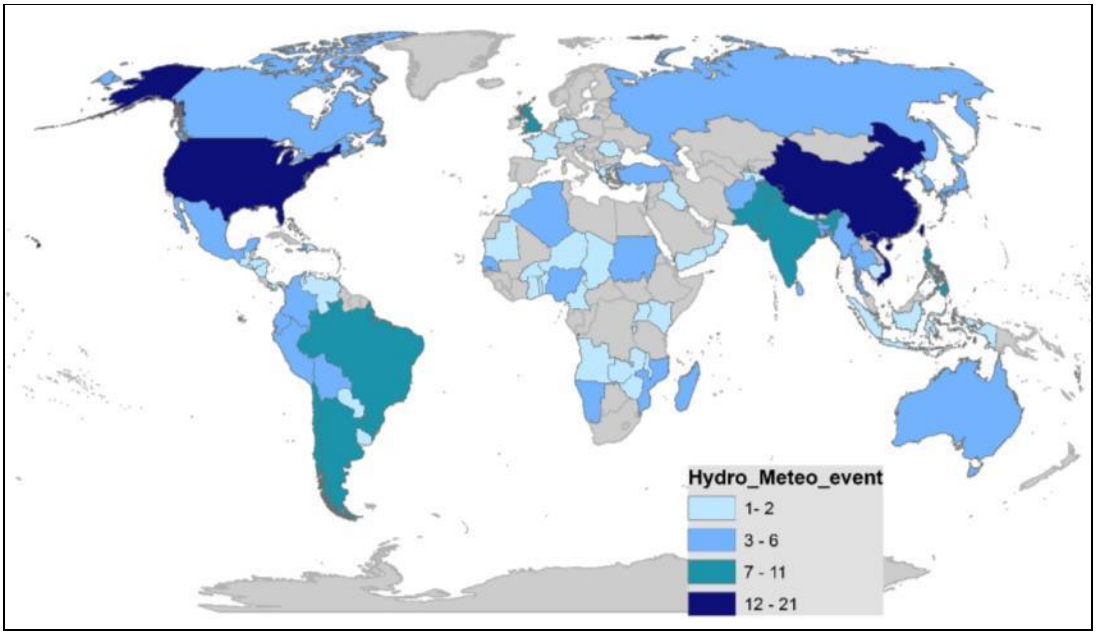


Figure 3-9 a. 2007-2015. Geographical distribution of Charter activations caused by hydro-meteorological related events (flood, ocean storm, wind storm, landslide caused by heavy rains, wildfire and, snowfall and ice jam).

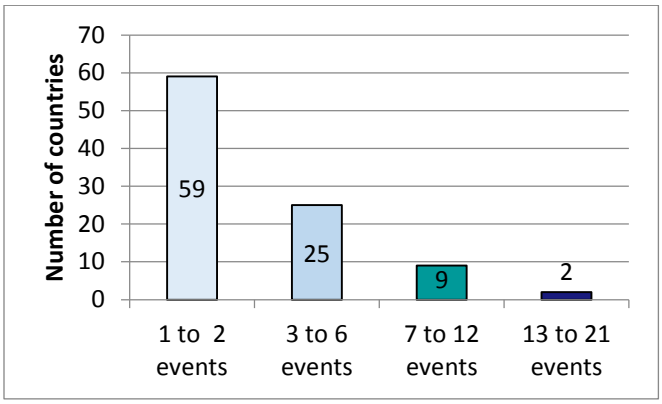


Figure 3.9 b. Hydro-meteorological events: Number of countries by activation classes

In total 86 countries benefited of the Charter service for hydro-meteorological related events during this 9-years period. Two large countries: USA and China used the service most frequently (Figure 3.9 b).

The following map shows by country the number of Charter activations (76 activations out of 365 activations in total = 21 %) caused by solid-earth related events for the period 2007-2015.

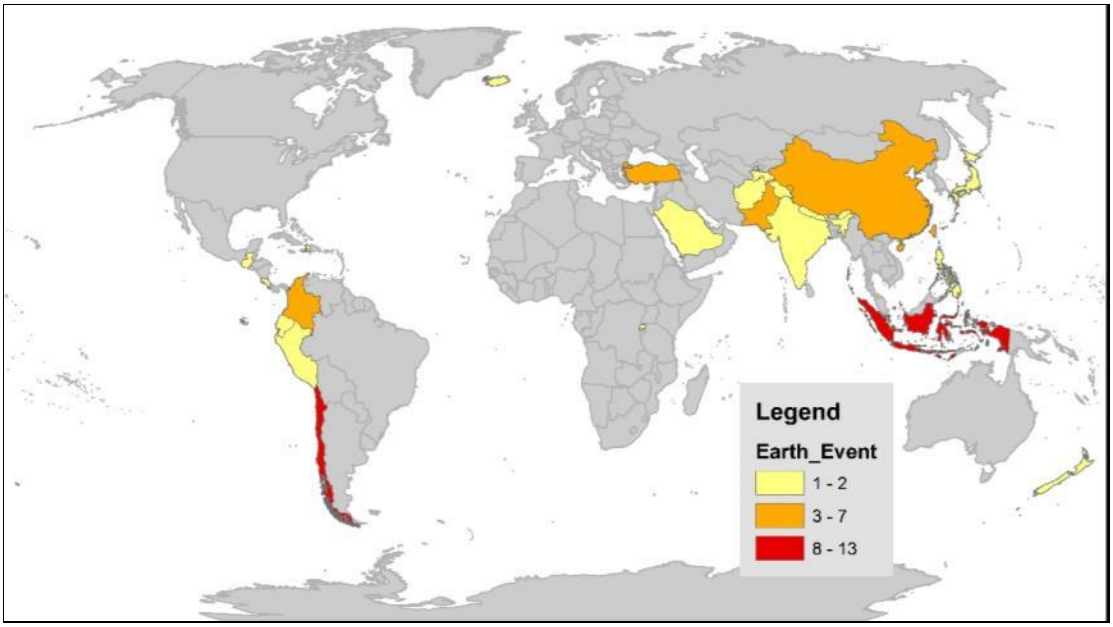


Fig 3-10a. 2007-2015 Geographical distribution of Charter activations caused by solid earth related events (earthquake, tsunami, volcanic eruption, landslide caused by earthquake, subsidence)

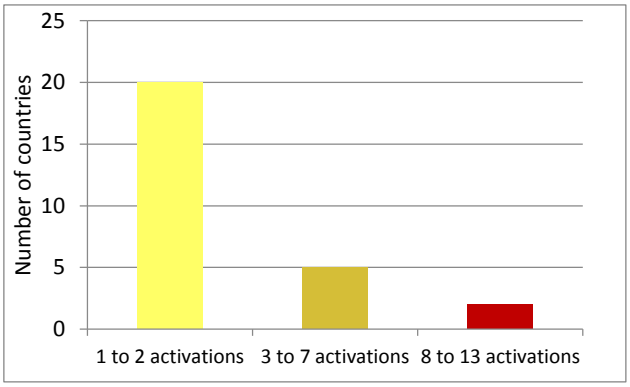


Figure 3.10b. Solid earth related events: Number of countries by activation classes

In total 27 countries benefited from the Charter service for solid-earth event during the 9 years-period. Interesting to note that Chile and Indonesia are countries for which the Charter was activated (8-13 activations in 9 years) and are localized along main active faults (Figure 3.10 b).

Figure 3-11 shows the geographic distribution of activations by access mode. Since 2010, there are 4 access modes that have been used:

- Mode 1: direct activation by an Authorized User (AU) for a disaster occurring in their country.
- Mode 2: activation by an Authorized User on behalf of a user from another country.
- Mode 3: activation by UNOOSA or UNITAR/UNOSAT for UN users.
- Mode 4: activation for national users from the Asia Pacific region via Sentinel Asia's partner, the Asian Disaster Reduction Centre.

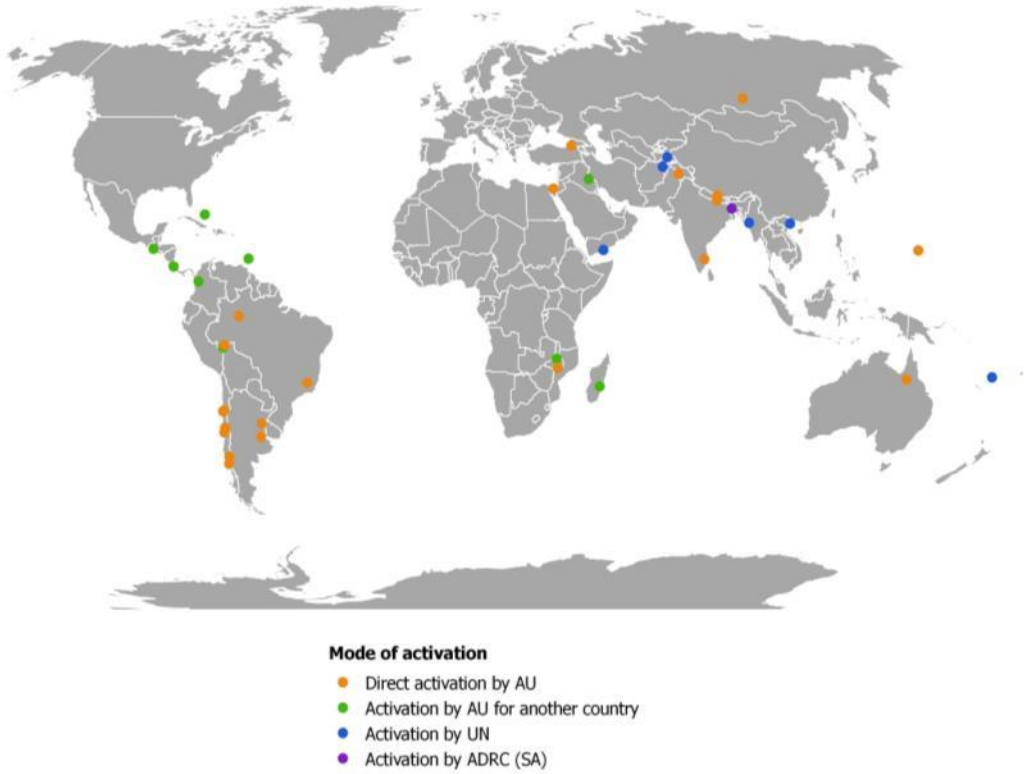


Figure 3-11. Location of the 2015 activations (per mode)

In 2015, mode 1 was used for disasters in Asia, South America, Africa, Middle East and Oceania; mode 2 was used for disasters in South and Central America, Africa, Middle East; Mode 3 was used mainly for disasters in Asia, Middle-East and Oceania. By definition, mode 4 was used in Asia (Figures 3-11 and 3-12). The number of activations in mode 1 in South America is noteworthy, due to the fact that countries like Chile have an AU thanks to the Universal Access process; in addition to Charter members: Brazil and Argentina. Indeed, Chile requested Charter activations six times.

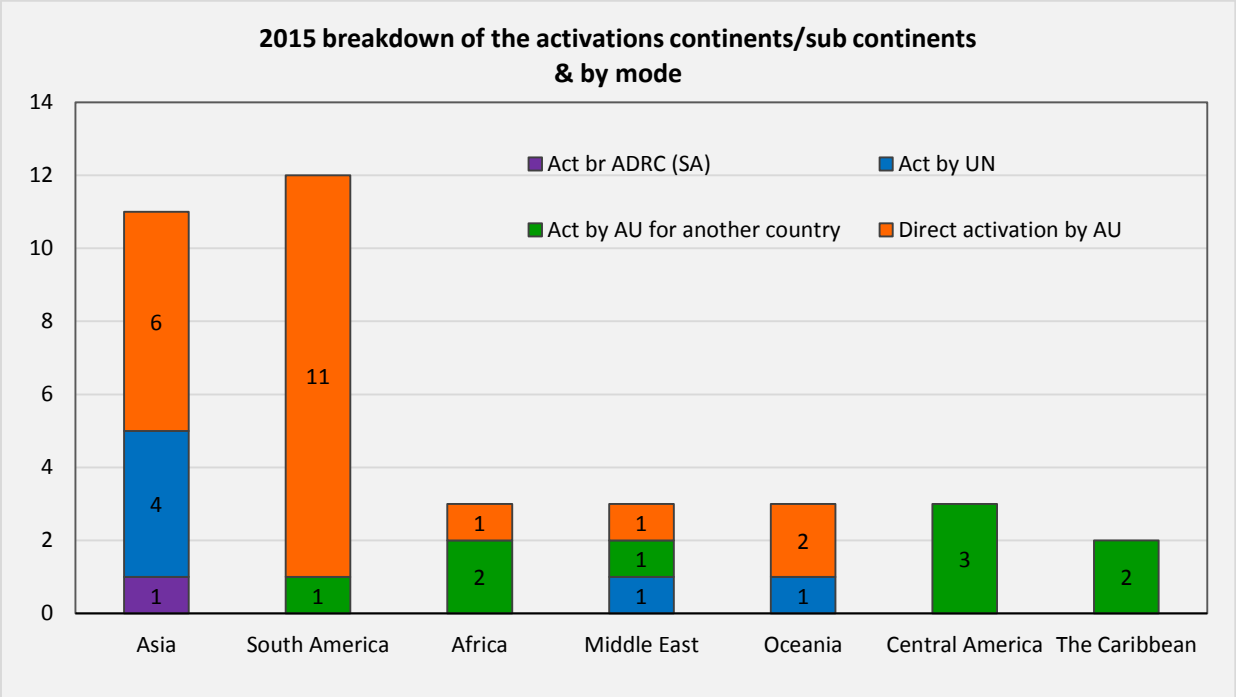


Figure 3-12. 2015 breakdown of Charter activations per continent/sub-continent & per mode

In 2015, activations by an AU (mode 1 & 2) were the main access modes (81% in total) while UN activations (mode 3) represented 16% of the total (Fig. 3-13).

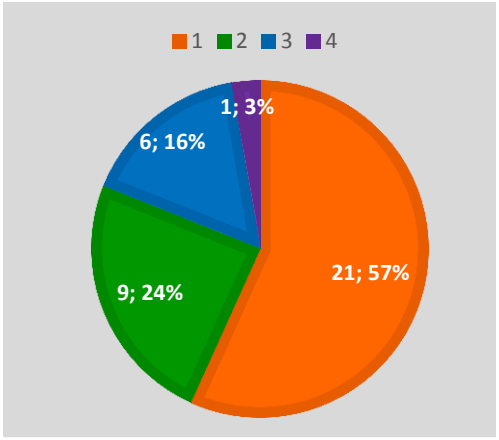
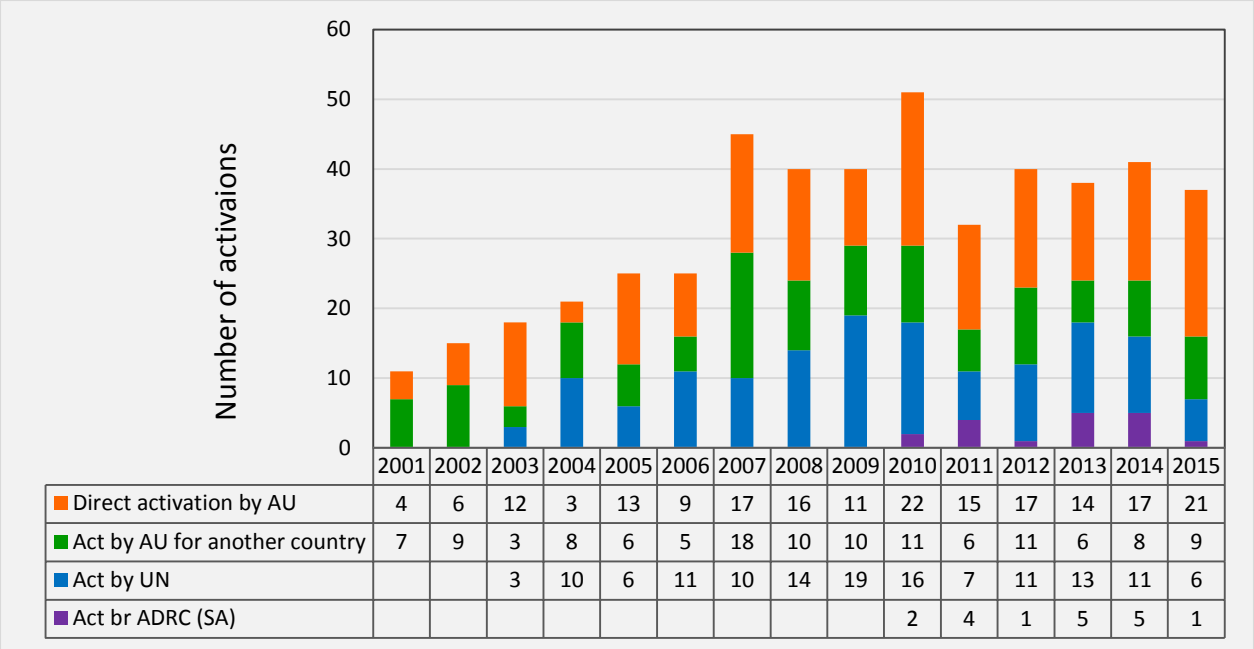


Figure 3-13. 2015 breakdown of Charter activations per mode

The diagram in Figure 3-14 compares the relative weight of the different access mechanisms adopted from 2001 to 2015, used to request the International Charter service. Since its inception, 93 countries without AUs have benefited from the Charter. For the period of 2007-2015, 63% of the activations were requests on behalf of a user (AUs for another country, UN or Sentinel Asia) in countries without an AU.

