

International Charter Space & Major Disasters



Annual Report 2016

CONTENTS

1	INTRODUCTION.....	5
1.1	PURPOSE AND SCOPE OF THIS DOCUMENT	5
1.2	STRUCTURE OF THE REPORT	5
1.3	APPLICABLE DOCUMENTS.....	5
1.4	LIST OF ACRONYMS	6
1.5	AUTHORS OF THE REPORT.....	7
2	THE INTERNATIONAL CHARTER SPACE AND MAJOR DISASTERS	8
2.1	OVERVIEW	8
2.2	LEAD AGENCIES OF THE CHARTER IN 2016	12
3	CHARTER OPERATIONS	14
3.1	CHARTER ACTIVATIONS	14
3.1.1	<i>Monthly activations</i>	18
3.1.2	<i>Geographical distribution</i>	20
3.2	RESOURCE REPORT	27
3.2.1	<i>EO data consumption in 2016</i>	27
3.2.2	<i>Human resource contribution (ECO and PM) in 2016</i>	34
3.3	SARE – SEMI ANNUAL REFRESHER EXERCISES	38
3.4	PROJECT MANAGER TRAINING.....	38
3.5	THE CHARTER OPERATIONAL TOOLS.....	39
4	EXTERNAL RELATIONS.....	40
4.1	NEW MEMBERS ACCESSION	40
4.2	UNIVERSAL ACCESS	40
4.3	COOPERATING BODIES & CHARTER USER INTERMEDIARIES.....	42
4.3.1	<i>Collaboration with UNOOSA and UNITAR/UNOSAT</i>	42
4.3.2	<i>Cooperation with Sentinel Asia</i>	43
4.4	COOPERATION WITH OTHER PROGRAMMES AND INITIATIVES.....	44
4.4.1	<i>Collaboration between European members of the Charter and the European Union Copernicus programme</i>	44
4.4.2	<i>Collaboration with CEOS Working Group on disasters</i>	45
5	COMMUNICATION.....	46
5.1	WEB SITE	46
5.2	CHARTER NEWSLETTERS.....	48
5.3	CONFERENCES AND PRESENTATIONS	49
5.4	PRESS RELEASES, ARTICLES.....	50
6	ASSESSMENT OF THE CHARTER OPERATIONS.....	51
6.1	OVERALL IMPACT	51
6.2	SYSTEM PERFORMANCES ASSESSMENT	57
6.3	ASSESSMENT OF PRODUCTS & SERVICES	59
6.4	USERS' APPRAISAL	60
6.5	COMMUNICATION ASSESSMENT	62
7	CONCLUSIONS	63

1 Introduction

1.1 Purpose and scope of this document

This document describes the 2016 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 - Conclusion; 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 Centre)
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	Oficina Nacional de Emergencia del Ministerio del Interior (Chile)
PA	Partner Agency
PDC	Pacific Disaster Center (Hawaii, 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 and Theodora Papadopoulou) based on contributions by all the Charter members.

2 The International Charter Space and Major Disasters

2.1 Overview

The Charter is an international collaboration amongst space agencies and space operators – the Charter members. Initiated by the European Space Agency (ESA), the French Space Agency (CNES) and the Canadian Space Agency (CSA) in 2000, 13 other space agencies joined between 2000 and 2016, 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 Centre, 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
- Bolivarian Agency for Space Activities, ABAE

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 517 disasters (as of the end of 2016), in 119 countries, since its inception in 2000. In 2016 alone, the Charter was activated 36 times for disasters in 24 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 2016, active satellites included (Table 2-1):

- Radar (high resolution and very high-resolution sensors): Riasat-1, RADARSAT-2, TerraSAR-X, TanDEM-X, Sentinel-1A/B, ALOS-2 and KOMPSAT-5.
- Optical (high resolution and very high-resolution sensors): UK-DMC 2, Landsat 7 and 8, VRSS-1, SPOT-6, SPOT-7, PLEIADES 1A and 1B, PROBA-V, SJ-9A, GF-1, GF-2, FY-3C, CBERS-4, KOMPSAT-2, KOMPSAT-3, IRS-P5 (Cartosat-1), Cartosat-2, Resourcesat-2, Resourcesat-2a, Oceansat-2, RapidEye, Kanopus-V, Resurs-P, Resurs-DK, Suomi NPP and Sentinel-2A.
- Optical (medium and low-resolution sensors): POES, GOES, Metop series, Meteosat first and second generation and Meteor-M.

In 2016:

- Sentinel-2A¹ was launched by ESA on 23rd June 2015. After the calibration and validation phase and since early 2016, the satellite was added to the Charter constellation. Sentinel-2B was launched in March 2017 and will also be made available to the charter within early 2018.
- Resurs-P3 satellite of the Resurs-P constellation was launched in March 2016 and later was integrated in the Charter constellation. First data were provided to the Charter in August 2016 for the flood in Sudan.
- KOMPSAT-5 was launched in August 2013, but was added to the Charter constellation in July 2016.
- VRSS-1 was added to the Charter constellation after ABAE's accession to the Charter in August 2016.

Specific agreements with other entities allow the Charter to access additional products (both high and very high resolution) from satellites such as, Formosat², GeoEye, IKONOS (decommissioned in March 2015), QuickBird, and WorldView.

¹ Operated by ESA in the frame of the European Union Copernicus Programme

² Archive images available up to August 2016.

Agency	Satellite (operational)	Agency	Satellite (operational)
ABAE	VRSS-1	ISRO	Oceansat-2
CNES	PLEIADES 1A & 1B		Resourcesat-2
	SPOT-6, SPOT-7		Resourcesat-2a
CSA	RADARSAT-2		Cartosat-1 (IRS P5)
CNSA	GF-1		Cartosat-2
	GF-2, SJ-9A, FY-3C		
	TerraSAR-X / TanDEM-X		
DLR	RapidEye	JAXA	ALOS-2
		KARI	KOMPSAT-2
	KOMPSAT-3		
DMCii	UK-DMC2		KOMPSAT-5
	Deimos-1	NOAA	POES
	NigeriaSat-2		GOES
	NigeriaSat-X		Suomi NPP
ESA	Sentinel-1A/B*	ROSCOSMOS	Kanopus-V
	Sentinel-2A*		Meteor-M
	PROBA-V		Resurs-P, Resurs-DK
EUMETSAT	Metop Series Meteosat MSG & MFG	USGS	Landsat 7 and 8
INPE	CBERS-4		WorldView
			GeoEye-1

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

Archived data from no-longer active 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 and FORMOSAT-2**) remain available for use in Charter activations (Table 2-2).

Agency	Satellite (archive only)
CNES	SPOT-5
	FORMOSAT-2**
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 2016

During this period, the lead agencies on a bi-annual rotational basis have been the United States Geological Survey, USGS (October 2015 – April 2016), the Comisión Nacional de Actividades Espaciales, CONAE (April 2016 – October 2016), and Russian Federal Space Agency, ROSCOSMOS (October 2016 – April 2017).



Figure 2-1. 35th Charter Board and Executive Secretariat members in Cordoba, Argentina, April 2016.



Figure 2-2. 36th Charter Board representatives from ROSCOSMOS, ABAE and ESA (during the official signature of ABAE as a new Charter member) in Moscow, Russia, October 2016.

3 Charter operations

3.1 Charter activations

In 2016, the Charter was activated 36 times, covering disasters in 24 countries (36 natural disasters).

The Charter was triggered for the major earthquake in Ecuador on 16th April 2016 and for Hurricane Matthew in Haiti, Cuba, Dominican Republic, the Bahamas and USA (in total 5 activations) in early October 2016. Besides USA, France and UN, several other Charter AUs and end users e.g. Comisión Nacional de Emergencias (CNE), US Southern Command, United Nations Office for the Coordination of Humanitarian Affairs (UNOCHA), United Nations Development Programme (UNDP), Pacific Disaster Center, Ministry of Housing and Environment - Bahamas Government and North Carolina Emergency Management) requested to receive the Charter products in order to assist their aid teams send to the affected areas. Moreover, several organizations provided value-added products (e.g. UNITAR/UNOSAT, SERTIT, ITHACA, Pacific Disaster Center, DLR/ZKI, EIGEO, GAF AG and Russian Space Systems - RSS). The International Charter has provided to the end-users, situational maps, flood extent maps and damage assessment maps: e.g. destruction impacts on structures (houses, buildings, roads, bridges, etc.).

Since 2007, the annual number of activations has oscillated between 32 and 51. The Charter has effectively managed about 40 activations per year thanks to its distributed operational capacities and human resources (Figure 3-1).

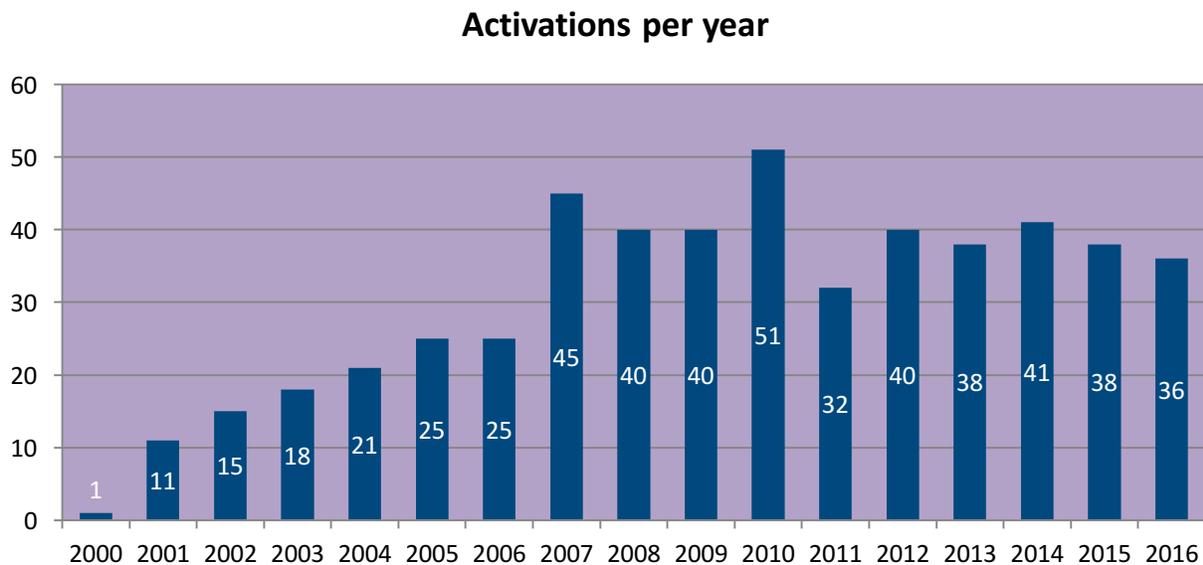


Figure 3-1. Number of Charter activations per year (2000 - 2016)

By the end of 2016, the Charter had been triggered for 517 disasters in 119 countries since 2000 (Figure 3-2 a, b).

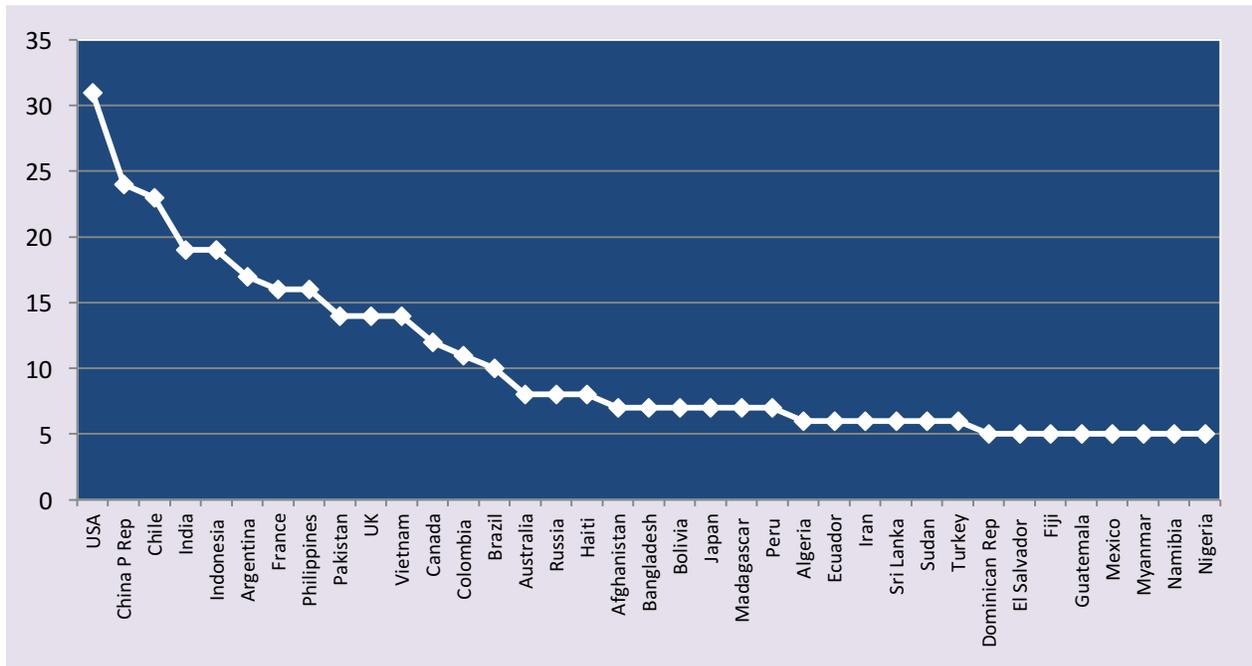


Figure 3-2 a) 2000-2016 breakdown of Charter activations by country

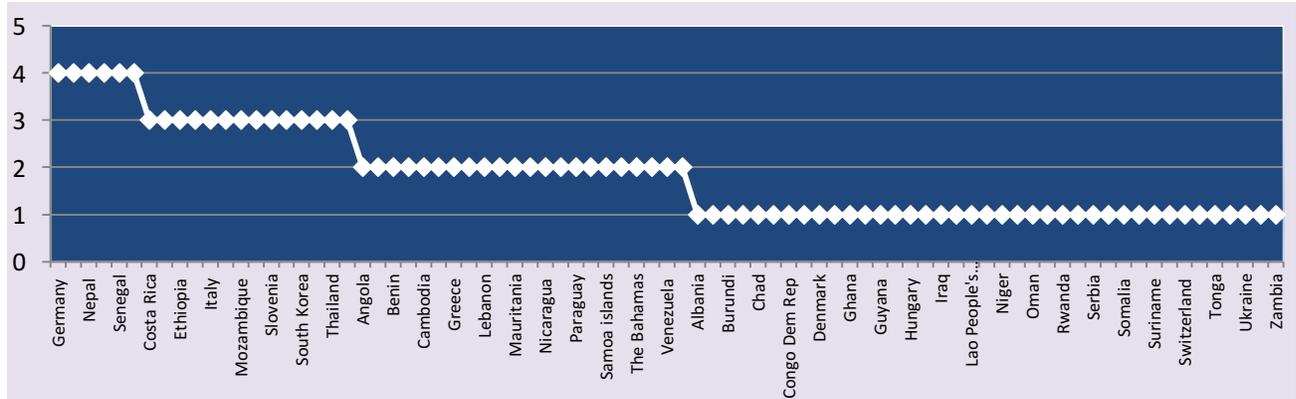


Figure 3-2 b) Continuation of Figure 3-2 a) 2000-2016 breakdown of Charter activations by country

119 Countries around the world have benefited from the International Charter since 2000. USA, China, Chile, France, Indonesia, India, Indonesia, Argentina, France, Philippines, Pakistan, UK, Vietnam, Canada, Colombia and Brazil are the hazard affected countries for which the Charter was activated most often (>10) to cover major disaster events during these 16 years, but 70 % of countries requested less often the Charter (1 to 4 activations in 16 years).

All 2016 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, 42 requests were received in 2016:

Five calls were merged in two activations for requests made for the same disaster events:

- Calls 581, 582 and 583 were requested for Hurricane Matthew in Haiti by USGS, COGIC and UNITAR/UNOSAT.
- Calls 559 and 560 were requested for flood in USA by USGS on behalf of the Federal Emergency Management Agency (FEMA) and the Department of Emergency Management of the State of Texas.

Three calls were denied in 2016 but some of them were rapidly withdrawn by the caller:

- Call 556 for earthquake in Taiwan (Province of China): the call was received by a non-Authorized User, namely National Applied Research Laboratories Taiwan. The call was resubmitted (call 557) by ADRC.
- Call 588 for flood in Panama: the call was received by a non-Authorized User (CATHALAC). The call was resubmitted (call 589) by USGS.
- Call 592 for wildfire in Israel: the call was received by ROSCOSMOS instead of EMERCOM who is the Russian Authorized User. The call was resubmitted (call 593) by EMERCOM.

Activation Number	Disaster type	Country	Activation date
482	Flood	USA	2016-01-03
483	Earthquake	China P Rep	2016-02-06
484	Ocean Storm	Fiji	2016-02-19
485	Flood	USA	2016-03-11
486	Flood	Argentina	2016-04-07
487	Earthquake	Japan	2016-04-14
488	Flood	Iran	2016-04-15
489	Earthquake	Ecuador	2016-04-17
490	Wildfire	Panama	2016-04-17
491	Ocean storm	Seychelles	2016-04-19
492	Fire	Canada	2016-05-04
493	Flood	Sri Lanka	2016-05-17
494	Volcano	Indonesia	2016-05-23
495	Ocean Storm	Bangladesh	2016-05-25
496	Flood	USA	2016-05-31
497	Flood	China P Rep	2016-06-21
498	Wind Storm	China P Rep	2016-06-24
499	Wildfire	Russia	2016-07-02
500	Flood	Bangladesh	2016-08-01
501	Flood	Sudan	2016-08-09
502	Flood	USA	2016-08-14
503	Flood	India	2016-08-27
504	Flood	Indonesia	2016-09-24
505	Flood	Australia	2016-09-26
506	Ocean Storm	Haiti	2016-10-03
507	Flood	Dominican Rep	2016-10-05
508	Ocean Storm	Cuba	2016-10-05
509	Ocean Storm	The Bahamas	2016-10-06
510	Ocean Storm	USA	2016-10-06
511	Flood	Panama	2016-10-20
512	Ocean Storm	Philippines	2016-10-24
513	Flood	Panama	2016-11-21
514	Wildfire	Israel	2016-11-24
515	Flood	Costa Rica	2016-11-28
516	Earthquake	Indonesia	2016-12-07
517	Ocean Storm	India	2016-12-12

Table 3-1. List of 2016 Activations

3.1.1 Monthly activations

During 2016, the monthly average of activations was 3. Figure 3-3 shows the monthly distribution of activations throughout 2016. The highest number of activations occurred in April, May, and October corresponding to 50% of the total number. The remaining months of 2016 saw a number of activations that varied from 1 to 4.

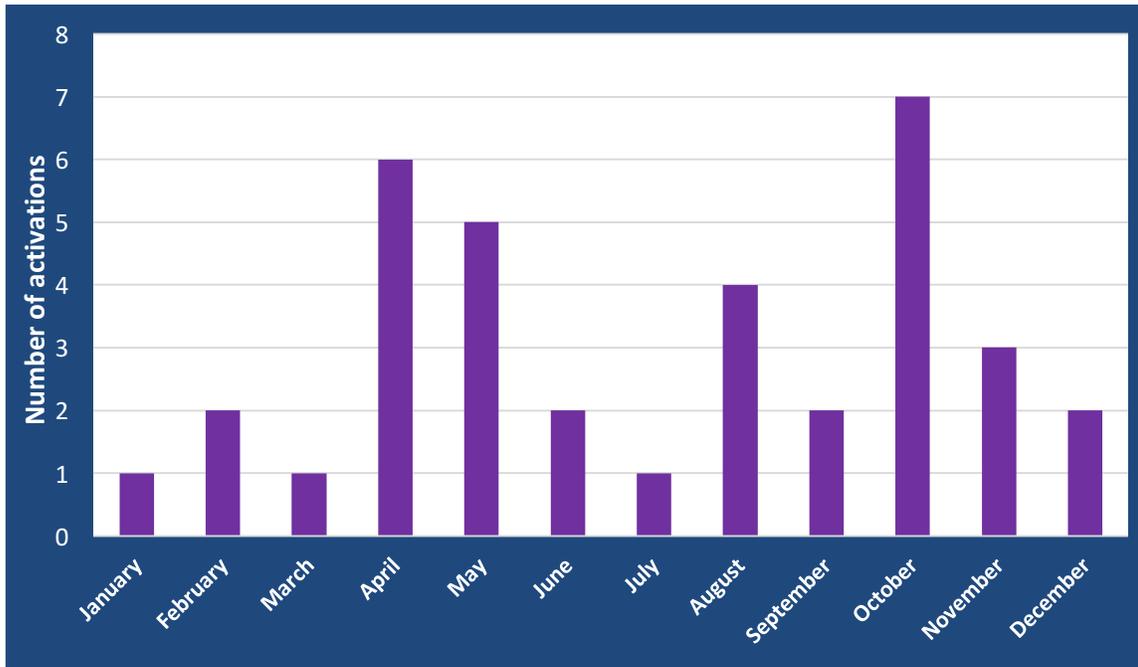


Figure 3-3. Distribution of the Charter activations by month in 2016

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 April 2016 was due to different types of disasters linked to meteorological events (floods in Asia and South America, ocean storm in Africa and a fire in Central America) as well as solid earth movement (earthquakes in Asia and South America). Peaks of activations in October 2016 are linked to meteorological events and in particular, the Charter was activated 6 times for ocean storms and floods in Central America, 5 of them being related to Hurricane Matthew and 1 time in Asia (ocean storm).

In order to find an overall trend through the years, the following diagram shows the number of activations per month for year 2016 in comparison to the monthly average number of activations for the period 2007-2016. The 2007-2016 diagram clearly shows the peak of activations at the end of summer and in early autumn while February is the second time-period showing a regular peak of activities. 2016 curve follows the 2007-2016 average curve and in particular, it has a great impact on it with the highest number of activations being in April, May and October.

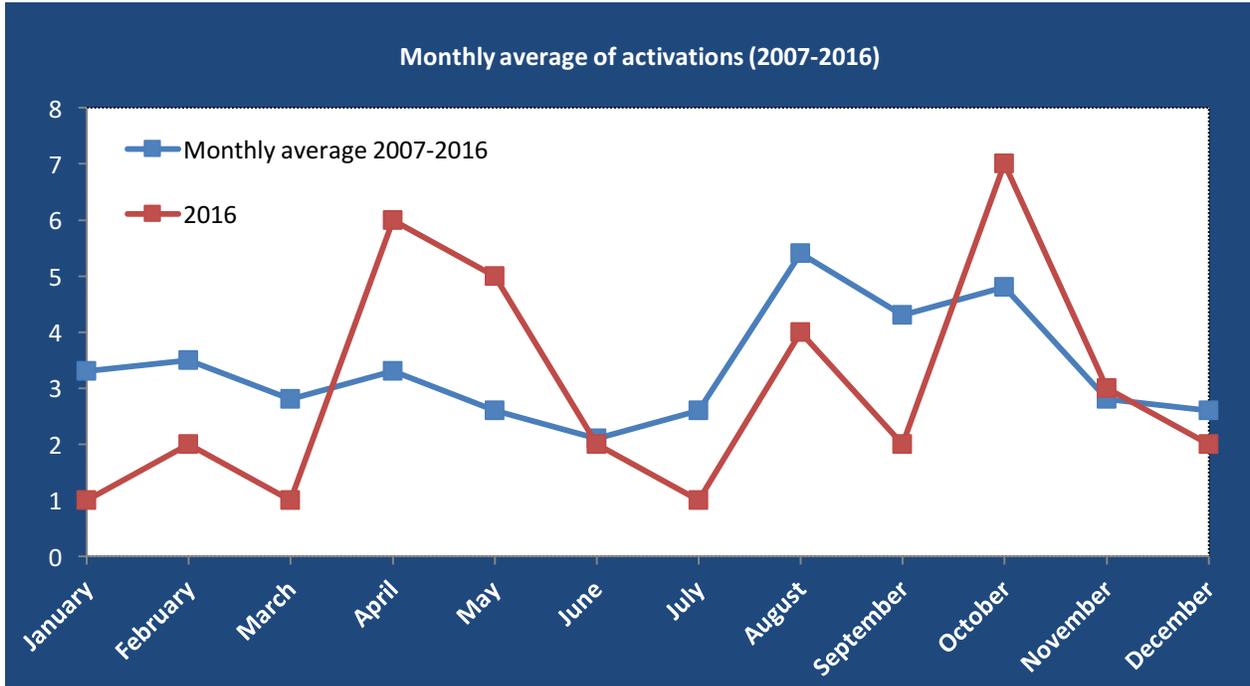


Figure 3-4. Number of 2016 activations per month (in comparison to the average number of activations) for the period 2007-2016

3.1.2 Geographical distribution

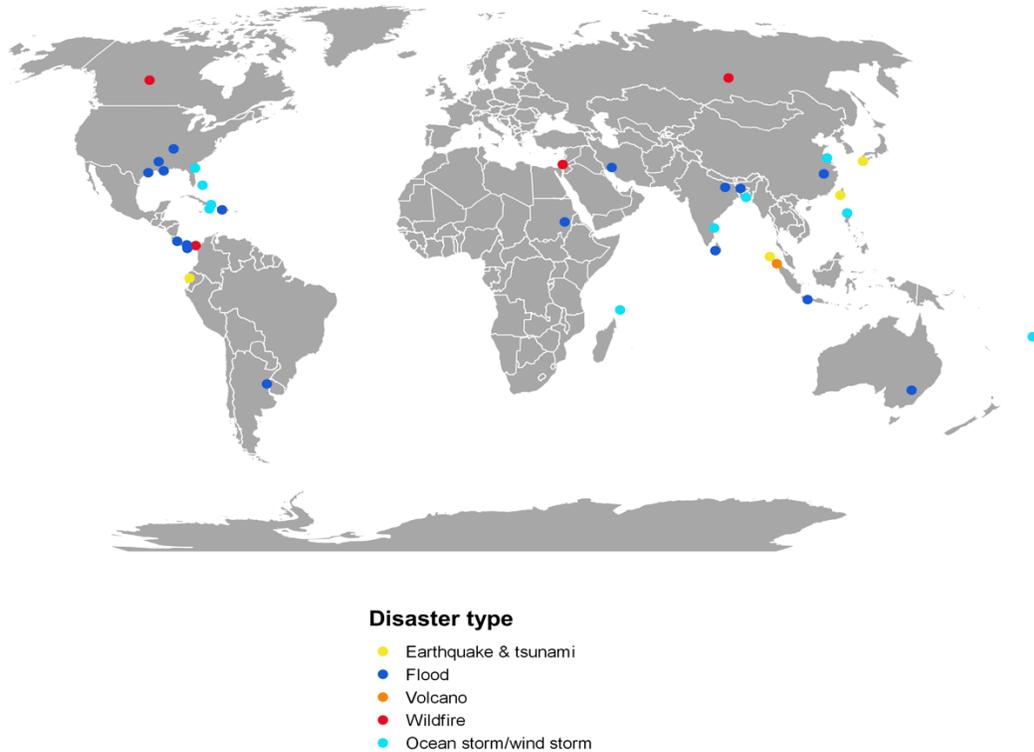


Figure 3-5. Location of the 2016 activations (by hazard type)

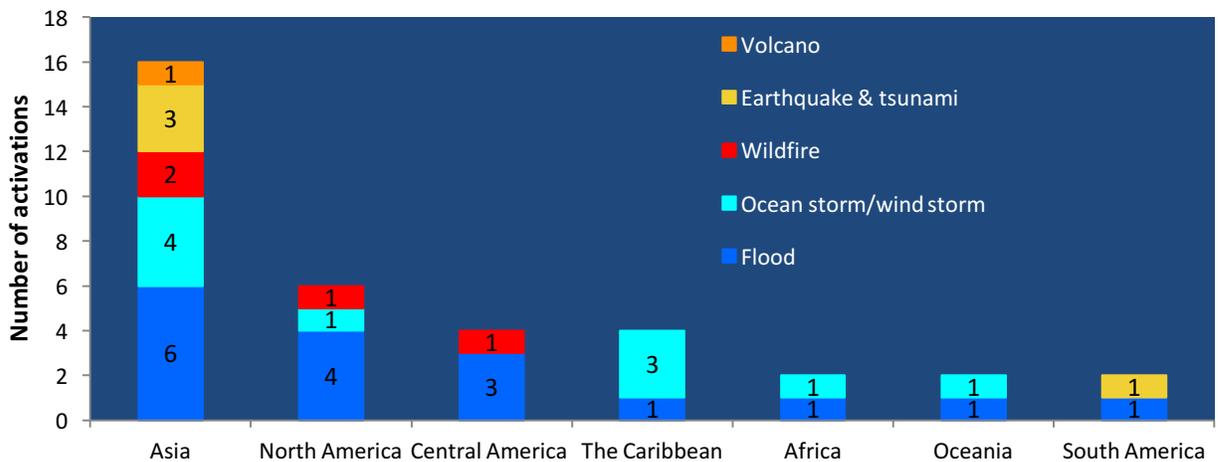


Figure 3-6. 2016 Number of activations by continent/subcontinent and hazard type

In 2016, 16 in Asia; 6 in North America; 4 in Central America and 4 in the Caribbean; 2 in Africa, 2 in Oceania and 2 in South America (Figures 3-5 & 3-6) with the most frequent hazard types being floods (47%) and ocean storms (28%) while solid earth-related hazards represented 14% and wildfires 11% 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. For example, while the Charter has been activated 5 times for Hurricane Matthew in Central and North America, 4 activations were for ocean/wind storm and 1 for flood (in Dominican Republic).