The International Charter continues to support users worldwide, including countries without direct access (through activations in mode 2, 3, and 4). At the same time, the number of AUs increases thanks to the Universal Access process, which changed the relative weight between the

activation modes. By the end of 2015, mandated organisations of seven countries prone to natural disasters have become AUs after a registration and training process under the Charter's Universal Access procedure.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Direct activation by AU	4	6	12	3	13	9	17	16	11	22	15	17	14	17	21
Act by AU for another country	7	9	3	8	6	5	18	10	10	11	6	11	6	8	9
Act by UN			3	10	6	11	10	14	19	16	7	11	13	11	6
Act br ADRC (SA)										2	4	1	5	5	1

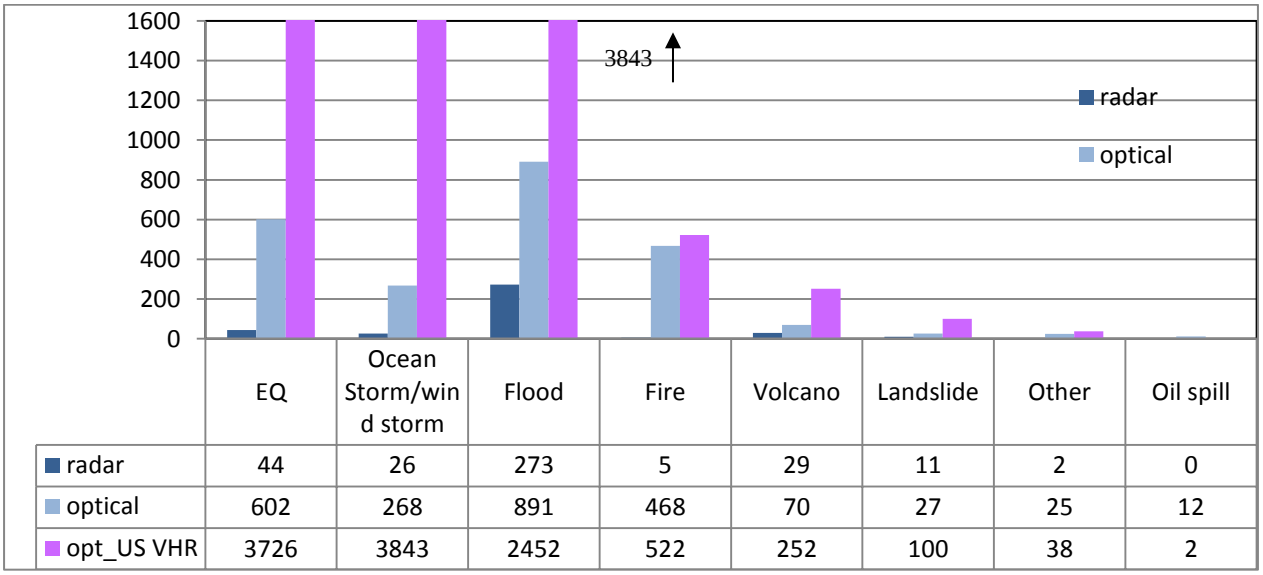
Figure 3-14. 2001-2015 number of Charter activations per mode

3.2 Resource report

3.2.1 EO data consumption in 2015

In 2015, a total of 2,753optical and radar images (Figures 3-17 & 3-18, table 3-2 & table 3-3) of the Charter constellation and 10,935 images of US VHR optical satellites (GeoEye, IKONOS, QuickBird, WorldView1, 2 and 3) were supplied (Figure 3-19, table 3-4) for 38 activations (including activation 451 for oil spill in Vietnam that was withdrawn by SA before a PM was nominated) in 27 countries.

Figure 3-16 shows the total number of EO data from the Charter virtual constellation and the US VHR optical data provided in 2015 by disaster type. A high number of the US VHR data were delivered to support the wind storm and heavy rains that occurred when hurricane "Joaquin" hit the Bahamas in October 2015 (24% of US VHR data) and the Nepal earthquake in April 2015 (21% of US VHR data).



	EQ	Ocean Storm/wind storm	Flood	Fire	Volcano	Landslide	Other	Oil spill
radar	44	26	273	5	29	11	2	0
optical	602	268	891	468	70	27	25	12
opt_US VHR	3726	3843	2452	522	252	100	38	2

Figure 3-16. 2015 EO data of the Charter virtual constellation and US VHR optical data grouped by disaster type
Other class regroups air crash and dam collapse

In 2015, a total of 2,753 optical and radar data were provided by the Charter members and 10,935 images of US VHR optical satellites for 38 in 27 countries. Particularly, for the April 2015 earthquake in Nepal, USGS provided also a large number of PLANET LABS archive data (3088 images) and DEM archive data (300 images).

Differences in the amount of EO data delivered by the agencies year by year are linked to the annual number of activations, the type of disasters, the sizes of the AOIs, the image tiles, the duration and severity of certain disasters and the change in the virtual Charter constellation (decommissioning of satellites and new satellites entering the constellation). It should be noted that resulting from the very different characteristics of different EO systems - such as the spatial resolution, ground coverage of the images, cloud screening procedures, time performance etc. – the total numbers of images of the different satellites alone do not adequately express the relative importance and contribution of a system to the overall capacity provided by the Charter.

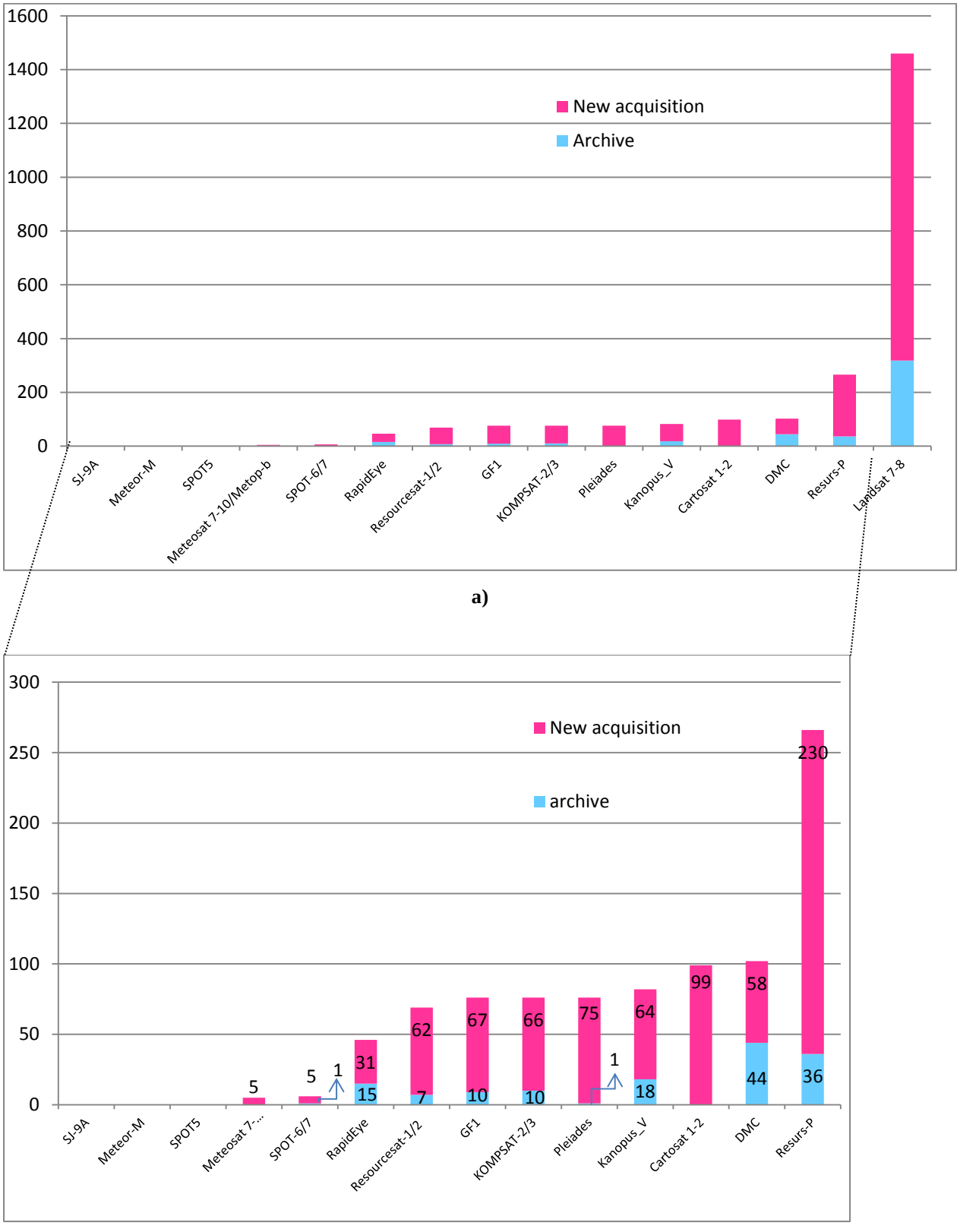


Figure 3-17 (a & b). 2015 Data Consumption (archive and new acquisition) - Optical sensors. a) all sensors; b) All sensors, except Landsat 7-8

Resource	SJ-9 A	Meteor_M	SPOT 5	Meteosat 7-10/Metop-b	SPOT-6/7	RapidEye	Resourcesat-1/2	GF-1	KOMPSAT-2/3	Pleiades	Kanopus-V	Cartosat- 1/2	DMC	Resurs-P	Landsat 7-8
Total number of delivered data	**0**	**0**	**0**	**5**	**6**	**46**	**69**	**76**	**76**	**76**	**65**	**99**	**102**	**266**	**1460**
archive	0	0	0	0	1	15	7	9	10	1	1	0	44	36	318
new acquisition	0	0	0	5	5	31	62	67	66	75	64	99	58	230	1142
Max. number of images per activation	*0*	*0*	*0*	*2*	*4*	*6*	*27*	*34*	*14*	*12*	*14*	*43*	*33*	*31*	*394*

Table 3-2. Statistics by Optical sensors (Charter virtual constellation)

Landsat data (7 and 8) represents an important optical resource with a total of 1,460 images. 27% of Landsat images were provided to support the activation for wildfire in Russia in August.

Contribution of the other optical sensors (low spatial resolution to high spatial resolution) varies from 5 to 266 images in total depending on the disaster type, spatial resolution and ground coverage of the images, etc. Resurs-P data contribution was significantly higher than last year providing 30 images for floods in Brazil in June and 31 images for floods and landslides in Chile in August. The contributions of RapidEye, Resourcesat-2, Kanopus-V, Pleiades and Cartosat 1-2 are higher than those in year 2014. In particular, the number of Resourcesat-2 and GF-1 data provided is almost 3 times higher than last year. 45% of the total CNSA contribution (GF1 data) was provided by to support the wildfire in Russia as well.

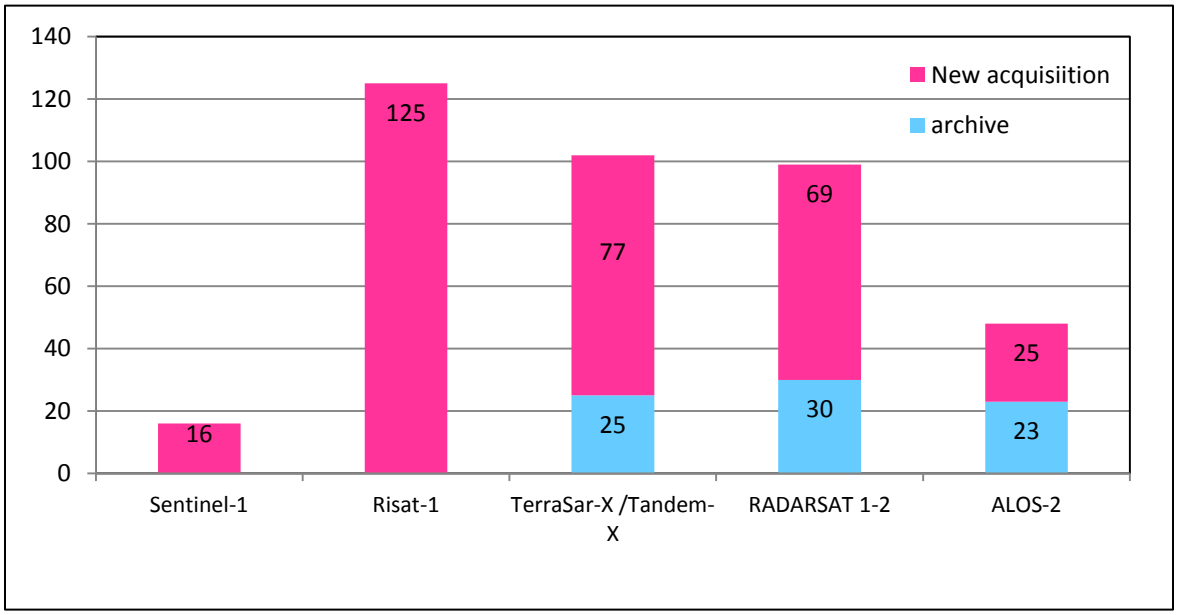


Figure 3-18. 2015 Data Consumption (archive and new acquisition) - Radar sensors

ALOS-2 was launched in May 2014 and is the new radar data source that was added to the Charter constellation. The first Charter delivery of ALOS-2 data took place in March 2015 for the

volcanic eruption of Turrialba in Costa Rica following an activation request by USGS on behalf of OVISICORI (Costa Rica and the National Disaster Submission). ALOS-2 data were used in subsequent Charter Calls over 2015 such as the landslides in Colombia in May, floods in Vietnam, Myanmar, Chile and Argentina in August and floods in India and Argentina in December. The contribution of Risat-1 data has more than doubled compared to 2014 (59 scenes), while the number of contributed RADARSAT and TerraSAR-X/TanDEM-X scenes were slightly lower than those of the year before (135 for RADARSAT and 123 for TerraSAR-X/TanDEM-X). For Sentinel-1, the number of scenes delivered increased from 11 in 2014 to 16 in 2015.

70% of radar data were used to monitor the 17 flood events. In the cases of flood disasters, radar satellite imagery often brings most benefit to emergency response, because radar systems are able to monitor the extent of flooded areas independent from the weather conditions.