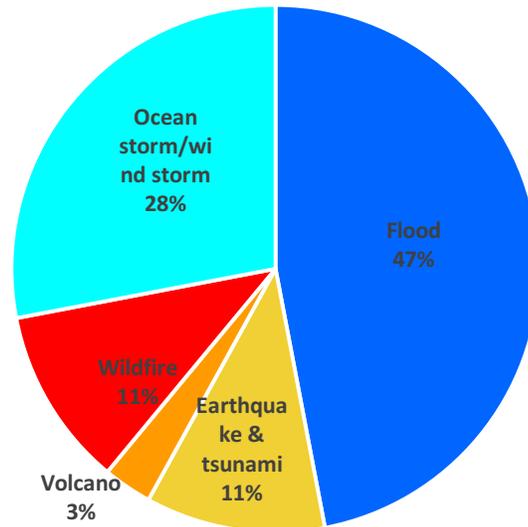


Figure 3-7. 2016 Number of activations by hazard type

As shown below (Figure 3-8), since 2000 the Charter has been frequently activated for weather-related disasters such as flooding, ocean and wind storms, landslides triggered by heavy rainfall or floods, ice/snow hazard – representing 72% 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 2000-2016 period.

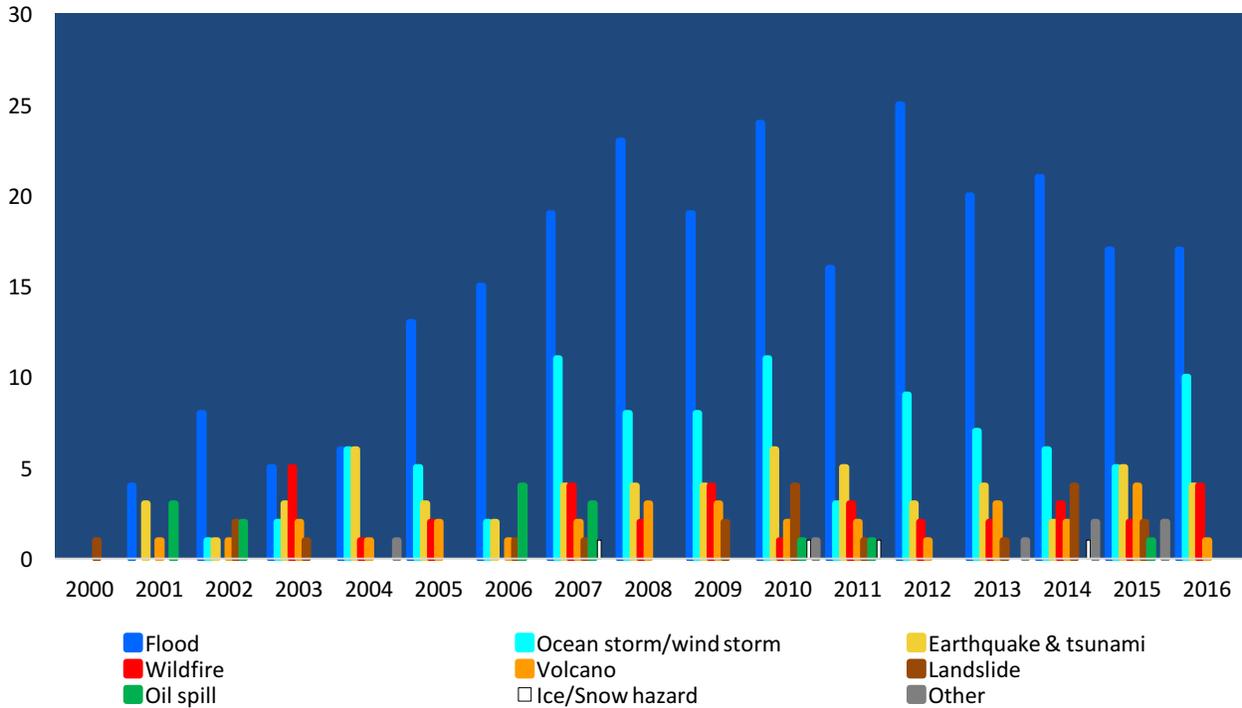


Figure 3-8. 2000-2016 Distribution of activations by hazard type

The following map shows by country the number of Charter activations caused by hydro-meteorological related events for the period of 2000-2016 (370 activations out of 517 activations in total = 72 %).

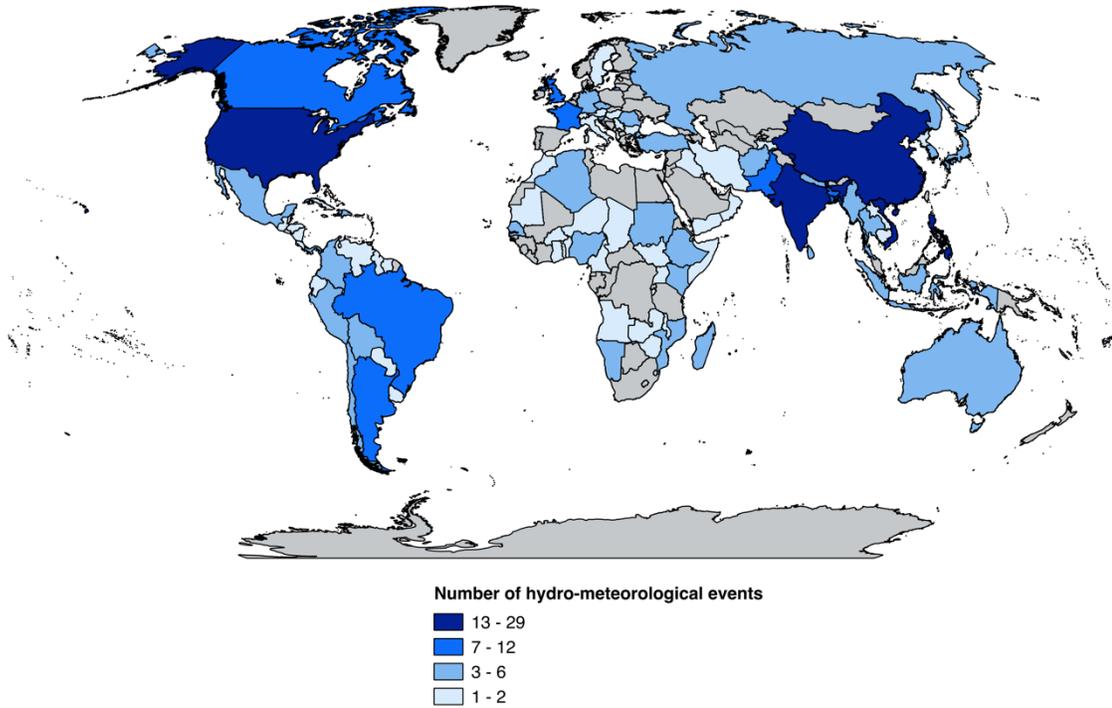
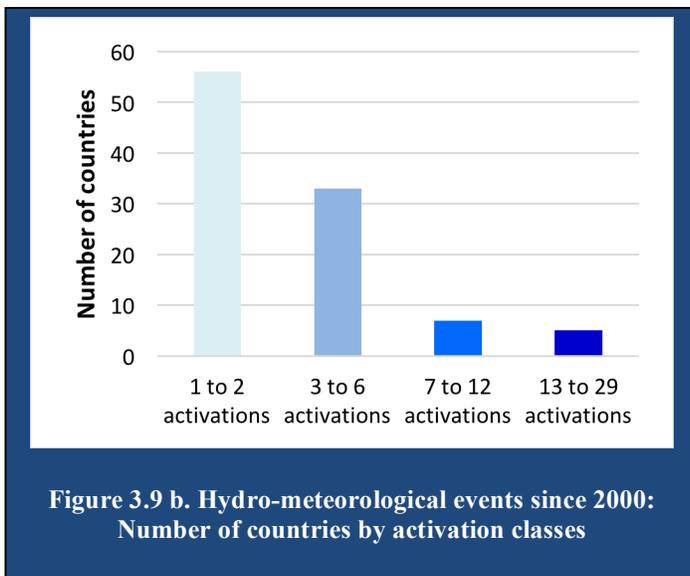


Figure 3-9 a. 2000-2016. Geographical distribution of Charter activations caused by hydro-meteorological related events (flood, ocean storm, wind storm, landslide caused by heavy rains, wildfire and, snowfall and ice jam).



In total 101 countries benefited of the Charter service for hydro-meteorological related events since 2000. USA, China, India, Philippines and Vietnam used the service most frequently (Figure 3.9 b).

The following map shows by country the number of Charter activations (90 activations out of 517 activations in total = 17 %) caused by solid-earth related events for the period 2000-2016.

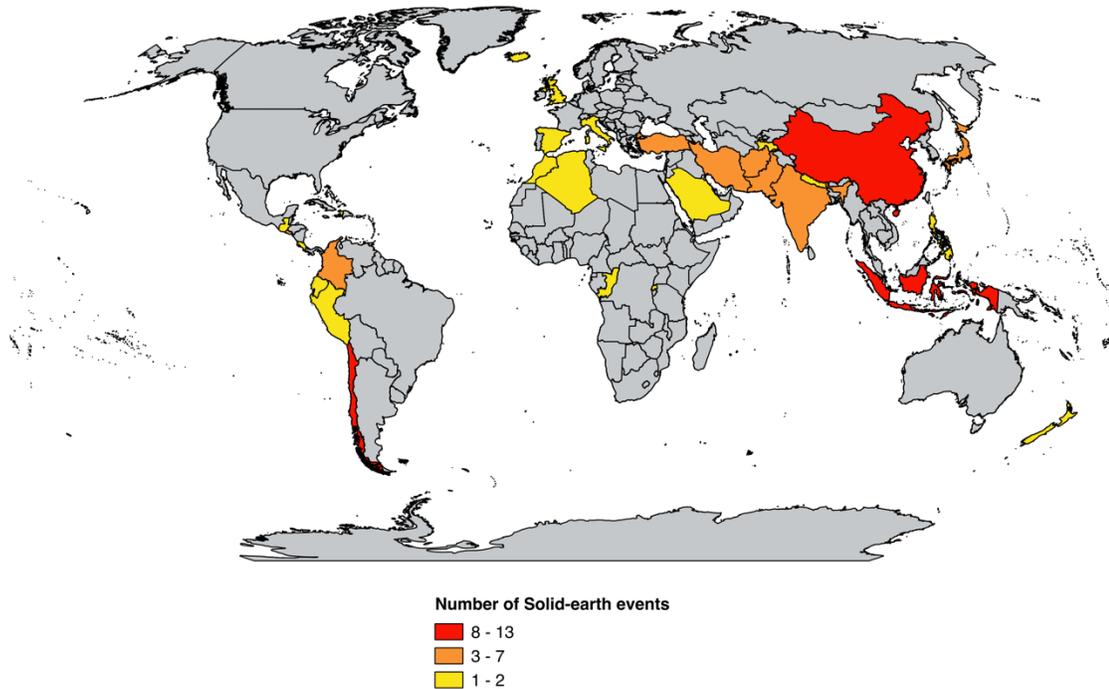
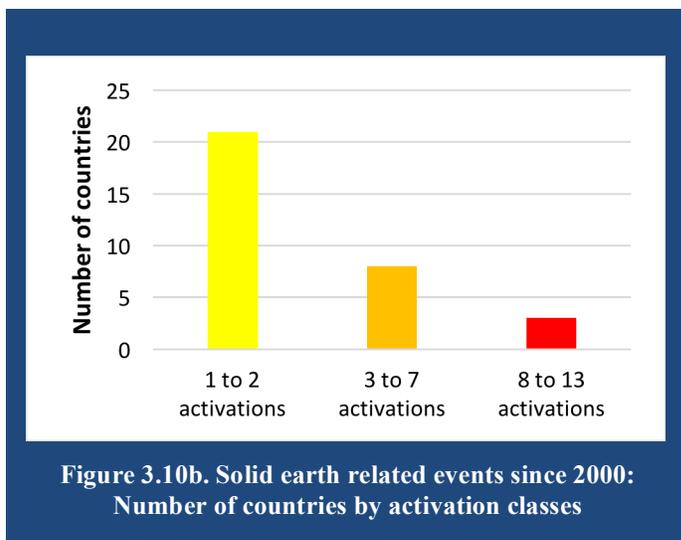


Fig 3-10a. 2000-2016 Geographical distribution of Charter activations caused by solid earth related events (earthquake, tsunami, volcanic eruption, landslide caused by earthquake, subsidence)



In total 32 countries benefited from the Charter service for solid-earth events since 2000. Interesting to note that Chile, China and Indonesia are countries for which the Charter was activated frequently (8-13 activations) and they are located along important 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.