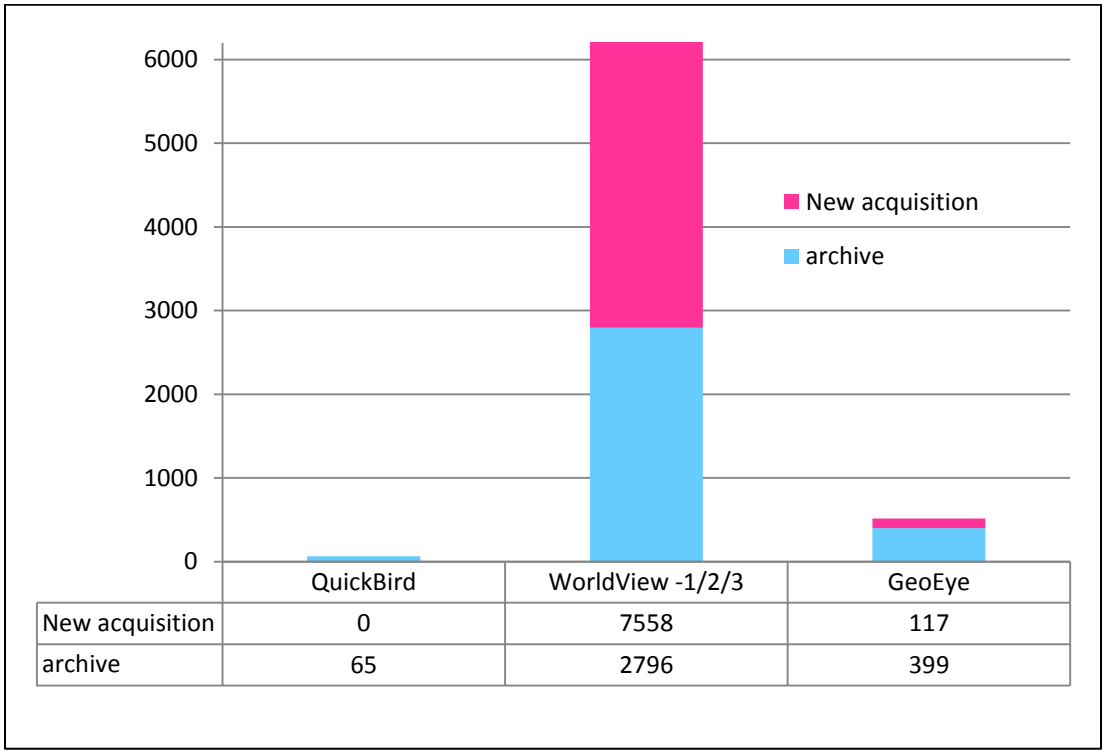
For EO satellite missions with open data policy (e.g. the Copernicus Sentinel-1), the exact number of used images cannot be traced. The actual number of Sentinel-1 images accessed and used in 2015 is significantly higher than the number figuring in 3-18 (16 is the number of traceable images). ESA is developing a system to account and trace the number of Sentinel images accessed.

Resource	Sentinel-1	RISAT-1	TerraSAR-X/ TanDEM-X	RADARSAT 1/2	ALOS-2
Total number of delivered data	**16**	**125**	**102**	**99**	**48**
archive	0	0	25	30	23
new acquisition	16	125	77	69	25
Max. number of images per activation	*8*	*48*	*10*	*10*	*12*

Table 3-3. Statistics by Radar sensors

In total, 10,935 images of US VHR optical satellites (GeoEye, IKONOS, QuickBird, WorldView-1, 2 and 3) were supplied in 2015. US VHR imagery was delivered to the Charter by the USGS using the HDDS system (Figure 3.19, table 3-4).

The WorldView-1/2/3 contributions are comparable to the ones in 2014 (12,432). The contribution of QuickBird is inferior to last year (216 scenes) and there was no contribution from IKONOS data. The number of GeoEye data delivered is more than 10 times superior to 2014 (49). More than 40% of the data provided were used to support the wind storm and heavy rains that occurred when hurricane Joaquin hit the Bahamas in October 2015 (2,613 WorldView images) and the Nepal earthquake in April 2015 (166 GeoEye and 2,119 WorldView images).



	QuickBird	WorldView -1/2/3	GeoEye
New acquisition	0	7558	117
archive	65	2796	399

Figure 3-19. 2015 Data Consumption –US Commercial optical satellites.

Resources	GEOEYE	QUICKBIRD	WORLDVIEW-1/2/3
Total number of delivered data	**516**	**65**	**10354**
archive	399	65	2796
new acquisition	117	0	7558
Max number of images per activation	*166*	*18*	*2613*

Table 3-4. 2015 Statistics concerning US commercial optical satellites

Overview of data consumption by activation:

Figures 3-20 and 3-21 depict the number of programmed (post-disaster) and archived (pre-disaster) images by activation and 3-22 shows the number of US VHR new acquisitions by activation.

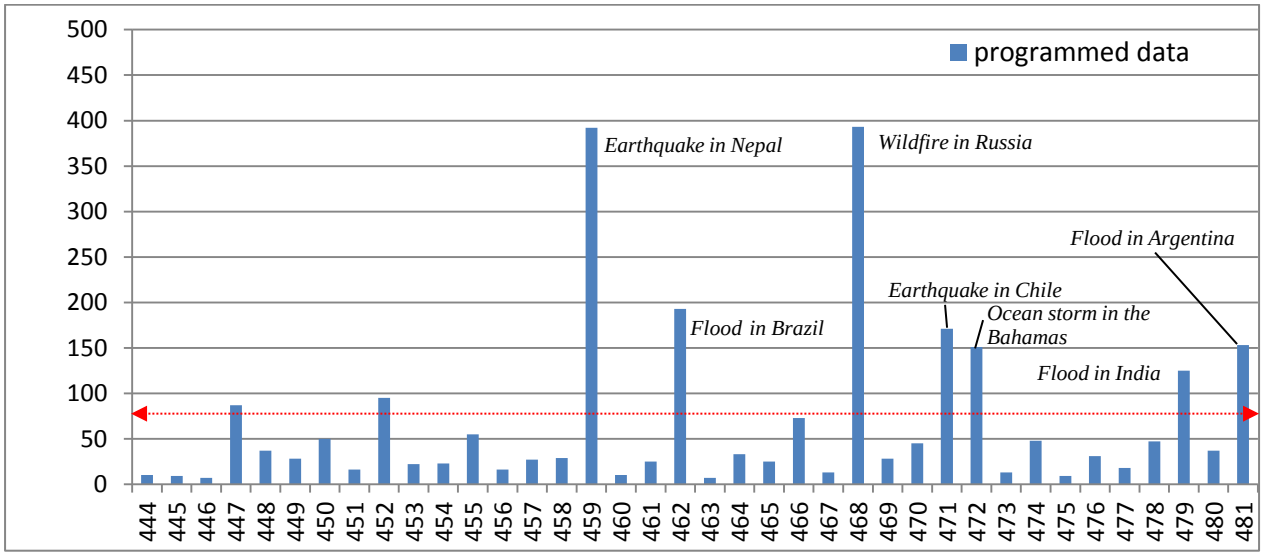


Figure 3-20. Number of programmed images (radar and optical) provided by activation

On average the quantity of images is **58 per activation**. There are seven activations with a number greater than 100 of programmed data (Charter optical & radar sensors), these are: **Act 459**, earthquake in Nepal, 269 images; **Act 462**, flood in Brazil, 184 images; **Act 468**, wildfire in Russia, 375 images; **Act 471**, earthquake in Chile, 166 images; **Act 472**, ocean storm in the Bahamas, 143; **Act 479**, flood in India, 117 images; **Act 481**, flood in Argentina, 125.

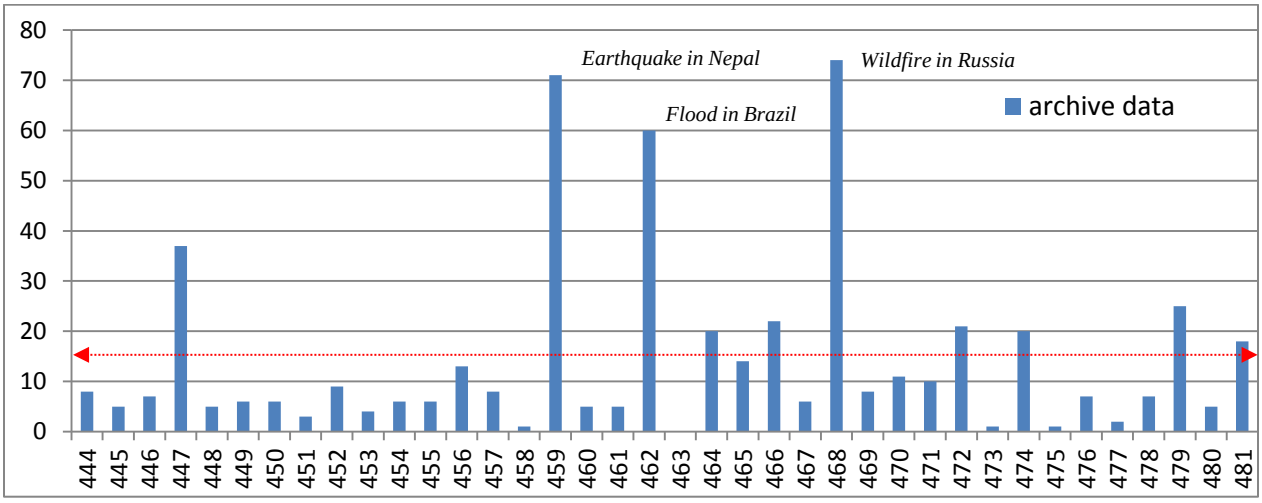


Figure 3-21. Number of archived images provided by activation (Charter EO sensors)

On average the quantity of images is **14 per activation**. In three cases, the number of archive data exceeded 35: **Act 447**, flood in Australia, 37 images; **Act 459**, earthquake in Nepal, 71 images; **Act 462**, flood in Brazil, 60 images; **Act 468**, wildfire in Russia, 74 images.

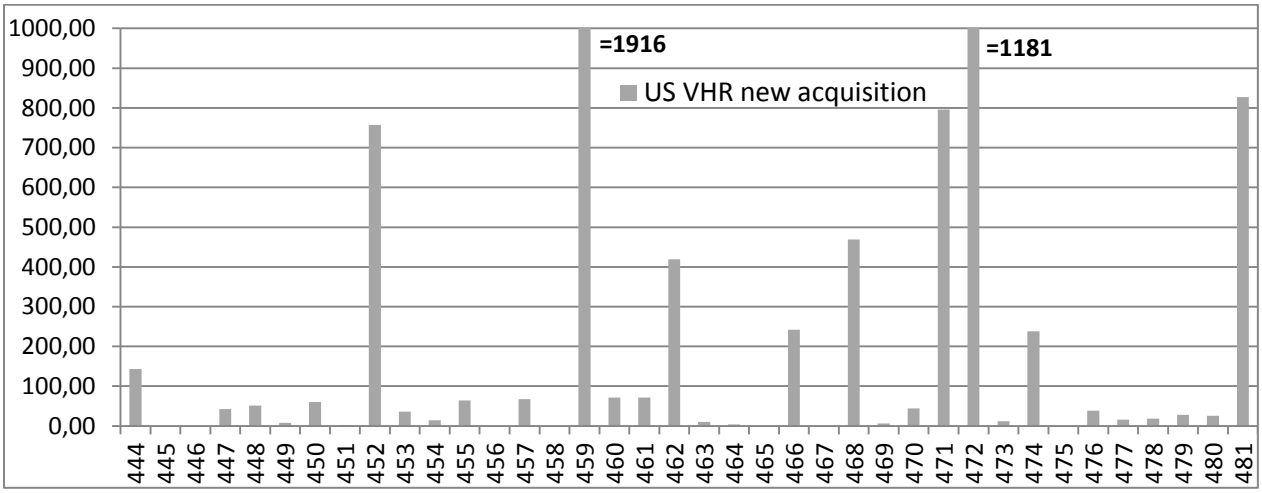


Figure 3-22. Number of new images provided by activation (US VHR commercial satellites)

In total, 32 activations out of 38 have benefited from US VHR data. The two activations with the highest number of US VHR data (greater than 2000 in total and greater than 100 for new acquisitions) provided are: **Act 459**, earthquake in Nepal, (2285 images in total out of which 1916 new acquisitions); **Act 472**, ocean storm in the Bahamas, (2613 images in total out of which 1181 new acquisitions).

3.2.2 Human resource contribution (ECO and PM) in 2015

- *ECO resources in 2015*

The Emergency On-Call Officer (ECO) services were provided on a weekly rotational basis by 11 Charter members agencies: CNES, CNSA, CONAE, CSA, DLR, DMCii, ESA, ISRO, JAXA, KARI, ROSCOSMOS. The random nature of calls resulted in an uneven workload distribution for the members, with JAXA handling nearly one fifth of the calls. There were 8 calls processed by JAXA, 7 calls by ISRO, 5 calls by CNES, DLR and ROSCOSMOS, 4 calls by ESA and CNSA, 2 calls by CONAE and 1 call by CSA. Some ECOs had to handle 2-4 calls during their week on duty, particularly in March, August and November, when the maximum number of calls occurred. KARI and DMCii did not receive any request call during their week on duty.

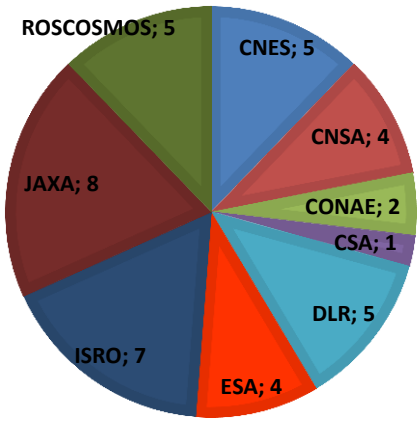


Figure 3-23. Distribution of Charter Parties responsible for the ECO services in 2015

- *Distribution of Charter members responsible for the PM services delivered in 2015*

Project Managers (PMs) were nominated for 37 activations.

PMs nominated by USGS handled 27% of Charter activations; CONAE, INPE, ISRO 13.5% each. DMCii nominated PMs that supported 8.1% of the activations, whereas ESA, ROSCOSMOS nominated PM for 5.4% of activations each; CNES, CNSA, DLR, JAXA, and KARI for 2.7% of activations each (Figure 3-24).

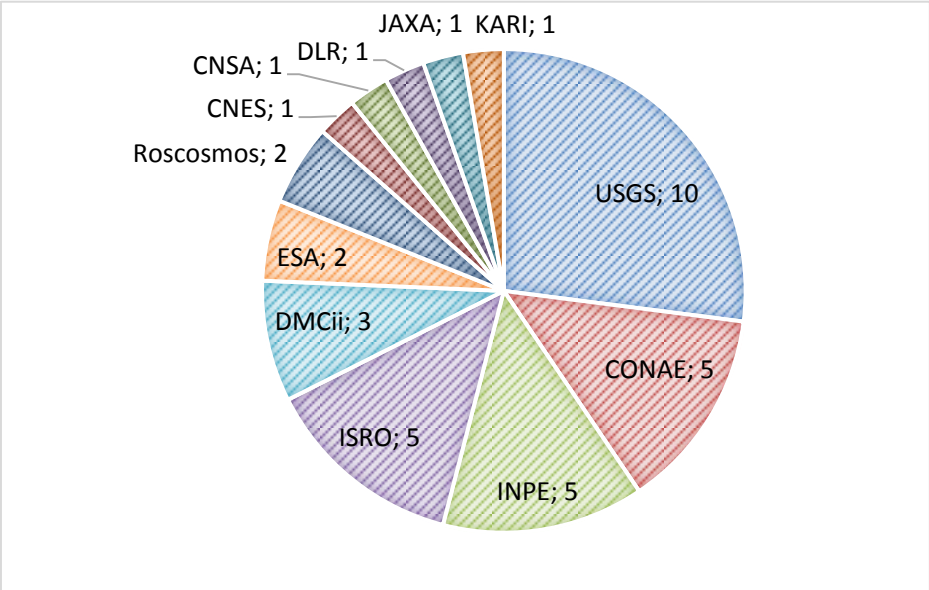


Figure 3-24. Distribution of Charter Parties responsible for the PM services in 2015

- *Distribution of organizations providing PM resources in 2015*

PMs may be sourced from a Charter party or a third party. Table (3-5) and Figure (3-25) show the breakdown of the PM organizations. In the case of third party organizations, it is required that a Charter member nominates them and takes the responsibility for the service they provide. During this reporting period, 18 different organizations contributed their PM services to Charter activations.