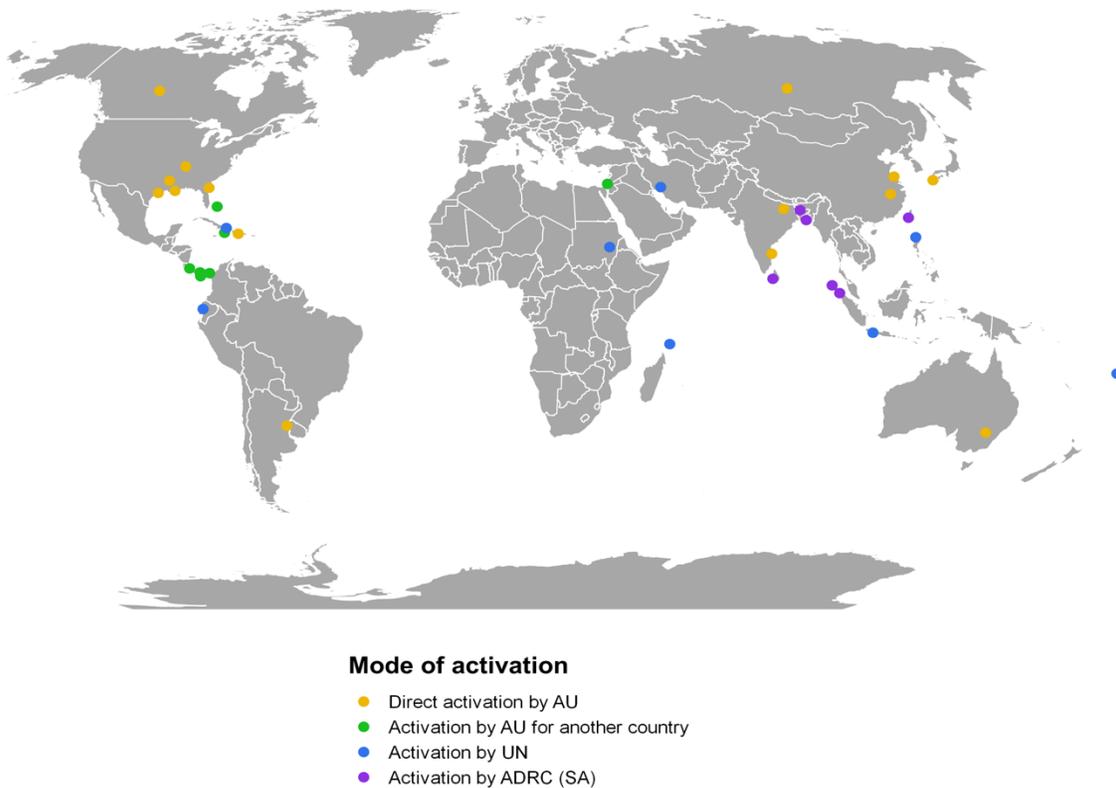


Figure 3-11. Location of the 2016 activations (per mode)

In 2016, mode 1 was used for disasters in Asia, South America, North America and Oceania; mode 2 was used for disasters in Central America and Middle East; Mode 3 was used for disasters in South and Central America, Africa, Asia, Middle-East and Oceania. By definition, mode 4 was used in Asia (Figures 3-11). Australia and Dominican Republic have activated the Charter for floods in September and October 2016, respectively, thanks to their AU status through the Universal Access initiative.

In 2016, activations by an AU (mode 1 & 2) were the main access modes (61.1% in total) while UN activations (mode 3) represented 22.22% of the total (Fig. 3-12).

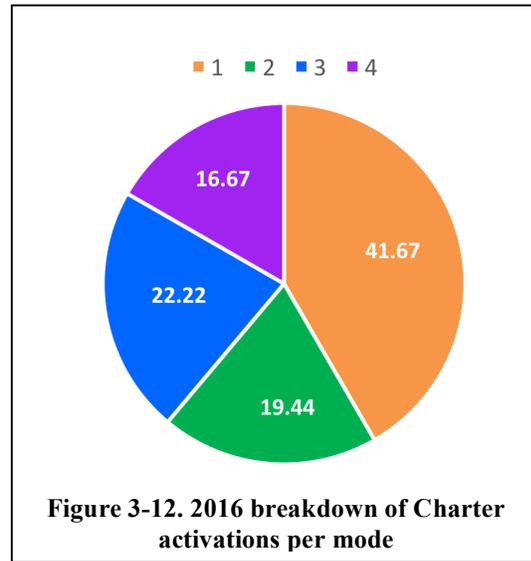


Figure 3-12. 2016 breakdown of Charter activations per mode

The diagram in Figure 3-13 compares the relative weight of the different access mechanisms adopted from 2001 to 2016, used to request the International Charter service. Since its inception, 93 countries without AUs have benefited from the Charter and 57% 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 2016, mandated organisations of 12 countries prone to natural disasters have become AUs after a registration and training process under the Charter’s Universal Access procedure.

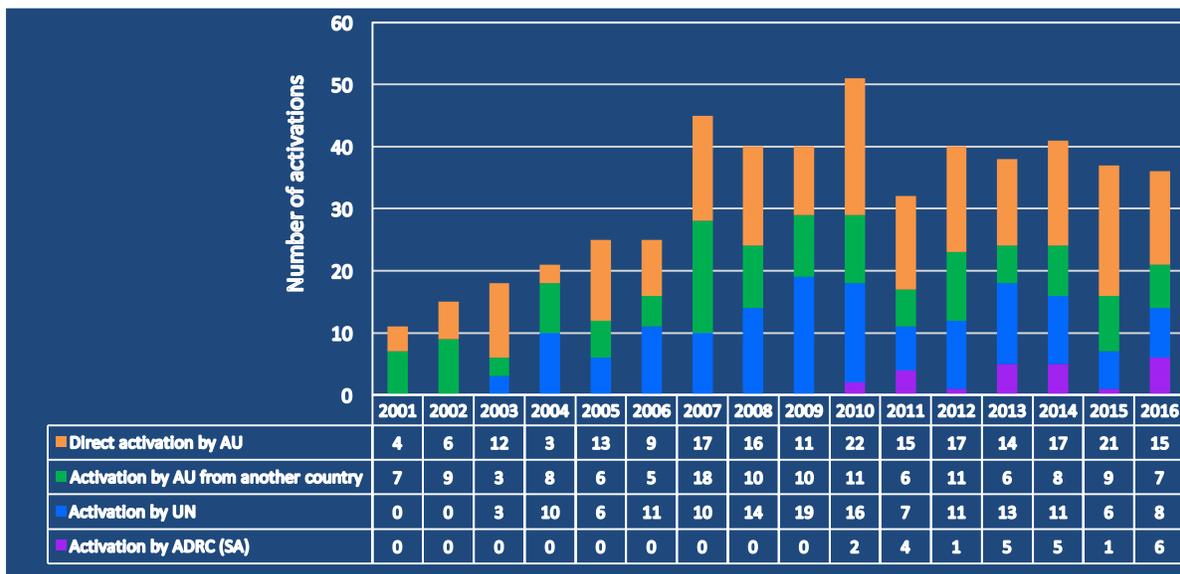


Figure 3-13. 2001-2016 number of Charter activations per mode

3.2 Resource report

3.2.1 EO data consumption in 2016

In 2016, a total of 2958 optical and radar data were provided by the Charter members (Figures 3-15 & 3-16, table 3-2 & table 3-3) with 2320 Optical images and 638 SAR images; this is complemented by 14430 images of US VHR optical satellites (GeoEye, IKONOS, QuickBird, WorldView1, 2 and 3) were supplied (Figure 3-17, table 3-4) for 36 activations in 24 countries. Figure 3-14 shows the total number of EO data from the Charter virtual constellation and the US VHR optical data provided in 2016 by disaster type. A high number of the US VHR data were delivered to support the floods that occurred in USA in January and August 2016 (23% and 13% of US VHR data, respectively).

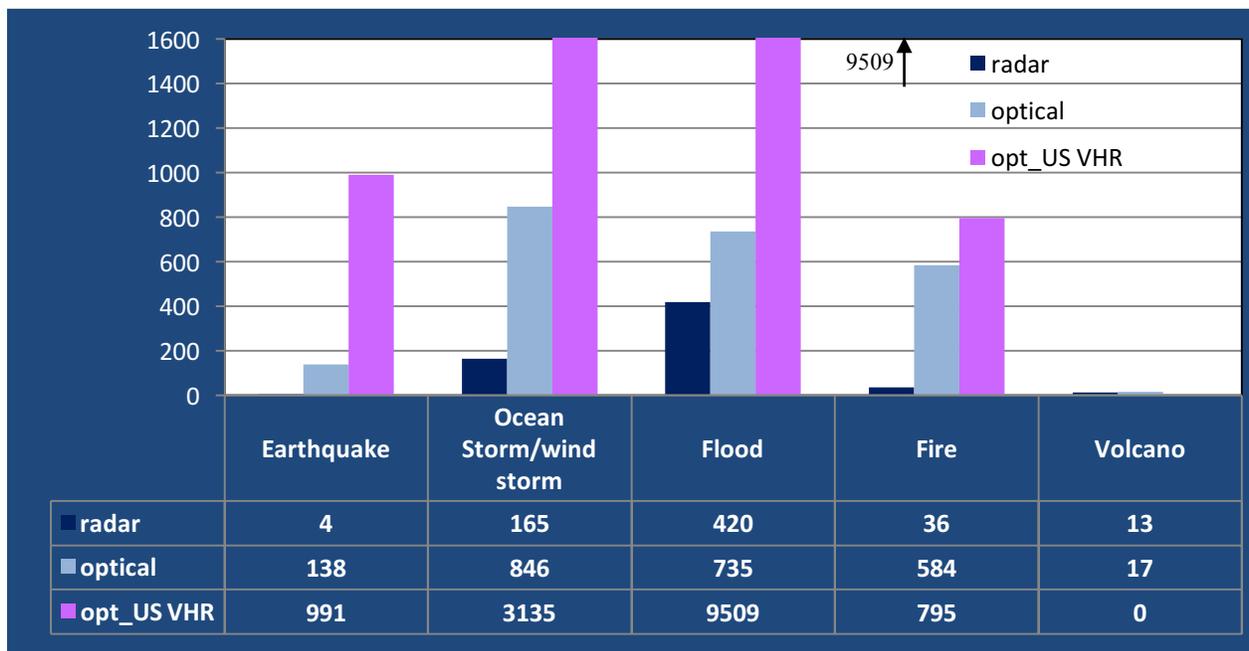


Figure 3-14. 2016 EO data of the Charter virtual constellation and US VHR optical data grouped by disaster type

Also, USGS provided also a number of EO data from the ISS (579 images), EO-1 (45 images), PLANET LABS (21 images), primarily for flood and ocean/wind storm events.

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.

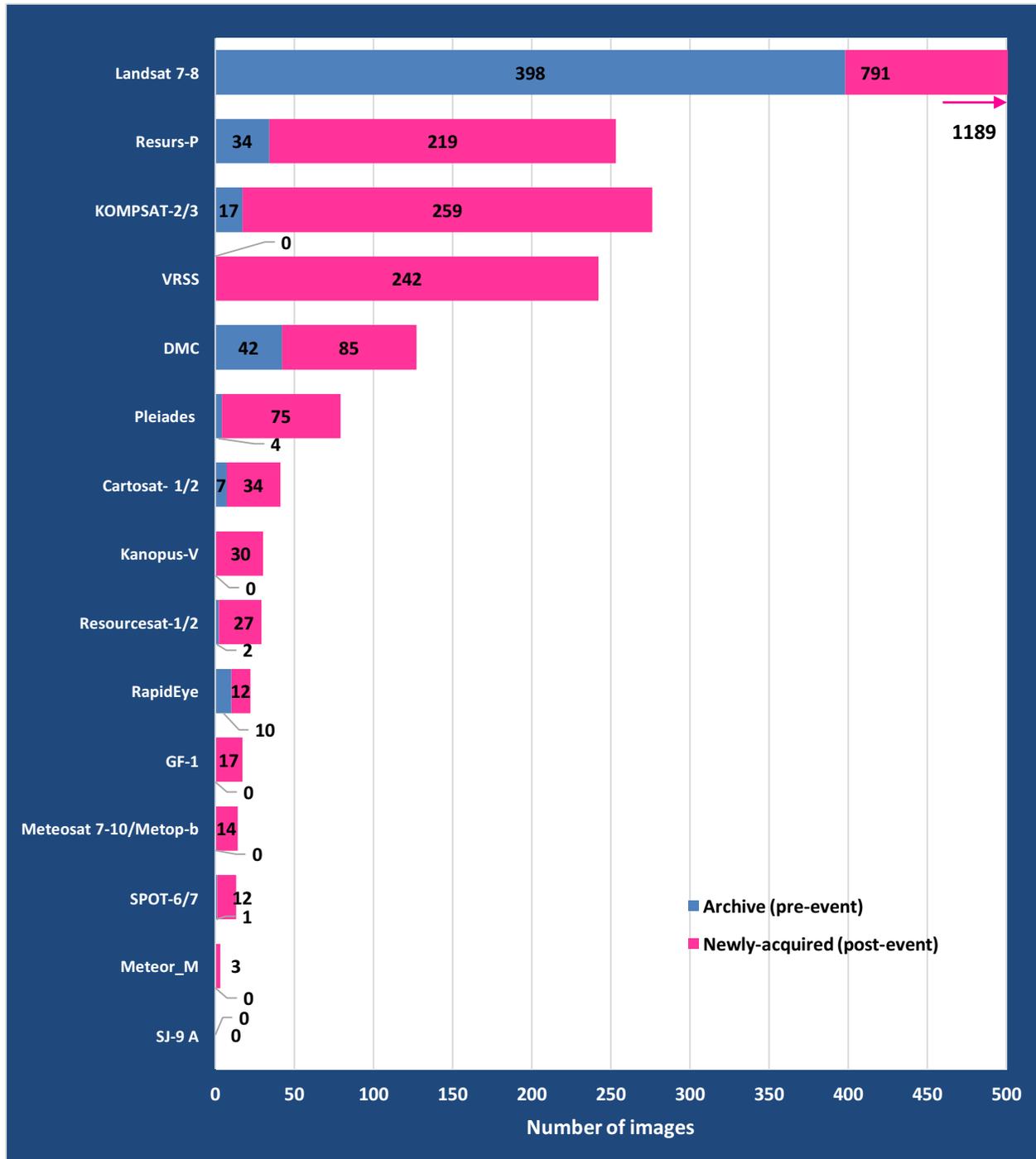


Figure 3-15. 2016 Data Consumption (archive and newly acquired) - Optical sensors

Resource	SJ-9 A	Meteor_M	SPOT-6/7	Meteosat 7-10/ Metop-b	GF-1	RapidEye	Resourcesat-1/2	Kanopus-V	Cartosat-1/2	Pleiades	DMC	VRSS-1	Resurs-P	KOMPSAT-2/3	Landsat 7-8
Total number of delivered data	0	3	13	14	17	22	29	30	41	79	127	242	253	276	1189
Archive (pre-event)	0	0	1	0	0	10	2	0	7	4	42	0	34	17	398
Newly-acquired (post-event)	0	3	12	14	17	12	27	30	34	75	85	242	219	259	791
<i>Max. number of images per activation</i>	<i>0</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>9</i>	<i>4</i>	<i>5</i>	<i>14</i>	<i>7</i>	<i>11</i>	<i>15</i>	<i>84</i>	<i>39</i>	<i>137</i>	<i>401</i>

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

Landsat data (7 and 8) represents an important optical resource with a total of 1,189 images. 33.7% of Landsat images were provided to support the activation for wildfire in Russia in July.