Organisation, Country	Number of PM service
UNITAR/UNOSAT (Switzerland)	6
ONEMI (Chile)	5
CONAE (Argentina)	3
USGS (USA)	3
CENAD - Centro Nacional de Gerenciamento de Riscos e Desastres (Brazil)	3
INPE (Brazil)	2
ISRO/NRSC (India)	3
ROSCOSMOS (Russia)	2
AIT (Thailand)	1
CATHALAC (The Water Center for the Humid Tropics of Latin America and the Caribbean) (Panama)	1
CNES (France)	1

DLR/ZKI (Germany)	1
Geoscience Australia (Australia)	1
NDRCC - National Disaster Reduction Centre of China (China)	1
OFDA -U.S. Foreign Disaster Assistance (USA)	1
PDC- Pacific Disaster Center (Hawaii, USA)	1
MVO- Montserrat Volcano Observatory	1
MALHE- Ministry of Agriculture, Land, Housing and the Environment (Montserrat)	1

Table 3-5. PM Organisations in 2015

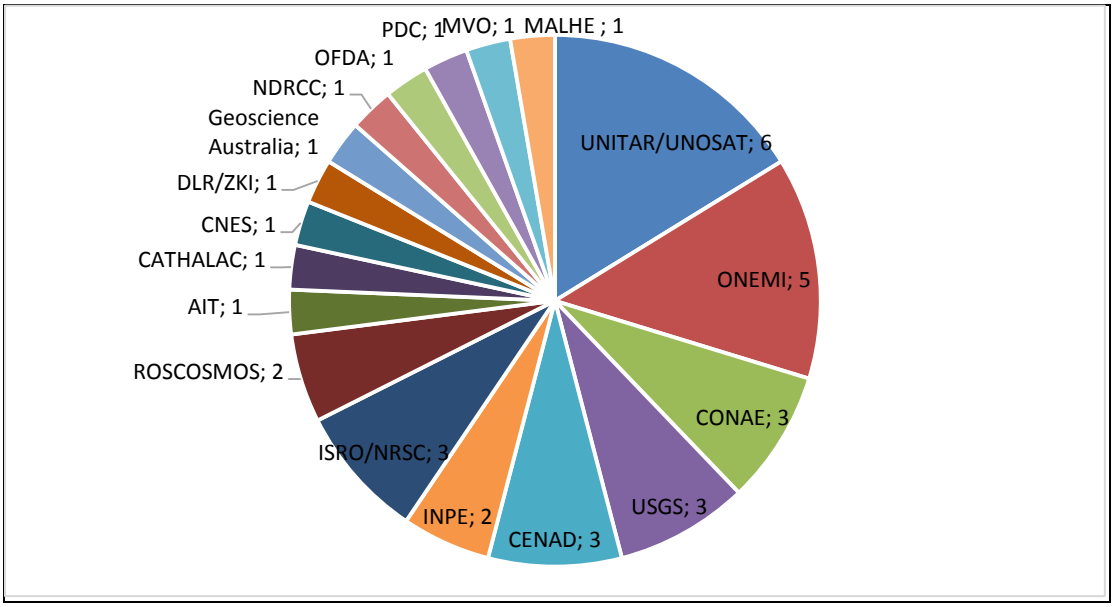


Figure 3-25. Distribution of organizations providing PM resources in 2015.

Difference between figures 3-24 & 3-25: Figure 3-24 represents the breakdown of Charter members who nominated PMs in 2015, while Figure 3-25 represents the breakdown of organizations performing the PM work for 2015activations.

Detailed comments:

- USGS managed 27% of the total PM services with the support of own personal (4 activations) and third parties: one from CATHALAC to cover event in Central America; one from MALHE to cover one event in the Bahamas; one from PDC to cover one event in Northern Mariana and three from UNITAR/UNOSAT** for the activations in Afghanistan, in Yemen, in Tajikistan.
- CONAE managed 13.5% of the total Project Manager services, with support of internal staff and USGS for an event in Guatemala, and third parties: ONEMI* for two events in Chile (volcanic eruption, and wildfire).
- INPE managed 13.5% of the total Project Manager services with support of internal staff for one event in Brazil and one in Columbia and, of CENAD - Centro Nacional de

Gerenciamento de Riscos e Desastres (Brazil); Brazilian AU, for two events in Brazil and one in Irak (flood).

- ISRO managed 13.5% of the total Project Manager services with support of internal staff for 4 events (3 floods in India and, the Earthquake and landslides in Nepal) and of UNITAR/UNOSAT staff for flood in Vietnam and Myanmar.
- DMCii managed 8.1% of the total Project Manager services with support of ONEMI* for events in Chile (volcanic eruption, floods and landslides and Earthquake and tsunami). ONEMI is the AU of Chile selected through the UA process and had to be followed by the agency (DMCii) which performed the training and the test.
- ESA managed 5.4 % of the total Project Manager services with support of third parties: Geosciences Australia for floods in Australia due to an ocean storm and UNITAR/UNOSAT for an ocean storm in Vanuatu.
- ROSCOSMOS managed 5.4 % of the total Project Manager services with support of internal staff for a wildfire in Russia and aircraft crash in Egypt.
- CNES managed 2.7% of the total Project Manager services with support of internal staff for a flood in Madagascar. The request was made by the COGIC (French AU) on behalf of the civil protection of Madagascar (BNGRC).
- CNSA managed 2.7% of the total Project Manager services with support of NDRCC-National Disaster Reduction Centre of China staff (Chinese AU) for an earthquake in China.
- DLR managed 2.7% of the total Project Manager services with internal staff (DLR/ZKI) acting as PM for a flood in Malawi.
- JAXA managed 2.7% of the total Project Manager services with support of AIT for a flood in Bangladesh requested by ADRC (escalation to the Charter).
- KARI managed 2.7% of the total Project Manager services with the support of ONEMI* for a flood in Chile.

*ONEMI is the DRM responsible of Chile, that became a Charter AU in 2014 and triggered the Charter 5 times in 2015.

**UNITAR/UNOSAT served as PM in particular for UN activations. UNOSAT contributed to 15.7% of all activations in 2015 (Vanuatu, Vietnam, Myanmar, Afghanistan, Yemen, Tajikistan), also providing value-adding services. It supported the Charter for 1 other activation providing damage and impact assessment maps under another PM (Earthquake and landslides in Nepal).

- *Distribution of Charter members responsible for the PM services over the last five years (2010-2015).*

The following graph represents the percentage of PMs nominated by each Charter member in 2010 (51 activations), 2011 (32 activations), 2012 (40 activations), 2013 (38 activations), 2014 (40 activations) and 2015 (37 activations).

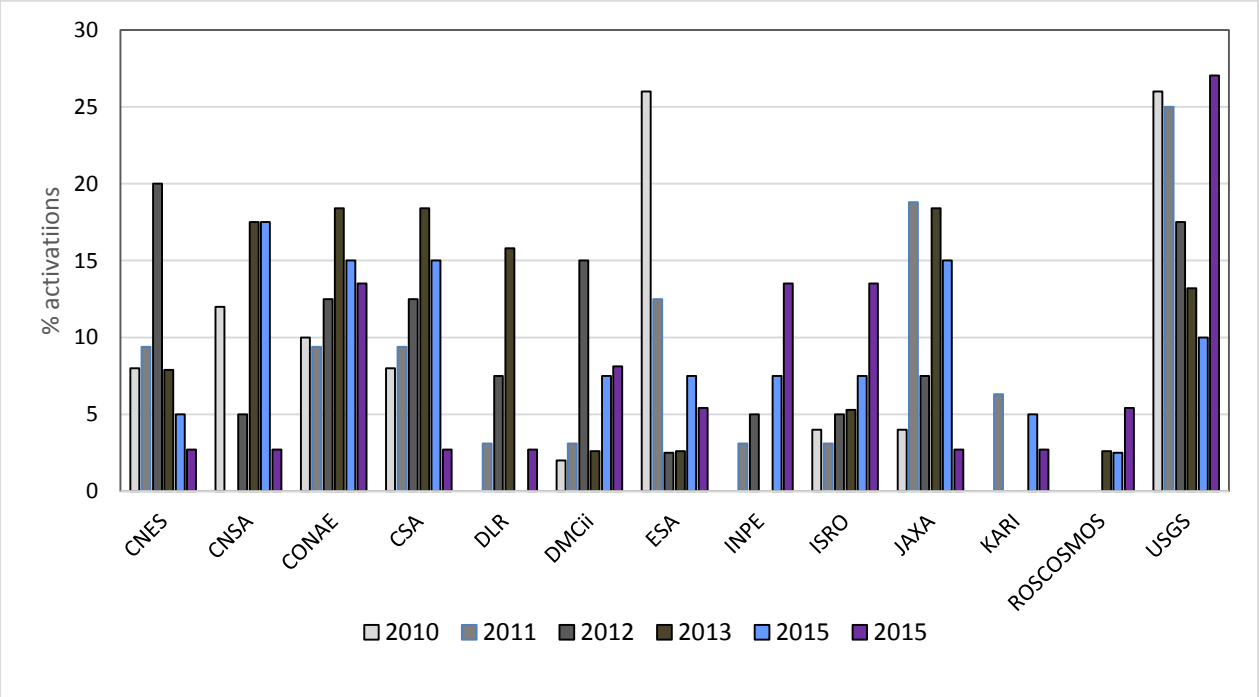


Figure 3-26. 2010-2015 Distribution (%) of Charter Parties responsible for the PM services

Figure 3-26 shows a large variability per agency per year. This breakdown is explained by:

- The annual number of disasters.
- The number of requests by AUs for disasters occurring in their countries. The PM is nominated by the relevant Charter member.
- The number of requests by AUs for another country without AU. The PM is nominated by the relevant Charter member.
- The number of requests by UN bodies. In that case, the current Charter Lead Agency has to nominate the PM. In 2015, KARI, ISRO, USGS were the Charter Lead.
- The number of requests by ADRC/SA. In that case, the PM is nominated by JAXA.
- The number of requests by Algeria, Nigeria and Turkey. In that case, the PM is nominated by DMCii.
- The number of PMs managed by each agency and their availability.
- The number of request by AUs nominated thanks to the UA process.

During the last five years, in total USGS is the member which has nominated/provided the highest number of PMs, followed by CONAE, ESA, and JAXA.

3.3 SARE – Semi Annual Refresher Exercises

The Emergency On-Call Officer (ECO) function is of utmost importance for the Charter operations, because the ECO orders appropriate data from the Charter members within few hours after an activation request comes in. Because some ECO staff might not face “real activations” frequently, two so-called “Semi Annual Refresher Exercises” are performed every year with all

the ECOs. In 2015, these exercises took place from 16 March to 30 March and from 16 November to 30 November, respectively, and the following scenarios were worked with:

- SARE-14: earthquake in China. This exercise was led by CNSA and KARI training teams; the report was prepared by KARI. 40 ECOs from 11 Charter member agencies participated.
- SARE-15: Ocean storm and flood in France. This exercise was led by CNES, CNSA and ESA training teams; the report was prepared by CNSA. 44 ECOs participated.

3.4 Project Manager Training

The PM training is aimed at strengthening the network of Charter PMs by providing refresher sessions for current PMs and training sessions for new PMs. Three PM training sessions were carried out in 2015.

- February (Vienna, Austria): As a side event to the Meeting of UN-SPIDER Regional Support Offices, this event was kindly hosted by UNOOSA and led by DLR and CNES. Participants came from several institutions in Asia, Africa, South America, and Europe.
- July (Miami, USA): Lead by UKSA/DMCii and USGS. The participants were from UK territories in the Caribbean.
- October (Sioux Falls, USA): As a side event to the Charter meeting in the US, this training was led by USGS and supported by JAXA, DLR and CNES. Participants were from American View Network. This network is composed by US Universities/ Research Centers of 41 US states.

USGS developed an online PM refresher training course to keep PMs up to date on the new members, additional satellites and updated Charter processes. The PM training material was revised to be tailored to this scope.

3.5 The Charter operational tools

ESA has developed and continues to develop tools: the web-based Charter Operations System "COS-2", linked to the Charter Geographic Tool (CGT), and HDDS, to improve Charter operational steps and facilitate the work of the different Charter operational staff (ODO, ECOs and PMs).

COS-2 is operational since the beginning of March 2015. Overall, it has been used successfully in all Charter calls. More than half of the Charter members have their EO metadata fetching executed on COS-2, allowing automated and on-line cataloguing of Charter acquisitions. The security features have been enhanced for personal access; the reporting aspect has been improved with the generation of ECO Dossier, PM dossier and generation of charter statistics. Manuals and training material were released during 2015. The next version (2.1) shall be released in August 2016 including fixes, management improvement and urgent implementations and the 2.2 version will be released in December 2016, including new features (full integration of the CGT and HDDS, synoptic view etc.).

COS-2 support was provided for the first time in SARE-15, in which 44 Emergency on-Call Officers (ECOs) from 12 Charter member agencies participated.

ESA performed trainings to six ESA member states and the Australian AU using on-line URF of COS-2. PM trainings on COS-2 will start next year.

4 External relations

4.1 New members accession

Following the request from the Bolivarian Agency for Space Activities (ABAE) of Venezuela to become a Charter member in May 2014, the Board members examined its' potential contribution. ABAE provided a presentation focused on their space activities during the 34th Board meeting (October 2015), and following discussions, the Charter Board accepted ABAE as a new member. To be fully integrated, a site visit at ABAE premises and an operational qualification process will take place in 2016.

4.2 Universal Access

Charter members, conscious of the need to improve Charter access globally, have adopted the principle of Universal Access (UA). Any national disaster management authority will be able to submit requests to the Charter for emergency response. Proper procedures will have to be followed, but the affected country will not have to be a Charter member. The UA process is designed to further strengthen the Charter's contribution to disaster management worldwide, and is being implemented gradually. UA implementation started in September 2012.

Universal Access is progressing, resulting in more and more disaster risk management users to be granted Authorized User (AU) status. Following Australia in 2013 and Malawi in 2014, Chile, Pakistan, Colombia, Bolivia and the Dominican Republic have had their national mandated disaster management organizations granted Charter access in 2015, and more candidates were under assessment or training. By the time of publishing this report, disaster management organizations from Belarus, Iraq, El Salvador, Guatemala, and Uruguay have become able to directly activate the Charter in case of major disasters in their countries due to their newly achieved status.

48 countries and the EC have dedicated AUs reaching the total of 56 user organizations able to directly request Charter activations by the end of 2015 (figure 4-1).

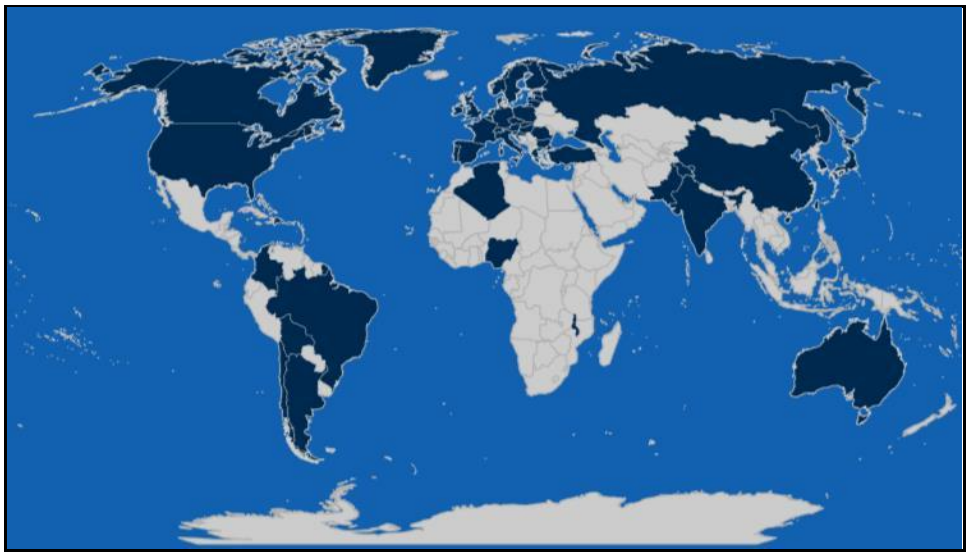


Figure 4-1. Map showing countries (in dark blue) with direct access to the Charter by end of 2015.

Charter members have continued to promote Universal Access and the Charter as a whole through their participation in different international events held in 2015 (e.g. the Canadian Remote Sensing Symposium in St-John's and the International Symposium Remote Sensing of the Environment (ISRSE) in Berlin).

Further Universal Access focused actions explaining the UA initiative and process and promoting the possibility to become a Charter user:

1) 6 African Nations were contacted by ISRO through their Embassies in India: Tunisia, Burkina Faso, Kenya, Morocco, Zambia and Senegal;

2) a letter has been sent to the International Civil Defense Organization (ICDO), Switzerland, explaining Universal Access and offering further exchange between ICDO and the Charter.

3) video-conferences have been conducted by CONAE to countries of Latin America and the Caribbean (linked with CONAE through UNOOSA's UN-SPIDER program) as a way to engage these National Emergency Operation Centers to become authorized users. The promotion in Latin America by UNOOSA/UN-SPIDER and CONAE was very successful and highly appreciated by all the Charter members.

4.3 Cooperating Bodies & Charter User Intermediaries

4.3.1 Collaboration with UNOOSA and UNITAR/UNOSAT

Active cooperation with the UN is continuing on the basis of existing arrangements with UNOOSA and UNITAR/UNOSAT.

Both participated to the 34th Board meeting (October 2015) by teleconferences and made a summary of their activities to support the Charter. Two reports were also delivered. The UNOOSA report mentioned the training in Vienna with the participation of DLR and CNES. Some positive outcomes were achieved: one of the trainees from Colombia has been added to the PM list by CONAE, another participant from Hungary might later become a DLR PM. The discussion with the UN-SPIDER Regional Support Offices (RSOs) to promote Universal Access

was encouraging. Some of these RSO have member states, and an action was taken on the RSOs to promote Universal Access towards their members.
In 2015, a request activation coming directly from Guatemala, was forwarded by UNOOSA to the Charter, which found a solution to activate the Charter and help the authorities of the country. Different activities of Charter and UA promotion have been conducted under UN-SPIDER including advisory services and international workshops. UNOOSA/UN-SPIDER worked directly with CONAE to promote UA, contacting disaster management authorities in Latin America.
All Charter activations and product references are published in the monthly UN-SPIDER Updates, an electronic publication which is posted on the Knowledge Portal (www.un-spider.org) and distributed to nearly 20,000 subscribers worldwide via e-mail.

7 of 37 Charter activations for 2015 (18.9 %) were requested by UNITAR/UNOSAT on behalf of UN agencies. UNOCHA was the main requestor with 4 calls; the others were initiated by UNICEF, UNDP and UNESCAP.

Throughout the reporting period, UNITAR/UNOSAT staff members were nominated as Project Manager for 6 activations; these PMs also provided value-adding services; in addition, UNITAR/UNOSAT provided value-adding service supporting ISRO for the Earthquake in Nepal.

The Nepal case was very challenging: UNITAR/UNOSAT coordinated closely with the European and U.S. partners of the Charter involved in DRM response (USGS, BGS, Copernicus EMS and also did a lot of aerial photography. It produced a lot of maps and image products derived from satellite images delivered by the Charter, and these products were shared with the various actors.

An Ocean storm in Vanuatu was also a disaster covered by UNOSAT, however, because of the size and extent of the affected areas, delivery of good VHR images, relevant analysis and value-added products took quite some time.

UNITAR/UNOSAT remarked that there is an increase of Charter value adding providers, especially national and regional, which is a very positive thing, to support the global access.

A regular summary of relevant satellite mapping activities including the Charter activations is produced and made accessible through the Global Disaster Alert and Coordination System (GDACS) portal (http://portal.gdacs.org/data), which is provided by UNOSAT and partners.

4.3.2 Cooperation with Sentinel Asia

Since March 2010, the Asian Disaster Reduction Centre (ADRC) has the status of a Charter Cooperating Body and can trigger the Charter in support of requests from national members of Sentinel Asia (SA) and ADRC. In 2015, SA was comprised of 99 organizations from 25 countries and regions including 15 international organizations. There were four new national members in 2015: Tokyo University, Japan; Department of Geology & Mines, Ministry of Economic Affairs, Bhutan; Udayana University, Indonesia; Vietnam Academy of Science and Technology, Vietnam.

The ADRC provided the Charter with monthly activation status reports and provided two bi-annual reviews presenting Sentinel Asia's emergency response and promotional / awareness activities.

In 2015, 25 calls (SA call 210 to SA call 234) and 24 activations since one call was denied for a wildfire in Bhutan (SA call 211). The escalation mechanism to the Charter was used in response to 1 event for a flood in Bangladesh. The number of escalations to the Charter is inferior to the last two years: 5 in 2013 and, 6 in 2014. For 2015, the escalation mechanism was used for 4 % of all SA activations.

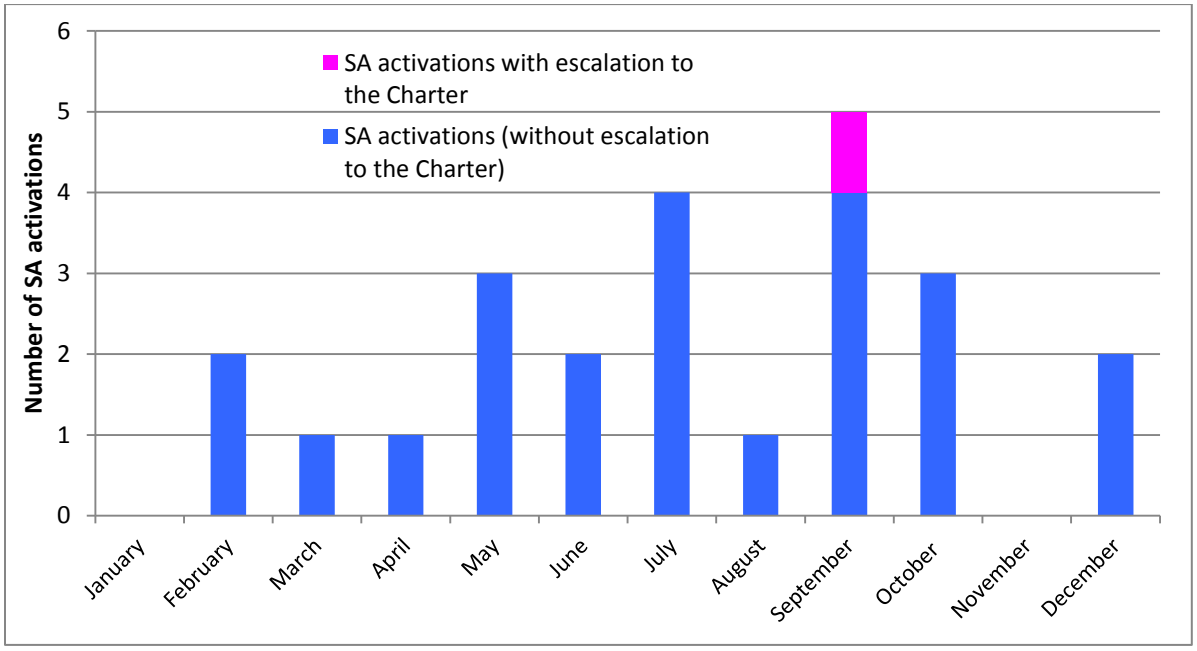


Figure 4-2. Sentinel Asia: 2015 monthly activations

SA – with the support of JAXA– continued to promote the Charter, explaining the escalation mechanism to activate the Charter and the UA initiative at several training workshops and conferences including: Sentinel Asia Joint Project Team Meeting (JPTM) in November 2015, the Asia Pacific Space Agency Forum (APRSAF) in December 2015 and the Sentinel Asia Steering Committee meeting in June 2015.

4.3.3 Collaboration with European Union Satellite Centre

Collaboration activities with the European Union Satellite Centre (EUSC or EU SatCen) are continuing. EUSC acts as a Collaborating Body since October 2010 to raise awareness and promote the Charter amongst their users in the EU Member States and within the context of the European External Action Service (EEAS).

EUSC may activate the Charter for natural and man-made disasters and may in addition provide suitable PMs.

EUSC made a report covering their 2015 activities to support the Charter: No requests to activate the International Charter Space and Major Disasters were submitted by the SatCen on behalf of its members; they continued to promote the Charter activities and service to their member states, in particular the Member States involved in the context of ongoing crisis in the Middle East, Africa and Europe.

In October 2016, the Charter will decide if the collaboration with EUSC will be confirmed and renewed for a period of two years.

4.4 Cooperation with other programmes and initiatives

4.4.1 Collaboration between European members of the Charter and the European Union Copernicus programme

The two systems are complementary with slightly different scope: the Charter is focused on the response phase during a major emergency, while the European Union Copernicus emergency management service (EMS) is intended to provide support for all phases of the emergency management cycle in Europe and outside of Europe. In addition, the EMS is not only activated for natural disasters, it can also be triggered for other types of emergency (e.g. humanitarian crises, environmental assessment after a natural disaster or war conflict).

The collaboration agreement was approved in 2013 and continued in 2015. It consists of providing advanced crisis mapping services by the EMS to support Charter activations based on a case-by-case decision. Additionally, the EU, as Authorized User of the Charter, could activate the Charter in the case of a major disaster and the European Joint Research Centre (JRC) could provide a Charter Project Manager (PM).

In 2015, Copernicus service was activated 31 times. there were no Charter activations for European countries but 8 Copernicus events out of Europe, activated by the European Response Coordination Centre (ERCC), on behalf of the EC Services/DG ECHO, were also covered by the Charter (Malawi, Vanuatu (2 EMS activation for the same event), Nepal, Myanmar, Chile, Afghanistan (2 EMS activation for the same event). In some cases, the Charter web included link to the products delivered by Copernicus, in particular for the earthquake in Nepal.

4.4.2 Collaboration with CEOS Working Group on disasters

The CEOS Working Group on Disasters aims at increasing and strengthening satellite Earth observation contributions to the various Disaster Risk Management (DRM) phases in these three domains. There are three specific pilot activities covering floods, earthquakes, and volcanoes.

Each of these thematic pilots intends to serve as a showcase for the international DRM community, in particular demonstrating a) the added value and uniqueness of increased CEOS coordination in this area; b) the benefits of closer ties to users (decision-makers, major stakeholders, and politicians), and ease of access to data; and c) the potential for the increased roles of space agencies in DRM under the new Sendai Framework for Disaster Risk Reduction 2015-2013 of the United Nations.

Following an agreement, once a Charter activation is closed, and access to Charter data is required from one of the CEOS Pilots, the Charter agencies could share the data collections acquired, according to data licensing of each agency. A procedure for requesting such collaboration was established in 2015. Within 2015, 5 requests have been received from the CEOS Flood pilot requesting data for floods in Malawi (January 2015), Vietnam (July 2015), Myanmar (August 2015), India (December 2015) and for landslide caused by floods in Indonesia (December 2014). Most of the Charter member agencies shared data with the Flood pilot, when there was an overlap in the AOIs.

5 Communication

5.1 Web site

The Charter website is currently available in English and some pages are available in French, Chinese, French, Japanese and Spanish. Next year, complete translation of the web pages, in Spanish with the support of CONAE and ABAE, and in French, with the support of CNES, will be performed.
https://www.disasterscharter.org/web/guest/home

In 2015, an improved version of the website was released. Its design and layout facilitate the user navigation and information search. In addition, it allows direct access to COS-2 to authorized Charter members' personnel.

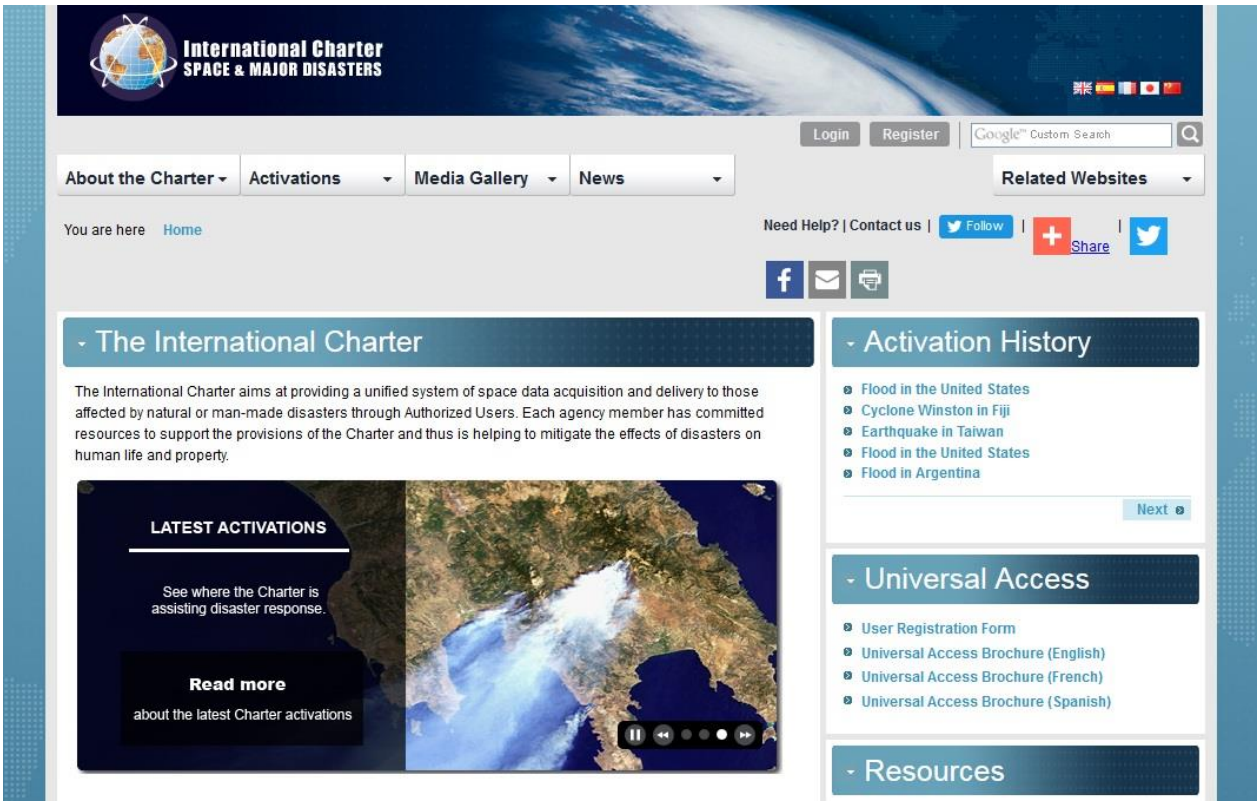


Figure 5-1. Charter website homepage

An overview of page and sessions views during 2015 is provided in the next two diagrams, to illustrate the website visits frequency.