Contribution of the other optical sensors (low spatial resolution to high spatial resolution) varies from 3 to 276 images in total depending on the disaster type, spatial resolution and ground coverage of the images, etc. Sentinel-2A was launched in June 2015 and was integrated in the Charter constellation in 2016. The first Sentinel-2A images provided through the Charter supported the activation for flood in Australia in September. The same activation was also supported for the first time with VRSS-1 (newly-integrated to the Charter constellation, after ABAE's accession) images. KOMPSAT-2 and KOMPSAT-3 data contribution was significantly higher than last year (almost four times higher) providing 137 images for Hurricane Matthew in USA, in October. It is worth-noting that VRSS-1, Resurs-P and KOMPSAT-2/3 contributions are exceeded the 200 images. 34.7% of the contribution of the newly integrated to the Charter constellation satellite, VRSS-1, supported a flood in China in June. The contributions of SPOT-6/7, Meteosat-7-10 and Metop-b have increased from 6 images to 13 and 14 respectively in 2016. On the other hand, the contributions of GF-1, RapidEye, Resourcesat-2, Kanopus-V and Cartosat-1/2 are lower than those in year 2015. In particular, the number of GF-1 data provided is almost 3 times lower than last year.

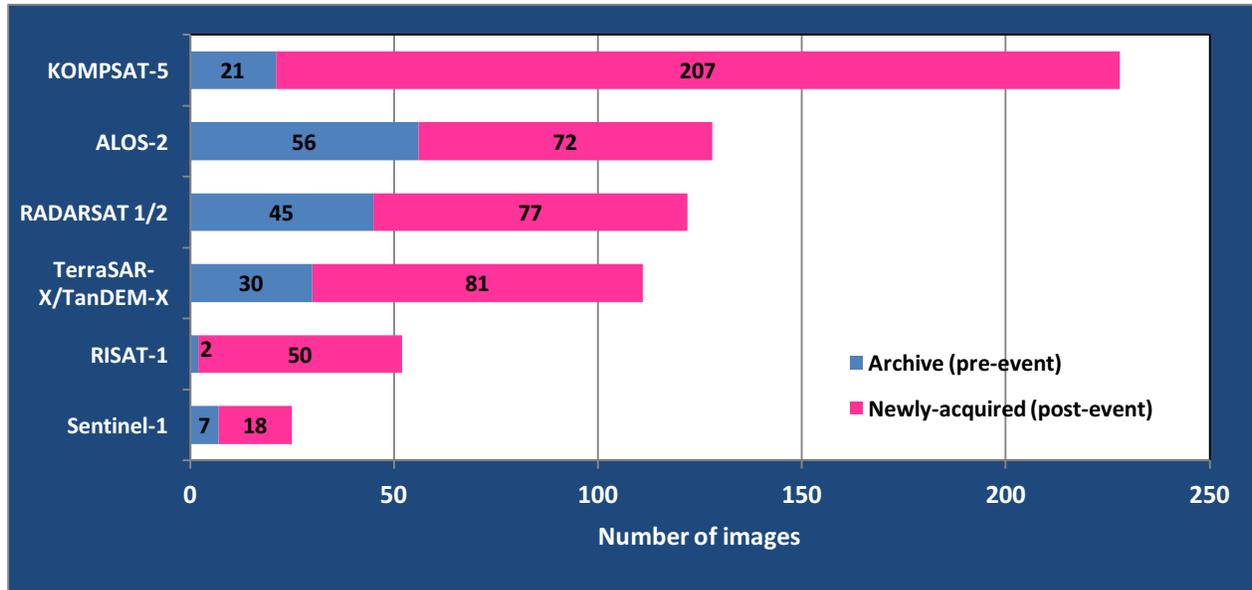


Figure 3-16. 2016 Data Consumption (archive and newly-acquired) - Radar sensors

KOMPSAT-5 was launched in August 2013 and was added to the Charter constellation in 2016. The first Charter delivery of KOMPSAT-5 data took place in August 2016 for the flood in Bangladesh following an activation request by Sentinel Asia (ADRC) on behalf of SPARSSO (Bangladesh Space Research and Remote Sensing Organization). The contribution of ALOS-2 data is almost three times higher than in 2015 (48 images), while the number of contributed Riset-1 images is quite lower than those of the year before (125 images). For Sentinel-1, TerraSAR-X/TandDEM-X and RADARSAT-2, the number of scenes delivered has slightly increased comparing to 2015.

65.8% 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.

Resource	Sentinel-1	RISAT-1	TerraSAR-X/ TanDEM-X	RADARSAT - 1/2	ALOS-2	KOMPSAT-5
Total number of delivered data	25	52	111	122	128	228
Archive (pre-event)	7	2	30	45	56	21
Newly-acquired (post-event)	18	50	81	77	72	207
<i>Max. number of images per activation</i>	5	9	11	8	25	49

Table 3-3. 2016 Statistics for Radar sensors

For EO satellite missions with open and free data policy (e.g. the Copernicus Sentinel-1, Sentinel-2), the exact number of used images cannot be traced, as data are fetched directly by the Charter Project Manager. The actual number of Sentinel-1 images accessed and used in 2016 is significantly higher than the number figuring in 3-16 (25 is the number of traceable images). ESA is developing a data-accounting system in order to trace the number of Sentinel images accessed. The accounting system will be in place in Q3 2018.

In total, 14430 images of US VHR optical satellites (GeoEye, IKONOS, QuickBird, WorldView-1, 2 and 3) were supplied in 2016. US VHR imagery was delivered to the Charter by the USGS using the HDDS system (Figure 3.17, table 3-4).

The WorldView-1/2/3 contributions are comparable to the ones in 2015 (10354). The contribution of QuickBird is inferior to last year (10 images) and there was no contribution from IKONOS data. The number of GeoEye data delivered is equivalent to 2015 (516). More than 31.7% of the GeoEye data provided were used to support the wildfire in Canada in May 2016 (167 images) and 38.51% of the WorldView data provided were used to support floods in USA in January and August 2016 (3582 and 1769 images, respectively).

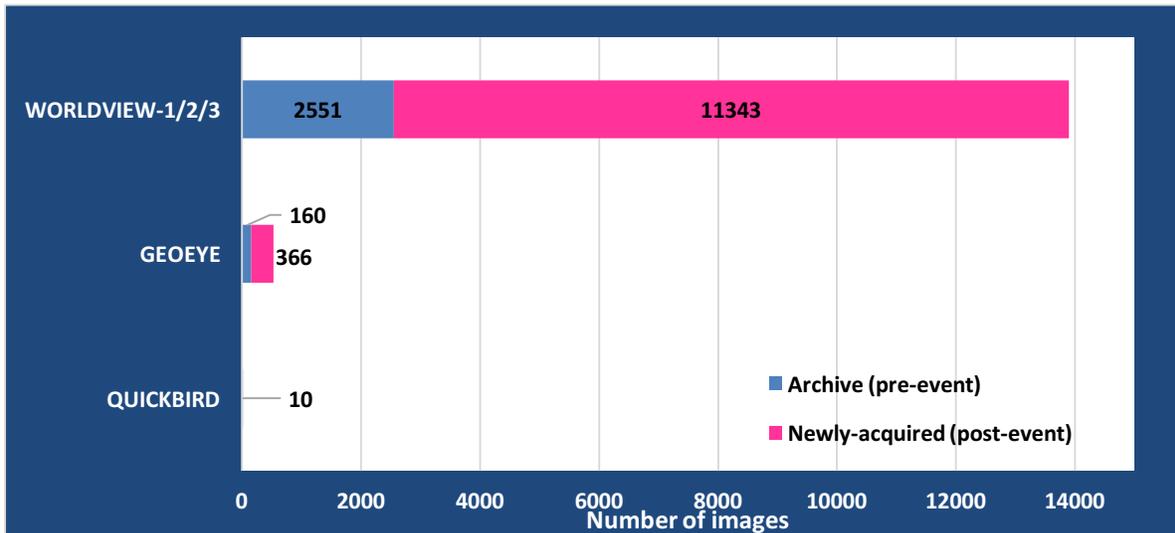


Figure 3-17. 2016 Data Consumption –US Commercial optical satellites

Resources	GEOEYE	QUICKBIRD	WORLDVIEW-1/2/3
Total number of delivered data	526	10	13894
Archive (pre-event)	160	10	2551
Newly-acquired (post-event)	366	0	11343
Max number of images per activation	167	8	3582

Table 3-4. 2016 Statistics concerning US commercial optical satellites

Overview of data consumption by activation:

Figures 3-18 and 3-19 depict the number of newly-acquired (post-event) and archived (pre-disaster) images by activation and 3-20 shows the number of US VHR new acquisitions by activation.

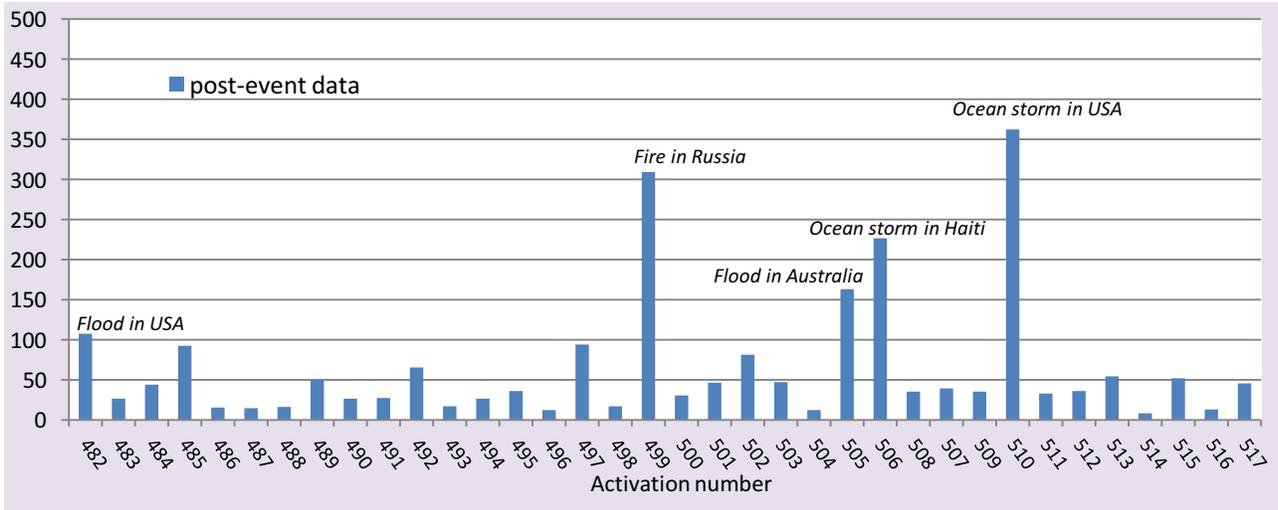


Figure 3-18. Number of post-event/newly-acquired images (radar and optical) provided by activation

On average the quantity of images is **64 per activation**. There are five activations with a number greater than 100 of programmed data (Charter optical & radar sensors), these are: **Act 482**, flood in USA, 107 images; **Act 499**, fire in Russia, 309 images; **Act 505**, flood in Australia, 163 images; **Act 506**, ocean storm in Haiti, 226 images; **Act 510**, ocean storm in USA, 362 images.

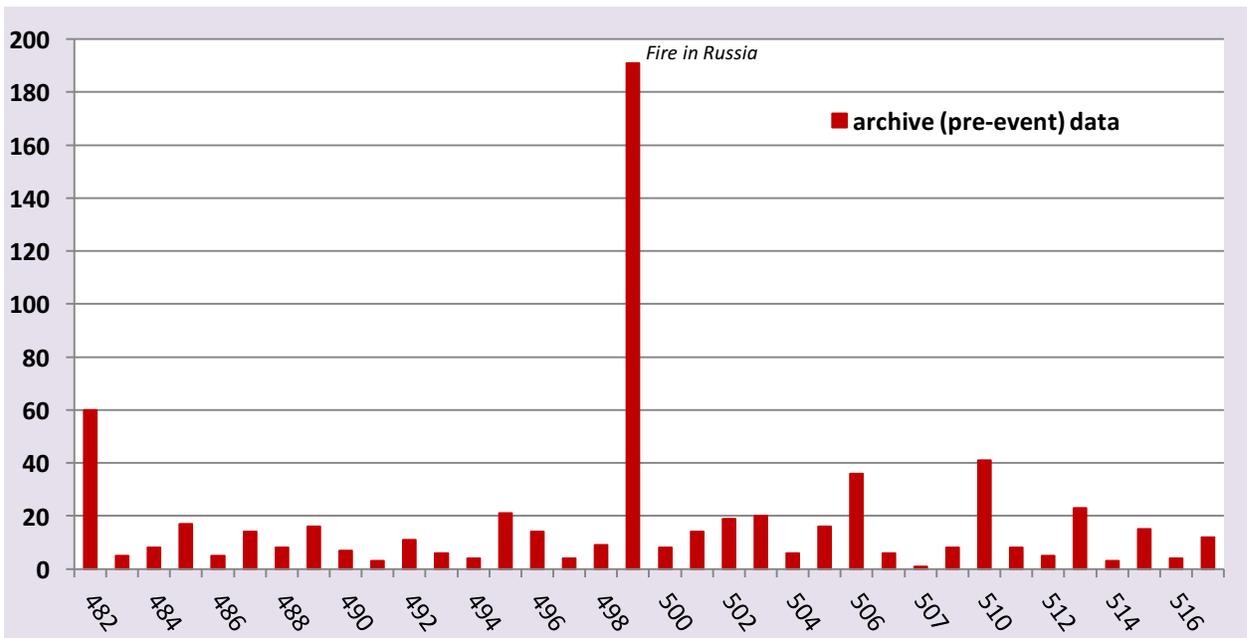


Figure 3-19. Number of pre-event/archived images provided by activation (Charter EO sensors)

On average the quantity of images is **18 per activation**. In one case, the number of archive data exceeded 100: **Act 499**, fire in Russia, 191 images.