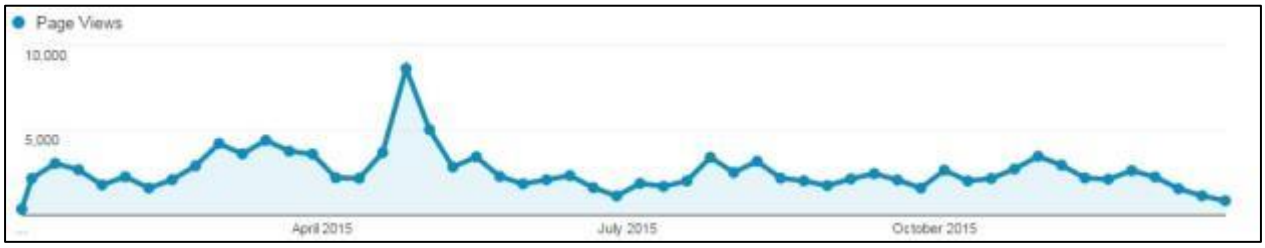


Figure 5-2. Breakdown of page views (January-December 2015)

Figure 5-3. Breakdown of sessions views (January-December 2015)

Charter visibility is also ensured through other social media outlets, such as Twitter, which had around 3160 followers by the end of 2015, which is a remarkable increase compared to 2014 (1840 followers) and 2013 (880).

The following diagram shows the number of impressions of Charter's followers in May 2015 reaching 161.000 (top tweets being images from the Calbuco volcano eruption in Chile and the Nepal earthquake).

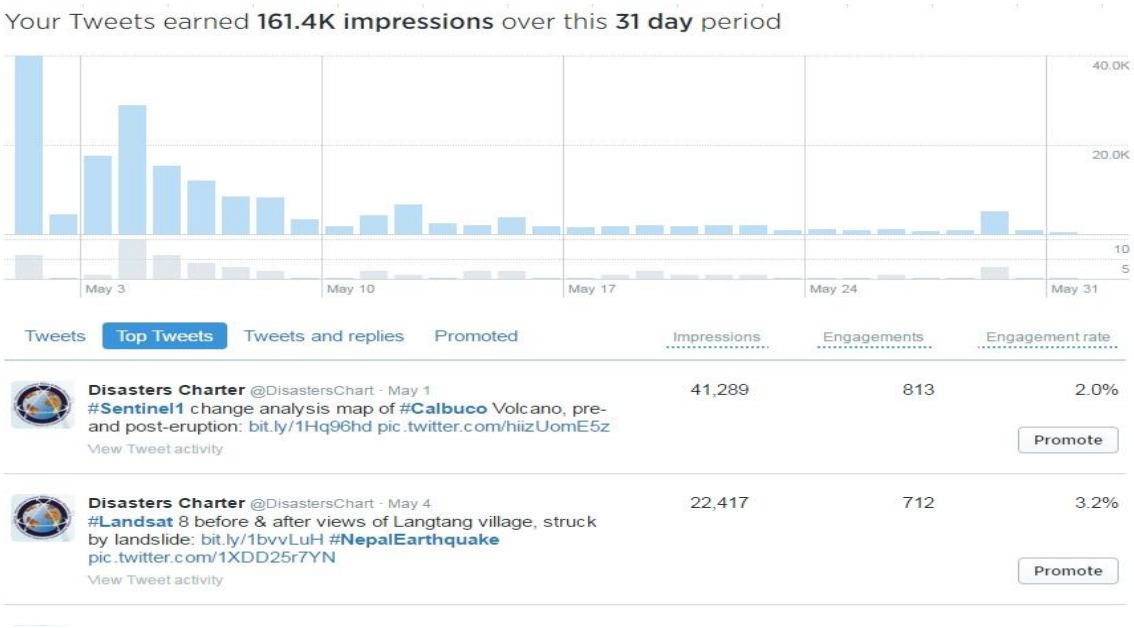


Figure 5-4. Number of impressions (May 2015)

5.2 Charter Newsletters

Charter newsletters were issued in March and September 2015. The newsletter represents an additional means of informing users, stakeholders, and the public on recent Charter activations, news, events and related activities.
https://www.disasterscharter.org/web/guest/news/newsletter

Figure 5-5. Charter newsletter issue 11

The March issue (10th) presented a summary of the KARI being the current lead of the International Charter 'Space and Major Disasters'; 2014 - A busy year for the International Charter; RapidEye Satellite contributes after fires in the Dominican Republic; JAXA to provide images from its new EO satellite; Sentinel-2: Colour vision for Copernicus; KOMPSAT- 3A getting ready for launch in March 2015; SAR Remote Sensing Education Website.

The September issue (11th) reported about the ISRO chairmanship of the International Charter 'Space and Major Disasters'; the Nepal Earthquake; the succesful launch of KOMPSAT-3A and its first imagery; 10 years of Cartosat-1; Charter at "UN World Conference on Disaster Risk Reduction" in Sendai, Japan; Malawi benefits from direct access to the Charter.

The dissemination of the newsletter is through the Charter website and by e-mail. Each agency deals with its own distribution list.

5.3 Conferences and presentations

The following table provides details of the 2015 events or conferences where the Charter was represented. On such occasions, presentations were given covering the Charter's role in the acquisition and production of satellite imagery for disaster response together with the Universal Access initiative.

Event	Venue	Date	Speakers
UN-SPIDER Regional Support Offices meeting	Vienna, Austria	5-6 February	DLR & CNES
UN World Conference on Disaster Risk Reduction	Sendai, Japan	14-18 March	JAXA
AmeriGEOSS: Meeting during NOAA Satellite Users Conference	Maryland, USA	29 April	NOAA
GEO Work Plan Symposium	Geneva, Switzerland	6 May	NOAA
International Symposium Remote Sensing of the Environment (ISRSE)	Berlin, Germany	11-15 May	DLR & ESA
GIS for the United Nations and the International Community Conference	Geneva, Switzerland	18-20 May	UKSA/DMCii
United Nations/Germany International Conference on Earth Observation 2015	Bonn, Germany	26-28 May	DLR
Joint Master Programme "Geography of Environmental Risks and Human Security" of the UN University Institute for Environment and Human Security (UNU-EHS) and University of Bonn (lecture)	Bonn, Germany	29 May	DLR
Summer School on "ICTs for Disaster Risk Management", organized at Central European University in conjunction with UNDP (lecture)	Budapest, Hungary	13-17 July	DLR
IAA Climate Change and Disaster Management Conference	Mexico City, Mexico	17 September	CNES
AmeriGEOSS Side Event at GEO-XII Week	Mexico City, Mexico	10 November	NOAA
UK Government Workshop: Use of Satellite Technology for Disaster Management (DMCii organised event)	UK	23 November	UKSA/DMCii

Table 5-1. List of conferences/workshops with Charter presence

UNOOSA and UNITAR/UNOSAT also contributed towards increasing Charter awareness through presentations to a wider public audience, ranging from Ministers and Heads of Agencies to operational entities within the UN system.

5.4 Press releases, articles

Table 4-3 summarises the main press releases, web and paper articles issued by the member agencies or others during this reporting period.

The 15th Anniversary of the Charter was celebrated during the 34th meeting in Sioux Falls. A scribble video celebrating the 15th Anniversary of the Charter was set by ESA (http://www.esa.int/spaceinvideos/Videos/2015/10/Saving_lives_when_disasters_strike) and a special publication untitled "International Charter Space and Major Disasters, a journey of 15 years (2000-2015)" was issued in October 2015 and distributed.

Date	Issuing agency	Title
17 March 2015	CNES	CNES press release - Cyclone Pam au Vanuatu : le CNES apporte ses capacités en imagerie https://presse.cnes.fr/fr/cp-9736
17 April 2015	ISRO	ISRO takes over the chairmanship of the International Charter 'Space and Major Disasters': https://www.disasterscharter.org/web/guest/news/-/asset_publisher/xg3Vzc7VlTN6/content/isro-takes-over-the-chairmanship-of-the-international-charter-space-and-major-disasters?redirect=https%3A%2F%2Fwww.disasterscharter.org%2Fweb%2Fguest%2Fnews%3Fp_p_id%3D101_INSTANCE_xg3Vzc7VlTN6%26p_p_lifecycle%3D0%26p_p_state%3Dnormal%26p_p_mode%3Dview%26p_p_col_id%3Dcolumn-1%26p_p_col_count%3D1
30 April 2015	DLR	Disaster relief – DLR provides aerial images of Kathmandu (http://www.dlr.de/dlr/en/desktopdefault.aspx/tabid-10081/151_read-13487/year-all/#/gallery/19391)
11 May 2015	DLR	Satellites – a reliable source for Earth observation (http://www.dlr.de/dlr/en/desktopdefault.aspx/tabid-10081/151_read-13630/year-all/151_page-10/#/gallery/19490)
16 September 2015	CNES	Book "Climate change and Satellites 2015 – Knowledge for action", 'The International Charter', pages 122-123, Sud[s] Concepts Editors, 2015
30 October 2015	ESA	14th Annual Report of the Charter: https://www.disasterscharter.org/web/guest/news/-/asset_publisher/xg3Vzc7VlTN6/content/14th-annual-report-of-the-charter?redirect=https%3A%2F%2Fwww.disasterscharter.org%2Fweb%2Fguest%2Fnews%3Fp_p_id%3D101_INSTANCE_xg3Vzc7VlTN6%26p_p_lifecycle%3D0%26p_p_state%3Dnormal%26p_p_mode%3Dview%26p_p_col_id%3Dcolumn-1%26p_p_col_count%3D1
3 November 2015	USGS	USGS takes over chairmanship of the International Charter 'Space and Major Disasters': https://www.disasterscharter.org/web/guest/news/-/asset_publisher/xg3Vzc7VlTN6/content/usgs-takes-over-chairmanship-of-the-international-charter-space-and-major-disasters?redirect=https%3A%2F%2Fwww.disasterscharter.org%2Fweb%2Fguest%2Fnews%3Fp_p_id%3D101_INSTANCE_xg3Vzc7VlTN6%26p_p_lifecycle%3D0%26p_p_state%3Dnormal%26p_p_mode%3Dview%26p_p_col_id%3

		Dcolumn-1%26p_p_col_count%3D1
9 November 2015	USGS	Fifteen Years of Collaborative Disaster Response: https://www.disasterscharter.org/web/guest/news/-/asset_publisher/xg3Vzc7VlTN6/content/fifteen-years-of-collaborative-disaster-response?redirect=https%3A%2F%2Fwww.disasterscharter.org%2Fweb%2Fguest%2Fnews%3Fp_p_id%3D101_INSTANCE_xg3Vzc7VlTN6%26p_p_lifecycle%3D0%26p_p_state%3Dnormal%26p_p_mode%3Dview%26p_p_col_id%3Dcolumn-1%26p_p_col_count%3D1
11 November 2015	CNES	Web article for the 15years of the Charter –Evénements climatiques extremes : une réalité pour la Charte https://cnes.fr/fr/evenements-climatiques-extremes-une-realite-pour-la-charte
4 December 2015	DLR	Überschwemmungen in Indien - DLR-Radarsatellit liefert Bilder zur Katastrophenhilfe (http://www.dlr.de/dlr/presse/desktopdefault.aspx/tabid-10172/213_read-16014/#/gallery/21401)
7 December 2015	CNES	Web article 'Catastrophe minière au Brésil : les images Pléiades' https://cnes.fr/fr/catastrophe-miniere-au-bresil-vue-par-les-pleiades
10 December 2015	DLR/ CNES	Web article "The International Charter "Space and Major Disasters" helped by our Satellite Constellation", including interviews with DLR/ZKI and CNES (http://www.geo-airbusds.com/en/6919-international-charter)
21 January 2016	CNES	Book « Demain L'Espace », "L'espace, après la catastrophe', Cherche-Midi Edition, 2015

Table 5-2. List of articles and press releases

In addition, Charter activations and product references are published in the monthly UN-SPIDER Updates (www.un-spider.org) and on the GDACS portal (http://portal.gdacs.org/data) where a regular summary of relevant satellite mapping activities including the Charter activations is published by UNITAR/UNOSAT.

6 Assessment of the Charter operations

This chapter provides a synopsis of the overall assessment including lessons learned and recommendations to be taken into consideration for improving Charter operations.
Statistics on the 2015 activations were compared with EM-DAT data to evaluate the overall impact of the Charter as a service in supporting disaster response – www.emdat.be (*D. Guha-Sapir, R. Below, Ph. Hoyois - EM-DAT: International Disaster Database – Université Catholique de Louvain – Brussels – Belgium).* MunichRE as NatCatService and relevant analysis were also consulted (http://www.munichre.com/natcatservice).

The reports issued by the Project Managers of the Charter activations remain one of the main sources of information for assessing the performance and quality of service provided by the Charter during 2015.

6.1 Overall impact

In 2015, the most catastrophic event was the Nepal earthquake on April 25, affecting more than 5 million and killing nearly 9,000 people. The earthquake has been recorded as the third most severe disaster by number of fatalities since 2009. Apart from this event, 2015 was evaluated as a moderate year concerning the impact of natural disaster events in terms of fatalities and damages, by contrast to years such as 2004, 2008, or 2010 (see Figure 5-1).

323 natural events (excluding droughts, extreme temperature, and including earthquakes and tsunamis, floods, landslides, storms, volcanic eruptions, wildfires, and mass movement) are recorded in the database managed by the Centre for Research on the Epidemiology of Disasters (CRED) (http://emdat.be/disaster_list/). The Charter responded to around 12% of the total number of natural disasters registered by EM-DAT in 2015; this is equivalent to the percentages of the previous years (i.e. 13% in 2014, 11% in 2013, 13 % in 2010 and 2012; 10% in 2011).

Munich RE's natural catastrophe loss database (*Topics GEO, Natural catastrophes 2015 Analyses, assessments, positions, 2016 issue; Munich RE*) registered 1,060 catastrophic events and also a high number of minor loss events in emerging economies countries. Direct overall losses from natural catastrophes in 2015 amounted to US$ 100bn, well below the average for the last ten years of US$ 190bn. A total of 23,000 people lost their lives globally. 9,000 people out of the 23,000 died in a series of earthquakes that struck Nepal and the neighboring states of India, China and Bangladesh. A large number of victims (47%) lost their lives in meteorological events. The distribution by continent shows that Asia was again worst affected in 2015, with 39%, followed by North America with 22% and Europe with 13%. Africa, South America and Australia accounted for 10%, 8% and 8% respectively of the registered events. In terms of the long-term average, relative frequency therefore declined in North America and Europe, but was 4 and 3 percentage points higher in Asia and South America respectively. The distribution of 2015 Charter activations by continent (Figure 3.6) confirms this trend.