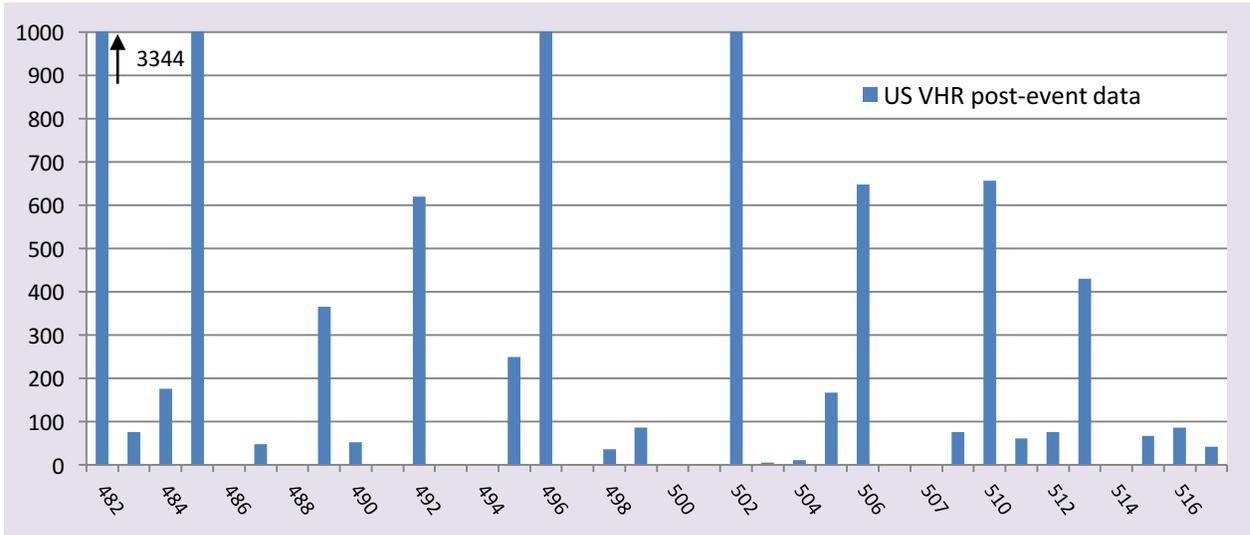


Figure 3-20. Number of post-event/newly-acquired images provided by activation (US VHR commercial satellites)

In total, 25 activations out of 36 have benefited from US VHR data. The two activations with the highest number of US VHR data (greater than 1800 in total and greater than 100 for newly-acquired images) provided are: **Act 482**, flood in USA, (3582 images in total out of which 3344 newly-acquired images); **Act 502**, flood in USA (1809 newly-acquired images were provided).

3.2.2 Human resource contribution (ECO and PM) in 2016

- *ECO resources in 2016*

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 ESA handling 33% of the calls, as shown in Figure 3-21. There were 14 calls processed by ESA, 8 calls by CSA, 5 calls by JAXA, 4 calls by ISRO, 3 calls by CNES, 2 calls by CONAE, DLR and DMCii and 1 call by CNSA and ROSCOSMOS. For the first time, ESA had to handle 7 calls within the same week (for hurricane Matthew hit Central America in October 2016). KARI did not receive any calls during its week on duty.

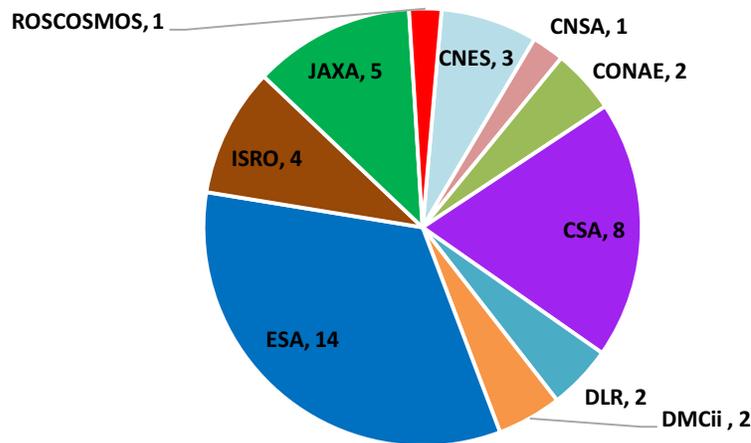


Figure 3-21. Distribution of Charter Parties responsible for the ECO services in 2016

- *Distribution of Charter members responsible for the PM services delivered in 2016*

Project Managers (PMs) were nominated for 36 activations. PMs nominated by USGS handled 36.1% (13 activations) of Charter activations; JAXA handled 7 activations; CONAE handled 5 activations; ROSCOSMOS handled 3 activations; ISRO, CNSA and CSA handled 2 activations each; and DLR and ESA handled 1 activation each (Figure 3-22).

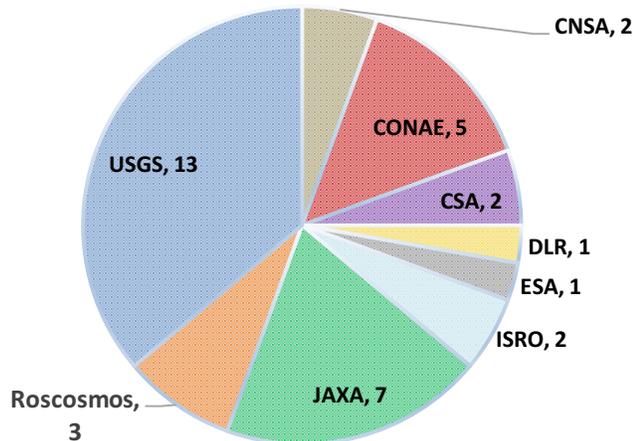


Figure 3-22. Distribution of Charter Parties responsible for the PM services in 2016

- *Distribution of organizations providing PM resources in 2016*

PMs may be sourced from a Charter party or a third party. Table (3-5) and Figure (3-23) 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, 19 different organizations contributed their PM services to Charter activations.

Organisation, Country	Number of PM service
UNITAR/UNOSAT (Switzerland)	6
AIT (Thailand)	4
CATHALAC (The Water Center for the Humid Tropics of Latin America and the Caribbean) (Panama)	3
CSA (Canada)	2
ISRO/NRSC (India)	2
LAPAN (Indonesia)	2
NDRCC - National Disaster Reduction Centre of China (China)	2
PDC- Pacific Disaster Center (Hawaii, USA)	2
ROSCOSMOS (Russia)	2
University of Louisiana (USA)	2
CONAE (Argentina)	1
DLR (Germany)	1
ESA (Italy, European Union)	1
Geoscience Australia (Australia)	1
UN-SPIDER Regional Support Office (Iran)	1
North Carolina Emergency Management (USA)	1
University of Texas (USA)	1
University of Tokyo (Japan)	1
USGS (USA)	1

Table 3-5. PM Organisations in 2016

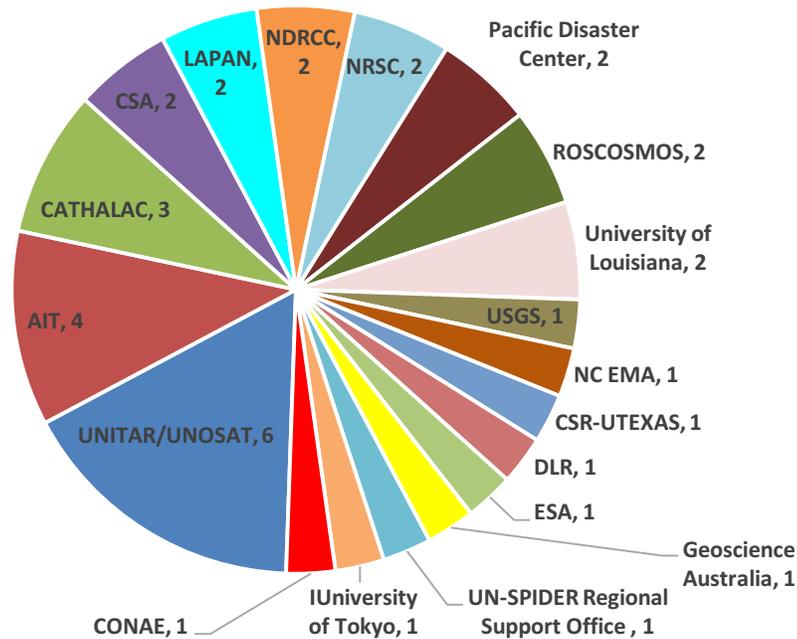


Figure 3-23. Distribution of organizations providing PM resources in 2016

Difference between figures 3-22 & 3-23: Figure 3-22 represents the breakdown of Charter members who nominated PMs in 2016 (the Charter member responsible for the PM service) while Figure 3-23 represents the breakdown of organizations performing the PM work for 2016 activations.

Detailed comments:

- USGS managed 36.1% of the total PM services with the support of own personal (1 activation) and third parties: three from CATHALAC to cover a fire and two floods in Panama; two from PDC to cover ocean storms in Haiti and the Bahamas; two from UNITAR/UNOSAT* to cover an ocean storm in Fiji and an earthquake in Ecuador; two from University of Louisiana to cover two floods in USA; one from UN-SPIDER Regional Support Office in Iran to cover a flood in Iran; one from University of Texas to cover a flood in USA; one from NC Emergency Management to cover an ocean storm in USA.
- JAXA managed 19.4% of the total Project Manager services with support from AIT for an earthquake in China, flood in Sri Lanka, ocean storm in Bangladesh, flood in Bangladesh requested by ADRC (escalation to the Charter); LAPAN for a volcano in Indonesia; University of Tokyo for an earthquake in Japan.
- CONAE managed 13.8% of the total Project Manager services, with support of internal staff for a flood in Argentina and with support from third parties: UNITAR/UNOSAT for two events: ocean storm in Seychelles, flood in Sudan and flood in Indonesia; Geoscience Australia for a flood in Australia.

-
- ROSCOSMOS managed 8.3 % of the total Project Manager services with support of internal staff for a fire in Russia and a fire in Israel and with support from UNITAR/UNOSAT for an ocean storm in Philippines.
 - CNSA managed 5.5% of the total Project Manager services with support from NDRCC-National Disaster Reduction Centre of China staff (Chinese AU) for 2 events: a flood and an ocean storm in China.
 - CSA managed 5.5% of the total Project Manager services with support of internal staff for 2 events: fire in Canada and flood in Costa Rica.
 - ISRO managed 5.5% of the total Project Manager services with support of internal staff (NRSC/ISRO) for 2 events: a flood and an ocean storm in India.
 - DLR managed 2.7% of the total Project Manager services with internal staff (DLR/ZKI) acting as PM for a flood in Dominican Republic.
 - ESA managed 2.7% of the total Project Manager services with support of internal staff for 1 event: ocean storm in Cuba.

*UNITAR/UNOSAT served as PM in particular for UN activations. UNOSAT contributed to 16.6% of all activations in 2016 (Fiji, Ecuador, Seychelles, Sudan, Indonesia, Philippines), also providing value-adding services. It supported the Charter for 1 other activation providing damage and impact assessment maps under another PM (ocean storm in Cuba).

3.3 SARE – Semi Annual Refresher Exercises

The Emergency On-Call Officer (ECO) function is of outmost 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 2016, these exercises took place from 16 April to 23 June and from 29 November to 20 December, respectively, and the following scenarios were worked with:

- SARE-16: earthquake and landslides in Costa Rica. This exercise was led by UKSA/DMC and CNES training teams; the report was prepared by CNES. 46 ECOs from 12 Charter member agencies participated.
- SARE-17: Floods and landslides in Italy. This exercise was led by UKSA/DMC, ESA and CNES training teams; the report was prepared by UKSA/DMC, ESA and CNES. 28 ECOs from 10 Charter member agencies 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. Five PM training sessions were carried out in 2016.

- March (Manila, Philippines): Led by JAXA. The participants were from the Philippine Atmospheric, Geophysical and Astronomical Services administration – PAGASA.
- April (Cordoba, Argentina): As a side event to the 35th Charter Board meeting, this event was kindly hosted by CONAE and led by CNES, DLR, UKSA/DMC, JAXA, CONAE and ESA. Participants came from the Bolivian and the Argentinean civil defense agencies “Sistema Nacional de Gestión de Riesgos (SINAGER)” and “Dirección Nacional de Protección Civil”, and students of the “Maestría en Aplicaciones de Información Espacial” of the Gulich Institute (a joint program between Córdoba National University and CONAE).
- April (Bogota, Colombia): Led by USGS. Colombian agencies involved in emergency response and remote sensing, three participants represented the government of Belarus.
- September (Jakarta, Indonesia): Led by JAXA. The participants were from Indonesia (LAPAN, the Agency for the Assessment and Application of Technology - BPPT, and the National Disaster Management Authority - BNPB).
- December (London, UK): Led by UKSA/DMC. The participants were from UK (Hydrology and Flooding for the UK Environment Agency).

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 Geobrowser 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 new main version of the COS-2 system has been transferred in operation in November 2016, improving the user interface and fixing the main issues. At the last Executive Secretariat teleconference, in December 2016, all members agreed to open COS-2 to the Authorised Users (opening put on hold since more than one year). On-line trainings to Authorised Users and trainings about Universal Access have been conducted in the first months of 2017.

Since COS-2 entered in operation (March 2015), the system was used for handling the totality of Charter activations. All Project Managers (PM) were able to access to the information and metadata stored in the COS-2. All ECOs used the system to generate the Activation Dossier. A special instance of COS-2 has been setup in order to support the SARE (the ECO Semi-Annual Refresh Exercise) exercise, with dedicated accounts for each Charter agency. The next major version of COS-2 is foreseen in September 2017 in order to implement additional features (in particular for the Project Managers) and improve the synergy with the Charter Geobrowser (the Geographic Tool available at <http://cgt.prod.esaportal.eu/charterng/>) – now finally with maintenance and evolution under industrial contract managed by ESA. A team of Charter member agencies has been setup to follow the COS-2 developments, acting as beta testers.

COS-2 support was provided for the SARE-16 and SARE-17, in which 46 and 44 (respectively) Emergency on-Call Officers (ECOs) participated.

Charter members (ESA, CNES, DLR, ROSCOSMOS, CONAE and INPE) performed trainings to the AUs of France, Germany, Belarus, El Salvador, Guatemala, Uruguay, Venezuela, Canada, Chile, Iraq, USA, Pakistan, Argentina, UK and Ecuador using on-line URF of COS-2.

Since January 2016, all PM trainings are performed with the support of COS-2.

4 External relations

4.1 New members accession

The Bolivarian Agency for Space Activities (ABAE) has been fully integrated into the Charter, after a site visit at ABAE premises and an operational qualification process that took place in April 2016. The Charter conducted the official signature ceremony, that marked the accession of ABAE to the Charter during the 36th Board meeting in Moscow, Russia on 17-20 October 2016. Looking at new Charter members applications and following the request of the United Arab Emirate Space Agency (UAESA) to become Charter member providing the role of Board member, supported by the Mohammed Bin Rashid Space Centre (MBRSC) - operating two VHR optical satellites - for the role of the Charter Executive Secretariat is under evaluation. Representatives from UAESA will introduce their organization during the 37th Charter Board meeting in Oxford, UK on 24-28 April 2017.

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, Malawi in 2014 and Chile, Pakistan, Colombia, Bolivia and the Dominican Republic in 2015, in 2016, Belarus, Iraq, El Salvador, Guatemala, and Uruguay have had their national mandated disaster management organizations granted Charter access and more candidates were under assessment or training. By the time of publishing this report, disaster management organization from Ecuador, has become able to directly activate the Charter in case of major disasters in their countries due to their newly achieved status.

53 countries and the EC have dedicated AUs reaching the total of 63 user organizations able to directly request Charter activations by the end of 2016 (Figure 4-1).



Figure 4-1. Map showing countries (in dark blue) with direct access to the Charter by April 2017.

Significant efforts have been done for promoting the Charter:

- EUMETSAT promoted Universal Access to African Meteorological Services and a handful of disaster management agencies, during the 12th User Forum for Africa that was held on 12-16 September 2016 in Kigali, Rwanda.
- ROSCOSMOS promoted the Charter through two short presentations to the Ministry of the Russian Federation for Civil Defence, Emergencies and Elimination of Consequences of Natural Disasters (EMERCOM) on 24 May and 2 August 2016.
- CNES published four web articles to promote Charter activations for the earthquake in Ecuador and cyclone in Seychelles in April 2016, for floods in Bangladesh in August 2016 and Hurricane Mathew that hit 5 countries in October 2016.
- DLR published four web-articles to promote the Charter for the activation in the Dominican Republic for Hurricane Matthew, the 500th activation for floods in Bangladesh, for DLR contribution to the Charter for 2016 and for satellite images for Disaster Risk Reduction.
- DLR, USGS and CNES participated in a paper for Global Trends in Satellite-based Emergency Mapping to promote the Charter mechanism.
- CSA attended the 17th Meeting of the International Ice Charting Working Group to present the Charter and to share with the group that the Charter could support disasters in the arctic seas.

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 36th Board meeting (October 2016) by teleconferences and made a summary of their activities to support the Charter. Two reports were also delivered.

The cooperation between the Charter and UNOOSA was highlighted and detailed in statements and presentations during a number of international events and conferences during the reporting period. Every opportunity was used by UNOOSA staff to raise awareness on the opportunities offered by the Charter and particularly the Universal Access initiative, in accordance with the original Cooperating Body Agreement.

This includes direct technical advisory services (Technical Advisory Missions) and follow up activities provided to National Disaster Management Authorities and other stakeholders in El Salvador (11 to 15 July 2016), the Dominican Republic (18 to 22 July 2016), Myanmar (27 June to 1 August 2016), Vietnam (7-13 may 2016) and Lao People's Democratic Republic (25-29 July 2016). The Charter was also introduced and thoroughly described to special training programme named "IMPACT - IM Preparedness and Coordination Training" hosted by the United Nations Office for the Coordination of Humanitarian Affairs (UN-OCHA) for its staff. The programme was organised in Bangkok, Thailand, where UN-SPIDER was invited to introduce the ways UN-OCHA can access imagery and services. This allowed over 60 personnel from various parts of the World to familiarize themselves with the Charter process and services.

In 2016, a request activation coming from the Iranian Space Agency 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 (as a result El Salvador, Guatemala and Uruguay were granted the Authorized User status in 2016).

The UN-SPIDER Knowledge Portal includes a dedicated page with information on the Charter <http://www.un-spider.org/space-application/emergency-mechanisms/international-charter-space-and-major-disasters>. 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 16,500 subscribers worldwide via e-mail.

Eight of 36 Charter activations for 2016 (22.2 %) were requested by UNITAR/UNOSAT on behalf of UN agencies, although the activation for Hurricane Matthew in Haiti was commonly requested by USGS and COGIC as well. UNOCHA was the main requestor with 6 calls; one call was initiated by the UN Resident Coordinator for Seychelles.

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 for Hurricane Matthew in Haiti and Cuba, supporting the Pacific Disaster Center (PDC) and ESA, respectively.

The Haiti case was challenging: The Project Manager (PM) nominated for this Charter call was PDC while UNITAR/UNOSAT along with other satellite mapping groups (SERTIT, Copernicus EMS, PDC) supported the Charter Call by providing (satellite-derived) value-added analysis & mapping products. Priority Areas of Interest (AOIs) for satellite imagery acquisition submitted by UNITAR/UNOSAT to the Charter have been requested by UN OCHA and UNCT based on operational requirements to assist most affected communities living in rural and urban areas in Grand South departments (Grand'Anse, Nippes and South).

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 2016, SA was comprised of 89 organizations from 27 countries and regions and 15 international organizations (104 organizations, in total). There were five new national members in 2016: the ministry of Works and Human Settlement (MoWHS), Bhutan, the national Survey of Seismic Protection (NSSP), Armenia, the department of Hydrology and Meteorology (DHM), Myanmar, the ASIAN Disaster Preparedness Centre (ADPC), Thailand and the National Research Institute of Earth Science and Disaster Resilience (NIED), Japan.

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 2016, 36 calls (SA call 235 to SA call 270) and 34 activations since two calls were denied for a drought in Vietnam and an earthquake in Myanmar (SA calls 243 and 244, respectively). The escalation mechanism to the Charter was used in response to 6 events for earthquake in Taiwan, flood in Sri Lanka, volcano in Indonesia, ocean storm in Bangladesh, flood in Bangladesh and earthquake in Indonesia. The number of escalations to the Charter is equivalent to the previous years: 5 in 2013 and, 6 in 2014 and superior to 2015 (1 escalation). For 2016, the escalation mechanism was used for 17.6% of all SA activations.

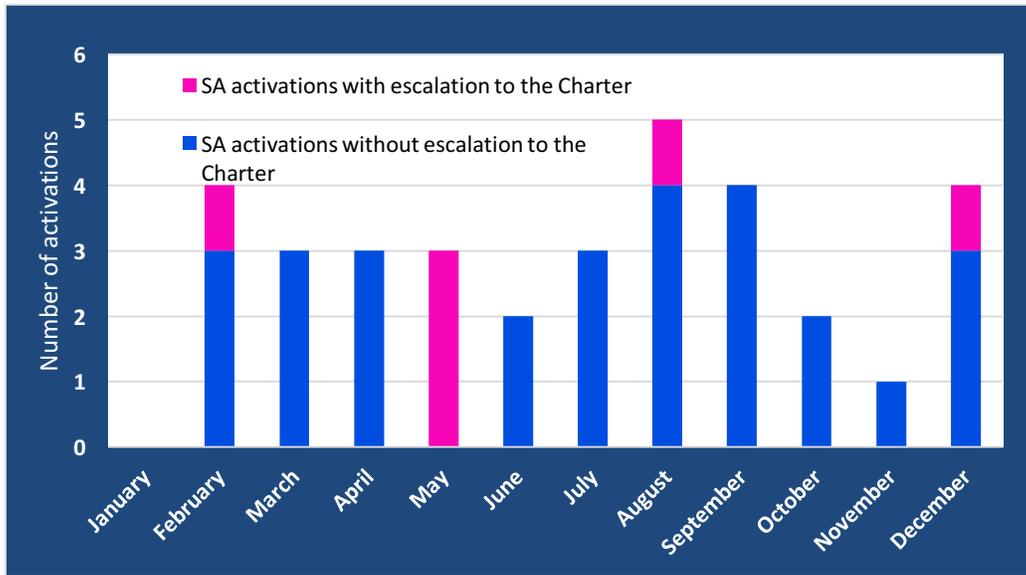


Figure 4-2. Sentinel Asia: 2016 monthly activations

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 Annual Meeting (JPTM) in January 2016 and the 2nd Sentinel Asia Steering Committee during APRSAF-23 meeting in November 2016.

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 2016. 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 2016, Copernicus service was activated 32 times. There were no Charter activations for European countries but 6 Copernicus events out of Europe, activated by the European Response Coordination Centre (ERCC), on behalf of the EC Services/DG ECHO. For these emergencies, the Charter was also triggered (in Fiji, Ecuador, Bangladesh, Australia, Haiti and twice in the USA). When relevant the Charter web site included links to the results delivered by the Copernicus EMS, in particular for the activations for Hurricane Matthew in Haiti and USA and in some cases, the Charter provided EO data to Copernicus e.g. for hurricane Matthew in Haiti (Copernicus value-added products generated using charter data are available on <http://emergency.copernicus.eu/>).

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 four specific pilot activities covering floods, earthquakes, volcanoes and landslides (the CEOS landslide pilot started its implementation in 2016).

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 2015-2030 of the United Nations.

Following an agreement established in 2015, once the peak of a Charter activation is passed, if access to Charter data is required from one of the CEOS Pilots, the Charter agencies are able to share the data collections acquired taking into account the data licensing of each data source. A procedure for requesting such collaboration was established in 2015. In 2016, 6 requests have been received from the CEOS Flood pilot requesting data for floods in USA (January 2016), Indonesia (February 2016), Argentina and Seychelles (April 2016), Bangladesh and Sri Lanka (June 2016), USA (September 2016) and for Hurricane Matthew that hit the Caribbean and USA (October 2016). Most of the Charter member agencies shared data with the Flood pilot, when there was an overlap with the area of interest of the Charter activation.

5 Communication

5.1 Web site

The Charter website is available in English and some pages are available in French, Chinese, French, Japanese and Spanish. Within 2017, the translation of the web pages in Spanish with the support of CONAE and ABAE, and in French, with the support of CNES, will be completed.

<https://www.disasterscharter.org/web/guest/home>

The Charter website allows direct access to COS-2 for authorized Charter members' personnel and provides information on how the Charter can be activated by Authorized Users through the Universal Access initiative.



Figure 5-1. Charter website homepage

An overview of page and sessions views during 2016 is provided in the next two figures, to illustrate the website visits frequency. The activation for fire in Fort McMurray in Canada was by far the most popular event reaching 4525 page views.

It is also noted that the number of new visitors of the Charter website has increased about 5%, since 2015.

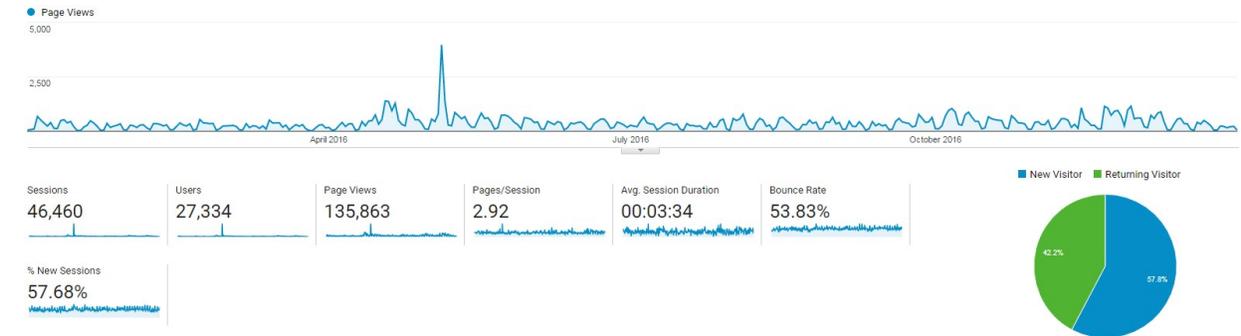


Figure 5-2. Breakdown of page views (January-December 2016)

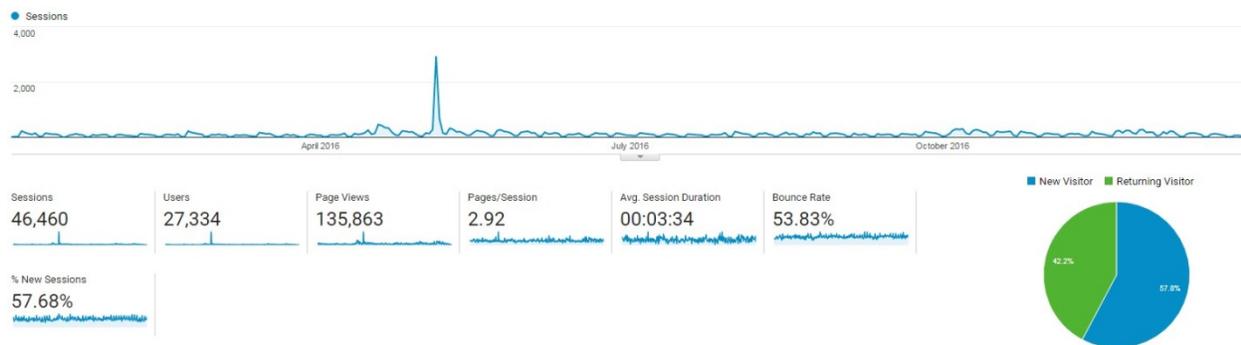


Figure 5-3. Breakdown of sessions views (January-December 2016)

Charter visibility is also ensured through other social media outlets, such as Twitter, which had around 4000 followers by the end of 2016, which shows that the charter audience continues to increase remarkably compared to 2015 (3160), 2014 (1840) and 2013 (880).