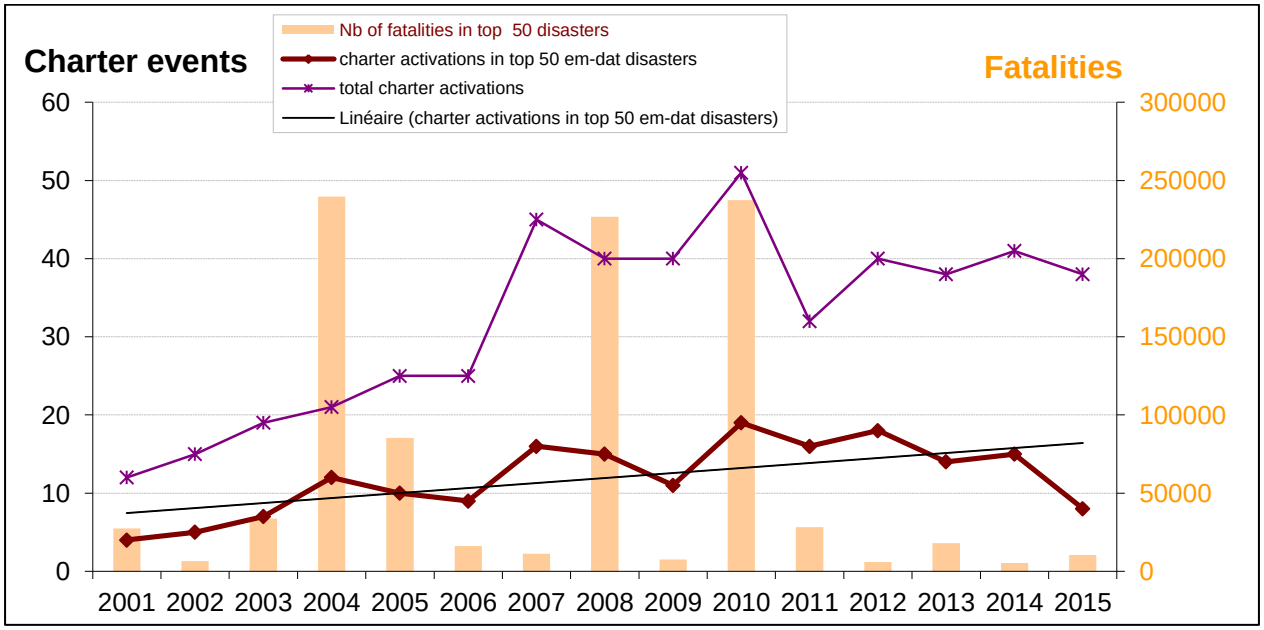


Figure 6-1. Number of Charter events over 2001-2015

Represented in red are the number of Charter events per year that are included within the 50 most severe disasters by fatalities recorded in EM-DAT each year. The total number of fatalities counted for the 50 main disasters was much lower than 2004, 2008 and 2010 and equivalent to 2007.

Figure 6-1 shows that 2015 total number of activations, with some 37 activations, is comparable to recent years, as the number of Charter activations fluctuates between 30 and 50 per year since 2007. Such oscillations can be explained in part by the variability in the number of total natural disasters occurring during the relevant year and by the existence of national and regional EO-based emergency response services (e.g. Copernicus EMS, Sentinel Asia).

In 2015, the Charter covered 3 of the 10 most severe disasters by fatalities (Table 6-1). Indeed, among the last six years (2009-2015), the Charter was triggered for 14 of the 15 most severe natural disasters by fatalities, as reported by EM-DAT (Table 6-2).

In addition, the Charter was activated, for the first time, for a dam collapse (17 fatalities) in Brazil. In this case, the Charter provided satellite imagery to support the production of maps in order to understand the causes of the accident, the size of the area affected by the tailing mud the affected communities, the environmental impact and the municipal contingencies plans.

Top 10 Disasters – Number Killed – 2015 *The text in italic indicates that the Charter was activated*					
Country	**Disaster type**	**Date**	**#killed**	**#Affected people**	**Total Damage (000' $)**
Nepal	***Earthquake***	***25/4/2015***	***8,831***	***5,639,722***	***5,174,000***
India	Flood	8/11/2015	325	1,801,000	2,200,000
Malawi	***Flood***	***1/1/2015***	***278***	***638,645***	***390,000***
Chile	***Flood***	***25/3/2015***	***178***	***193,881***	***1,500,000***
India	Flood	19/6/2015	81	9,000	604,000
China	Flood	13/5/2015	58	82,000	800,000
USA	Storm	26/12/2015	45	60	900,000
China	Flood	26/6/2015	35	144,900	645,000
USA	Flood	23/5/2015	32	12,000	2,700,000
USA	Flood	15/12/2015	31	4,050	600,000

Table 6-1. Ten most severe natural disasters by number of fatalities in 2015 (events covered by Charter activations are indicated in bold and italics. ***(Source: EM-DAT, filtered according to the type of disasters covered by the Charter).***

Top 15 Disasters – Number Killed – 2009-2015 *The text in italic indicates that the Charter was activated*				
Date	***Country/District***	***Type***	***# Killed***	***#Affected people***
12/01/2010	***Haiti***	***Earthquake***	***222,570***	***3,700,000***
11/03/2011	***Japan***	***Earthquake and tsunami***	***19,848***	***368,820***
25/4/2015	***Nepal***	***Earthquake***	***8,831***	***5,639,722***
8/11/2013	***Philippines***	***Tropical cyclone***	***7,354***	***16,106,807***
12-27/06/2013	***India***	***Flood***	***6,054***	***504,473***
14/04/2010	***China P Rep***	***Earthquake***	***2,968***	***112,000***
28/07/2010	***Pakistan***	***Flash flood***	***1,985***	***2,0359,496***
4-5/12/2012	***Philippines***	***Tropical cyclone***	***1,900***	***6,246,664***
07/08/2010	***China P Rep***	***Landslide***	***1,765***	***4,7200***
29/05/2010	***China P Rep***	***General flood***	***1,691***	***134,000,000***
15/12/2011	***Philippines***	***Tropical cyclone***	***1,439***	***1,150,300***
30/09/2009	***Indonesia***	***Earthquake***	***1177***	***679,402***
07/09/2009	India	Flood	992	1,886,000
11/01/2011	***Brazil***	***General flood***	***900***	***45,000***
05/08/2011	***Thailand***	***General flood***	***813***	***9,500,000***

Table 6-2. Fifteen most severe disasters by number of fatalities (2009-2015) (events covered by Charter activations are indicated in bold and italics). ***(Source: EM-DAT filtered according to the type of disasters covered by the Charter)***

Table 6-3 is the list of 50 most severe natural disasters by number of fatalities (listed by total damage) recorded by EM-DAT in 2015.

Note: EM-DAT events were filtered according to the type of natural disasters covered by the Charter.

Country	Disaster type	Event name	Start month	Start day	Total deaths	Total affected	Total damage (000' US$)	Charter activation
Nepal	Earthquake		4	25	8,831	5,639,722	5,174,000	x
China	Storm	Typhoon Mujigae	10	4	20	78,300	4,200,000	
USA	Storm		2	16	30		3,000,000	
USA	Flood		5	23	32	12,000	2,700,000	
India	Flood		11	8	325	1,801,000	2,200,000	
China	Flood		6	7	16	60,000	2,000,000	
USA	Storm	Joaquin	10	1	21	800	1,700,000	x
Chile	Flood		3	25	178	193,881	1500,000	x
Philippines	Storm	Typhoon Chan-Home	7	12	5	14,100	1,500,000	
Japan	Flood		9	9	21	45,046	1,400,000	
USA	Wildfire		9	13	4	7,302	1,400,000	
USA	Storm		4	7	3	12	1,400,000	
USA	Storm		5	6	4		1,400,000	
Australia	Storm		4	20	7	1,000	1,300,000	
China	Storm	Typhoon \'Soudelor\' (Hanna)	8	9	18	1,580,000	1,282,690	
China	Flood		7	20	28	128,610	1,200,000	
United Kingdom	Flood		12	26		48,000	1,200,000	
United Kingdom	Storm	Storm Desmond (Ted)	12	4	3	15,600	1,200,000	
Indonesia	Wildfire		9		19	409,664	1,000,000	
USA	Storm		5	6	6		1,000,000	
USA	Storm		8	2	4	40	950,000	
USA	Storm		4	24	4	12	950,000	
China	Storm	Typhoon Chan-Home	7	11		13,800	940,000	
France	Flood		10	3	20		924,000	
India	Storm		3	6	27		906,000	
USA	Storm		12	26	45	60	900,000	
Italy	Storm		3	2	3		869,000	
Mexico	Storm	Hurricane Patricia	10	22	14	15,000	823,000	
Chile	Earthquake		9	16	19	681,499	800,000	x
China	Flood		5	13	58	82,000	800,000	
USA	Storm		7	12	4		700,000	

China	Storm	Typhoon Dujuan	9	28			661,000	
USA	Storm		6	3			650,000	
China	Flood		6	26	35	144,900	645,000	
China	Flood		6	1	9	60,000	625,000	
India	Flood		6	19	81	9,000	604,000	
USA	Flood		12	15	31	4,050	600,000	
Chile	Volcanic activity	Calbuco	4	24		4,000	600,000	x
Australia	Storm	Cyclone \'Marcia\'	2	22	1	6,000	546,000	x
Iran	Flood		11	12	9	17,700	516,000	
China	Flood		5	28	17	60,000	500,000	
USA	Storm		3	25	1	3,312	500,000	
Dominica	Storm	Hurricane Erika	8	27	30	28,594	482,810	
China	Storm		5	7	7	79,800	461,000	
Vanuatu	Storm	Cyclone \'Pam\'	3	12	11	188,000	449,400	x
China	Flood		8	2	19	45,000	418,000	
Australia	Flood		4	30	6		400,000	
Malawi	Flood		1	1	278	638,645	390,000	x
USA	Storm		10	29	6		270,000	
China	Flood		5	13	20	60,000	254,000	

Table 6-3. Fifty most severe disasters by number of fatalities (listed by total damage) in 2015 ***(Source: EM-DAT filtered according to the type of disasters covered by the Charter)***

The Charter covered 8 of the 50 most severe natural disasters in terms of fatalities recorded by EM-DAT in 2015 (21% of 2015 Charter activations), excluding droughts and extreme temperature events (Figure. 6-1 and 6-2).

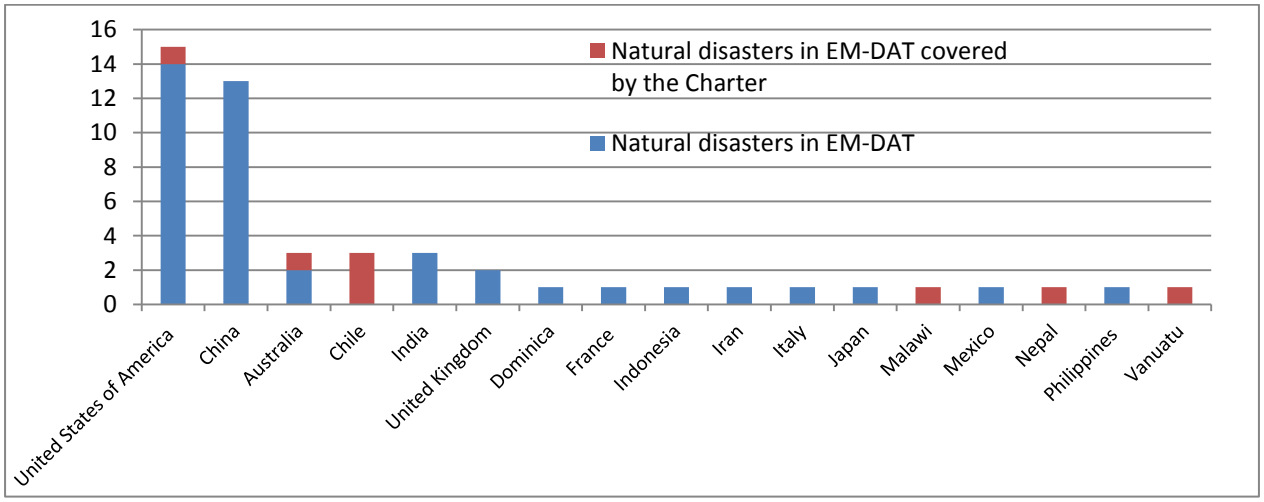


Figure 6-2. 2015 Breakdown by countries of the 50 major natural disasters (by fatalities) recorded by EM-DAT. In red the ones covered by the Charter.
(Source: EM-DAT filtered according to the type of disasters covered by the Charter)

For these 8 activations, requests were made by:

- Charter Authorised Users (AUs) for disasters in their countries: a flood in Malawi, an ocean storm in Australia, three disasters in Chile (a flood, a volcano eruption and an earthquake) and an ocean storm in the USA,
- AUs on behalf of other countries: earthquake in Nepal, and
- Charter Cooperating Bodies: ocean storm in Vanuatu and earthquake in Nepal (the activation for the Nepal earthquake was requested both by ISRO and UNITAR/UNOSAT).

This number is inferior to the ones registered in the period 2010-2014, where this number ranged from 14 to 19 (Figure 6-1).

The Charter service was not requested for 42 out of the 50 most severe disasters events (by fatalities):

- 37 out of 42 occurred in countries with an AU (USA, China, Australia, India, UK, France, Italy and Japan). For some of these events other satellite EO emergency response mechanisms were activated e.g. the flood in Japan (September) was covered by Sentinel Asia without escalation to the Charter, the floods in France (October) and UK (December) were covered by the European Copernicus EMS service.
- 5 out of the 42 occurred in countries without an AU. All fall well within the hazard types of the Charter.
    - 3 occurred in Asia (Indonesia, Iran and Philippines).
    - 2 occurred in North America (Dominica and Mexico). Hurricane Patricia in Mexico was covered by the European Copernicus EMS service.

The further progress of the Charter's Universal Access (UA) initiative will further improve Charter access globally.

6.2 System performance assessment

The triggering time (between reception of the User Request Form (URF) by the On-Duty Operator (ODO), and the Project Manager (PM) found for this event being informed by the Emergency on-Call Officer (ECO) about which satellite resources have been tasked by the Charter) is on average less than one day. This time span includes the process of assessing that the received request fulfils the requirements to activate the Charter, finding a qualified PM and his nomination by the Charter Executive Secretariat. In the meantime, the ECO requests data from the Charter member agencies to respond to the given disaster in the most appropriate way.

The histogram in Figure 6-3 shows the acquisition time of the first crisis satellite images received after Charter activations of the years 2011, 2012, 2013, 2014 and 2015. This parameter estimates the rapidity of Charter tasking and relevant image acquisition. It is calculated as [Date of first crisis image acquisition - Date of Charter activation]. These values are extracted from the PM reports when clearly stated. However, the PM/Value Adder may not use the first crisis scene to generate the first information product in some cases, e.g. if the first scene is too cloudy or too coarse to monitor the impact, shows little actual damage etc.

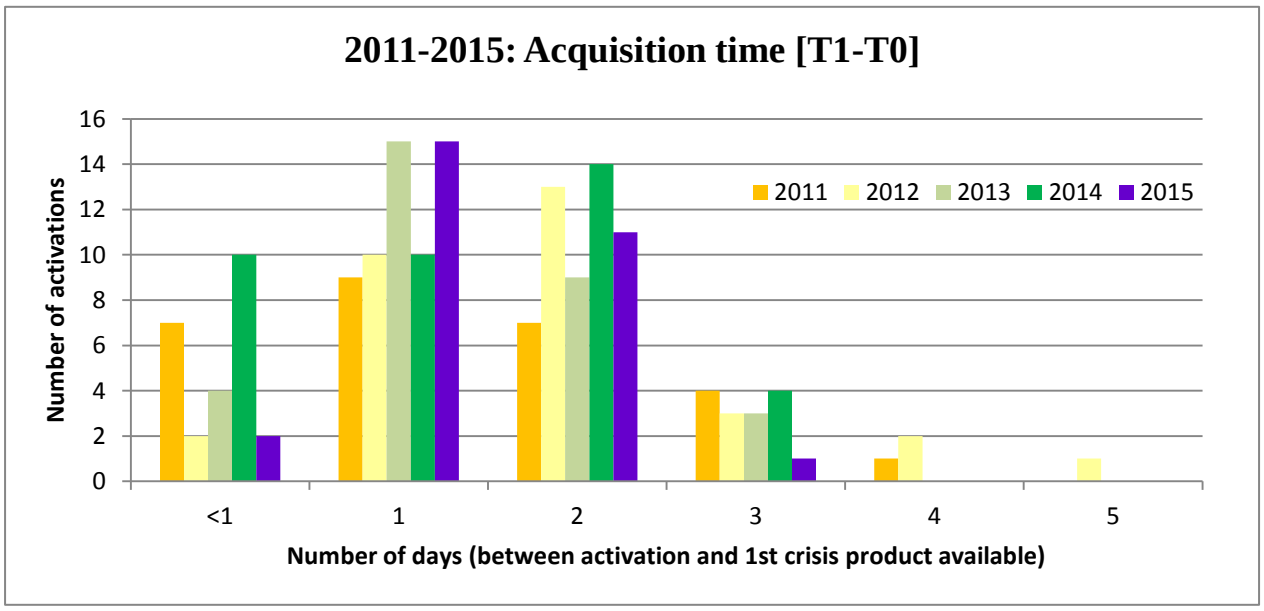


Figure 6-3. Time interval between Charter activation date and date of first data acquisition (2011-2015)
Statistics generated using information from 29 PM reports

In average, the bulk acquisition time is within one day after the activation. The majority of the acquisition times is observed within the first two days after the activation. In few cases, first images are available within the same day of the activation, as it is often the case when the Charter is triggered in anticipation by the requester (e.g. volcanic eruption, ocean storm).

It is difficult to compare such figures to user requirements in general and EO systems will always be slower than desired for certain users; a constraint being the timeliness in accessing new observations (and cloud-free observations in the case of optical systems) in the aftermath of a hazard impact; more satellites will be needed to reduce this constraint. More radar satellites, in particular, would reduce the effect of cloudy weather conditions in disaster zones on the Charter's performance.

In some cases, additional delay is caused by a change of the Areas of Interest (e.g. monitoring flash floods) or imprecise information given by the requestor of the activation, because this implies a re-tasking of the satellites.

It should also be noted that activation of the Charter by an AU or a Cooperating Body after a disaster event fluctuates mostly between < 1 (activation the same day of the event) to 3 days, but can be longer as shown in Figure 6-4. The quicker the Charter is activated after the occurrence of a disaster, the more effectively it can support emergency response.

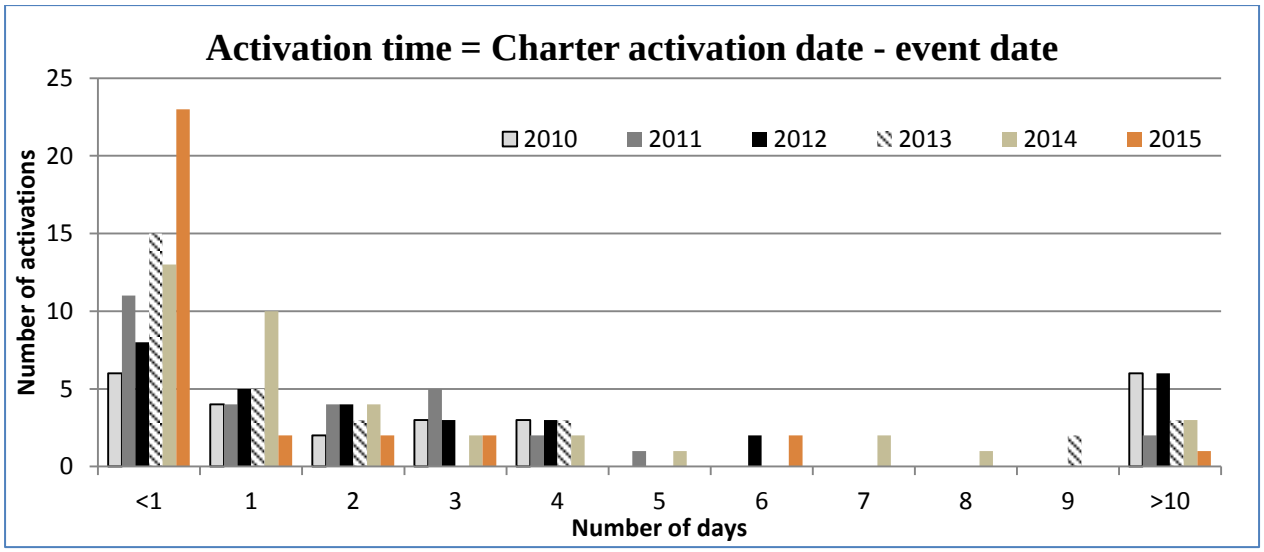


Figure 6-4. Time to activate the Charter by an AU or a Charter Cooperating Body (2010-2015 period)
Statistics generated using information from 32 PM reports

In 2015, the activation of the Charter by an Authorised User (AU) or Cooperating Body after a disaster event occurred in average in 1.4 days which is 1 day less than the activation time of years 2013 and 2014 (2.53 and 2.51 respectively) and less than the half activation time in years 2010-2012 (3.1 days).This is a great improvement in comparison to the years before, which is likely to be due to: (a) the Universal Access initiative, that allows AUs from non- Charter member countries to activate the Charter and (b) a quicker decision from the AU or end-user to request the Charter activation. Moreover, activation time is linked to the event type and the AU or end user decision process concerning the need for geo-information. In some cases, the delay in activating the Charter has huge impact on the usefulness of the Charter products, in particular, after flash flood events or hurricanes, while in other cases the impact might be noncritical; e.g. a flood disaster can worsen over days until an AU finally decides that it is a major disaster, and a Charter activation brings benefit to him.

For the year 2015, the activation time of the Charter has been correlated to the disaster type. As shown in Figure 6-5, for all earthquake events, a Charter activation was requested within the same day. Other events, such as aircraft crash and dam collapse also triggered the Charter within the same day. In case of floods, the activation time varies from same day activation to 6 days. For ocean and wind storms, as well as volcano eruptions the Charter was activated within 2 days.

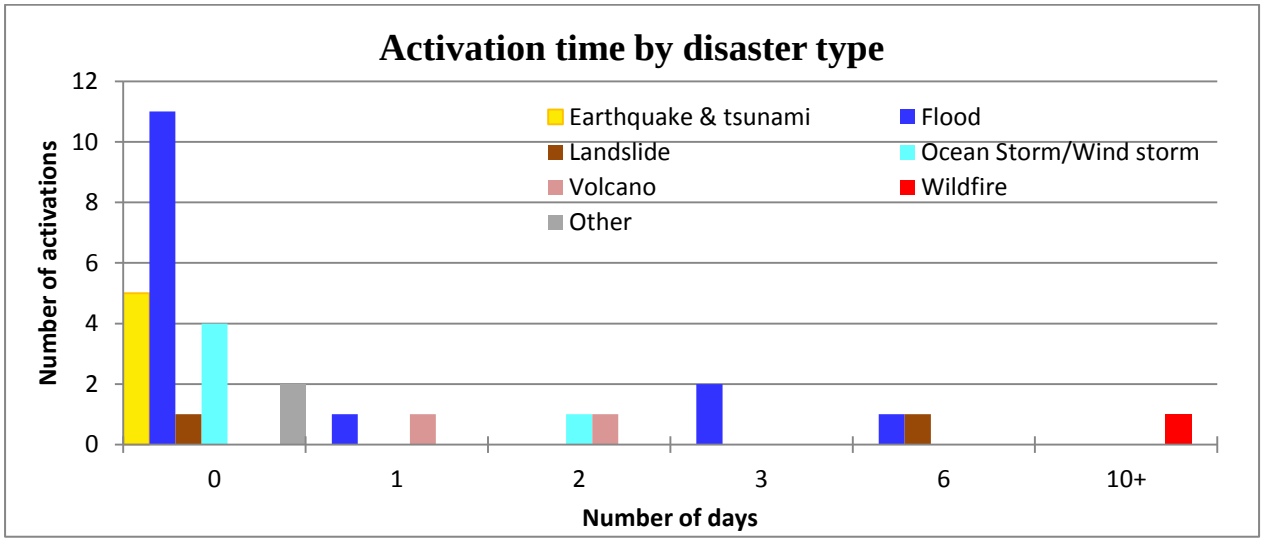


Figure 6-5. Time to activate the Charter by disaster type (2015 period)

Statistics generated using information from 32 PM reports

The new operational system COS-2, implemented in March 2015, helps to improve the speed and visibility to all Charter members of some operations and exchanges amongst the different operational staff involved during the activation. In the future, COS-2 will systematically monitor the Charter workflow and most of Charter performance parameters will be generated automatically, with the exception of those linked to the PM decisions (e.g. selection of the relevant crisis image to assess damage/extension of the disaster, request of additional EO data in case of event evolution / duration, etc.).

6.3 Assessment of services and products

The members of the Charter make a constant effort to ensure that all relevant staff (ODO, ECOs, the member agencies' order desks, the PMs and the Executive Secretariat members) is well-trained, and that Charter operations are running smoothly in every circumstance:

- Two SARE addressed to ECO staff were held in 2015, one of them being the first SARE supported by COS-2.
- Three PM trainings were held in Austria and USA [2]. That allows a regular growth and commitment of PMs that will enhance the ability to assign a PM from the geographical region of the disaster.
- 9 AU trainings were organised by ESA, CNES and DLR using digital URF of COS-2.

The different Charter scenarios describing the most appropriate response for the different disaster types, such as flooding, earthquake, volcanic eruption, etc. and definition of new scenarios (e.g. tsunami scenario) are permanently reviewed by the Charter's Executive Secretariat, taking into account every modification in the Charter satellite constellation, as well as recommendations by the ECOs and PMs. The objective is to offer optimal background procedures and to make the work of the ECOs and the PMs as efficient and easy as possible.

In addition to the systematic review of the PM training material, an online PM refresher training course is in preparation to keep PMs up-to-date on the new members, additional satellites, and updated Charter processes.

Although the Charter's mandate is limited to supplying satellite data quickly and at no cost, Charter members invest a significant amount of effort and resources in providing crisis mapping and damage assessment for most of the Charter activations.

6.4 Users' appraisal

It is essential for the Charter to gather feedback from end-users to understand the utility and to identify possible improvements of the Charter service. End-users feedbacks are gathered by the PM and included in the PM reports.

The end users are, in general, satisfied by the Charter's service and products that they exploited during the response phase.

Below, examples of comments from end-users:

- **Activation 475: Aircraft crash in Egypt** *"All Charter data were used to the full extent. VA maps were very useful for the End-user in monitoring the crash site and works planning. The Charter was activated in compliance with all related procedures and the collaboration was smooth."* **AU:** EMERCOM (Russia)
- **Activation 481: Flood in Argentina** *"Even though the affected areas were constantly changing, this did not cause any trouble in imagery acquisition and product elaboration. The selection of sensors was precise and generated products exceeded the expected requirement levels. Very good communication was held, although the flood was over the Christmas period."* **AU:** SIFEM/DNPC (Argentina)

However, a few AUs have remarked that the EO crisis products were too coarse to observe and estimate damages (e.g. in case of flash floods). Such cases could be limited by a better filtering of requests to avoid Charter activation for events that are not major or for events which cannot be efficiently assessed by satellite imagery. Moreover, some AUs noted that the products are of good quality but delivered too late to be used as direct support to relief operations. In a few cases, some data were not used due to cloud coverage or resolution not adequate for damage assessment (e.g. landslides in narrow valleys).

Examples of recurrent users' recommendations reported by the PMs are:

- A better understanding of available resources, acquisition times and its compatibilities to each disaster type would reduce the waste of efforts, handle expectations and provide a better scenario for future activations.
- The availability of quicklooks of the received data would help the PM/VA to save time of downloading useless data.
- A single FTP gathering all satellite data would be very convenient.
- The PM report can be restructured to be simpler and more convenient.

It should be noted that there is an increase in AUs and end users able to perform EO analysis and GIS processing themselves and, in some cases, the PMs/VA organizations already provides GIS

layers to the end-users.

Several AU trainings were held, via teleconference, using digital URF of COS-2, by ES members (ESA, CNES and DLR), with the goal of providing the relevant authorities with the necessary information and exercises to use the International Charter 'Space and Major Disasters' in the event of a natural or man-made disaster in the region:

- ESA members (6): Belgium, Spain, Switzerland, Hungary, Finland [2], Norway
- Geoscience Australia Australia (ESA)
- COGIC (France – CNES)
- GMLZ (Germany – DLR)

Efforts to increase awareness of stakeholders went on with the participation of Charter members at international conferences and meetings. UNOOSA/UN-SPIDER also supported the Charter to promote UA, contacting disaster management authorities in Latin America.

6.5 Communication assessment

The improved version of the website facilitates the user navigation and information search.

Several channels were used to ensure more comprehensive communication to Charter users, stakeholders and the general public:

- The publication and distribution of newsletters.
- The Charter Twitter account. All Charter activations and news are distributed via tweets. 3160 followers were counted by end of 2015 (many more will actually be reached due to re-tweets of Charter messages, e.g. through Charter agency twitter accounts).
- Charter articles published on Wikipedia in several languages (e.g. English, French, German)
- Participation in international/regional events all over the world to promote the Charter and the Universal Access (UA) initiative.
  - The issue and distribution of a scribble video (http://www.esa.int/spaceinvideos/Videos/2015/10/Saving_lives_when_disasters_strike) for the 15th Anniversary of the Charter and a special publication untitled "International Charter Space and Major Disasters, a journey of 15 years (2000-2015)".

The Charter movie, flyer and brochure in English and French are distributed and used regularly at conferences and workshops both nationally and internationally.

7 Conclusions

In 2015, the following agencies took the lead function which rotates among Charter members on a six-month basis: the Korean Aerospace Research Institute, KARI, until the middle of April, the Indian Space Research Organisation, ISRO from April to mid-October, and the United States Geological Survey, USGS from mid-October to April 2016. With the beginning of the leadership periods, the members of the Charter Board and the Executive Secretariat came together to their bi-annual meetings in Hyderabad, India, in April 2015, and in Sioux Falls, USA, in October 2015.

Throughout the reporting period, there were 37 activations in 27 countries, a similar figure to the yearly 'average' between 2007 and 2015. In total, the Charter has been triggered for 480 disasters in 118 countries since 2000. The Charter was activated for a dam-collapse, for the first time: this accident in Brazil caused the death of 9 people, while thousands have been affected. For the second time an aircraft accident led to Charter activation: the crash of the Russian airliner in Egypt (224 deaths).

March and August were the months with the largest number of activations due to different types of disasters linked to meteorological events as well as solid earth movement.

Three Charter activations were among the 10 most severe natural disasters in 2015 as registered by EM-DAT. The Nepal earthquake has been recorded as the deadliest event in 2015, killing nearly 9,000 people and the third most severe natural catastrophe since 2009 by number of fatalities. Apart from this event, 2015 was evaluated as a moderate year concerning the impact of natural disaster events in terms of fatalities and damages. A total of 23,000 people lost their lives globally.

The Charter Board has accepted the Bolivarian Agency for Space Activities (ABAE) of Venezuela as a new member and their integration will be completed in 2016.

Universal Access (UA) is gradually progressing. UA allows disaster risk management organizations worldwide to be granted Authorized User (AU) status. Chile, Pakistan, Colombia, Bolivia and the Dominican Republic have had their national users granted Charter access in 2015. Other candidates are under assessment or training. 48 countries and the EC have dedicated AUs reaching the total of 56 user organizations able to directly request Charter activations by the end of 2015. Charter members have continued to promote UA and the Charter as a whole through their participation in different international events held in 2015. Among several promotional activities, the promotion performed by UNOOSA/UN-SPIDER and CONAE in Latin America was especially successful and is highly appreciated by the Charter.

The Charter also started collaboration with the CEOS Working Group on Disasters to allow CEOS Pilot teams to access Charter data in order to support their research, once an activation is closed.

The new web-based Charter Operational System (COS-2) is operational since the beginning of March 2015. Overall, it has been used successfully in all Charter calls. In particular, the COS-2 system automates many steps in the Charter workflow, aiming to increase the activation performance (timeliness, best usage of resources). In the future, it will generate helpful statistics to support Charter reporting.

Three Project Manager training sessions were organized by DLR, CNES, USGS and UKSA/DMCii to strengthen the network of Charter PMs. An on-line refresher training course is also in preparation.

An improved version of the Charter website was released in 2015. Its design and layout facilitate the user navigation and information search (https://www.disasterscharter.org/web/guest/home). In addition, it allows direct access to COS-2 to authorized staff. Two Charter newsletters were issued in 2015. Twitter is also used as a tool to increase visibility of the Charter activations and other relevant news and raising public awareness on the Charter.