The following diagram shows the number of impressions of Charter’s followers in the period April- June 2016 reaching 251.500 (top tweets being images from the Fort McMurray fires in Canada).

Your Tweets earned **251.5K impressions** over this 91 day period

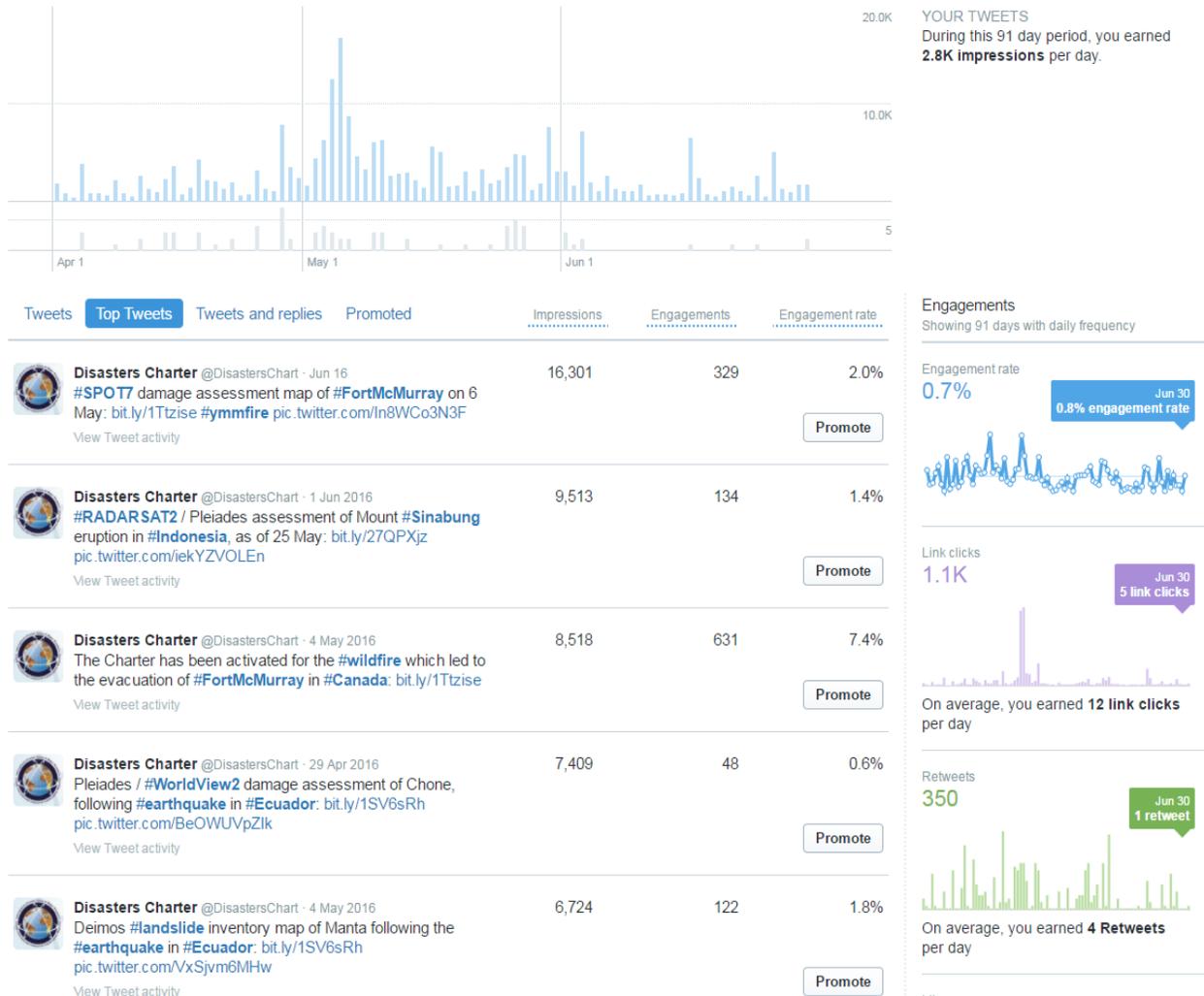


Figure 5-4. Number of impressions (April-June 2016)

5.2 Charter Newsletters

Charter newsletters were issued in July and November 2016. 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>

The July issue (13th) presented a summary of CONAE assuming chairmanship of the International Charter 'Space and Major Disasters'; UN/India Workshop on 'Use of Earth Observation data for disaster management and risk reduction: Asian experience' at Hyderabad, India; Charter products "aided situational awareness" of Fort McMurray wildfires in Alberta, Canada; Project Manager training course in CONAE's Space Centre, Argentina.

The November issue (14th) reported about the 500th Activation of the International Charter; New Charter Users in Latin America; Flooding in Sudan; New Charter Project Managers Trained in July and September 2016.

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

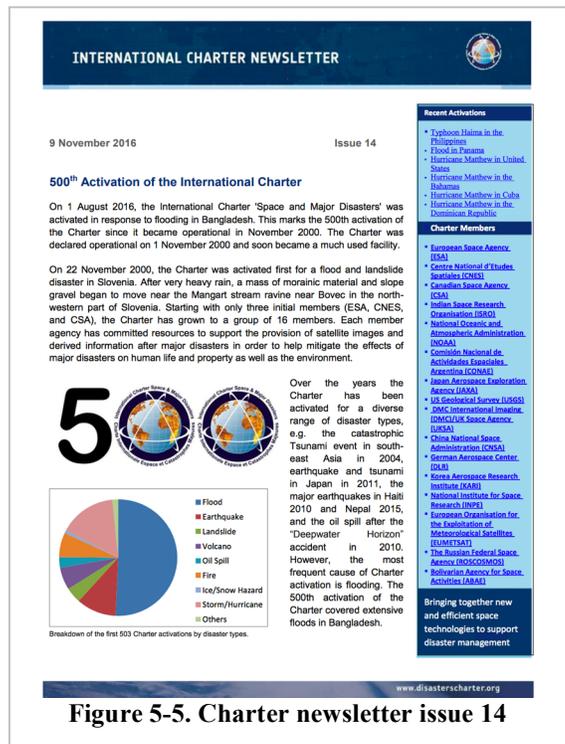


Figure 5-5. Charter newsletter issue 14

5.3 Conferences and presentations

The following table provides details of the 2016 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
EUMETSAT's 12th User Forum for Africa - short (2-slide) presentation to advertise UA to African Meteorological Services and a handful of disaster management agencies	Kigali, Rwanda	12-16 September	EUMETSAT
Sentinel Asia Annual Meeting (JPTM)	Colombo, Sri Lanka	19-21 January	JAXA
Presentation of Charter activities to the regional reps of the Russian Federation for Civil Defense, Emergencies and Elimination of Consequences of Natural Disasters (EMERCOM) and relevant organizations	Teleconference	24 May	ROSCOSMOS
EM-DAT Technical Advisory Group meeting	Washington, USA	15 October	USGS
2nd Steering Committee for Sentinel Asia during APRSAF-23	Manila, Philippines	15-18 November	JAXA

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.

Date	Issuing agency	Title
8 March 2016	DLR	Satellite images for Disaster Risk Reduction (http://www.dlr.de/dlr/en/desktopdefault.aspx/tabid-10081/151_read-17064/year-all/)
29 April 2016	CNES	Fantala, the powerful cyclone ever observed in the Indian ocean (https://spacegate.cnes.fr/fr/seychelles-latoll-de-farquhar-devaste-par-le-cyclone-fantala)
30 April 2016	CNES	Earthquake in Ecuador: Zoom in the city of Muisne (https://spacegate.cnes.fr/fr/seisme-en-equateur-zoom-sur-la-ville-muisne)
15 July 2016	DLR, USGS, ESA, CNES	Voigt, S., F. Giulio-Tonolo, J. Lyons, J. Kučera, B. Jones, T. Schneiderhan, G. Platzeck, et al. (2016): "Global Trends in Satellite-based Emergency Mapping." Science 353 (6296): 247–252.
18 July 2016	DLR	DLR provided Earth Observation data during 16 Charter Activations in 2016 (https://www.zki.dlr.de/article/2800)
1 August 2016	DLR	DLR supports the 500th activation of the International Charter (https://www.zki.dlr.de/article/2801)
4 August 2016	CNES	Charter reaches 500 th activation as it swings into action for Bangladesh 9 (https://cnes.fr/en/charter-reaches-500th-activation-it-swings-action-bangladesh)
7 October 2016	CNES	Hurricane Matthew: The Charter was activated in 5 countries (https://spacegate.cnes.fr/fr/ouragan-matthew)
8 October 2016	DLR	Hurricane Matthew in the Dominican Republic (https://www.zki.dlr.de/article/2829)
1 December 2016	KARI	https://www.kari.re.kr/

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 2016 activations were compared with EM-DAT data to evaluate the overall impact of the Charter as a service in supporting disaster response – EM-DAT: The Emergency Events Database - Université catholique de Louvain (UCL) - CRED, D. Guha-Sapir - www.emdat.be, 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 2016.

6.1 Overall impact

In 2016, the most catastrophic events were the Ecuador earthquake on April 16, affecting more than 380,000 and killing 673 people and Hurricane Matthew in the Caribbean and USA, affecting more than 2,000,000 and killing 601 people. Apart from this event, 2016 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).

275 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 13% of the total number of natural disasters registered by EM-DAT in 2016; this is equivalent to the percentages of previous years (i.e. 12% in 2015, 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 2016 Analyses, assessments, positions, 2016 issue; Munich RE*) registered 750 catastrophic events and also a high number of minor loss events in emerging economies countries. Direct overall losses from natural catastrophes in 2016 amounted to US\$ 18075bn, equivalent to the average for the last ten years of US\$ 190bn. A total of 9,200 people lost their lives globally. 2,400 people out of the 9,200 died in extreme flood events that struck China, India and Pakistan. A large number of victims (54%) lost their lives in hydrological events. The distribution by continent shows that Asia was again worst affected in 2016, with 61%, followed by North America with 12% and Africa 11%. South America, Europe and Australia accounted for 10%, 5% and 1% respectively of the registered events. The distribution of 2016 Charter activations by continent (Figure 3.6) confirms this trend.

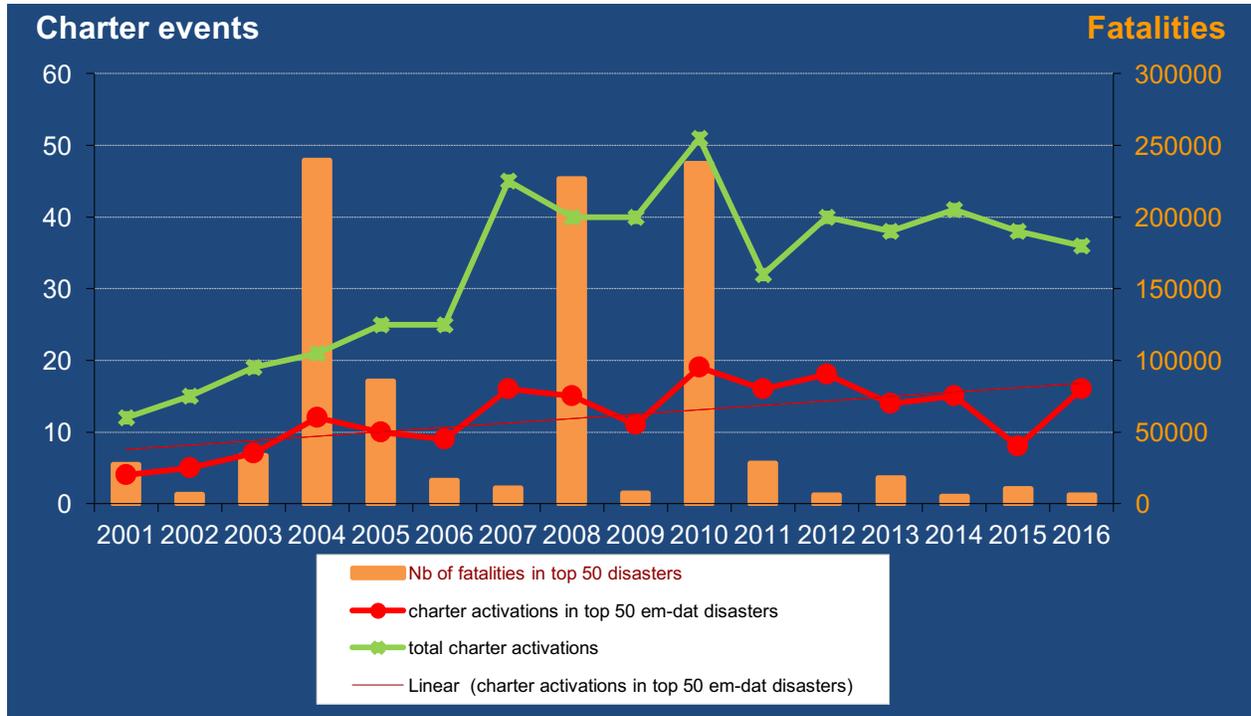


Figure 6-1. Number of Charter events over 2001-2016

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 2002, 2012 and 2014.

Figure 6-1 shows that 16 of the 50 most severe events recorded in EM-DAT in 2016 are Charter activations. In 2016 the number of Charter activations (36) is comparable to recent years, as the number of Charter activations fluctuates between 32 and 51 per year since 2007. Such fluctuations 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 2016, the Charter covered 5 of the 10 most severe disasters by fatalities (Table 6-1 next page). Among the last seven years (2009-2016), the Charter was triggered for 14 of the 15 most severe natural disasters by fatalities, as reported by EM-DAT (Table 6-2).

Top 10 Disasters – Number Killed – 2016					
<i>The text in italic indicates that the Charter was activated</i>					
Country	Disaster type	Date	#killed	#Affected people	Total Damage (000' \$)
<i>Ecuador</i>	<i>Earthquake</i>	<i>16/04/2016</i>	<i>672</i>	<i>389,364.00</i>	<i>2,000,000.00</i>
<i>Haiti</i>	<i>Storm</i>	<i>28/09/2016</i>	<i>546</i>	<i>2,100,439.00</i>	<i>2,000,000.00</i>
Korea (the Democratic People's Republic of)	Flood	29/08/2016	538	600,000.00	61,000.00
Italy	Earthquake	24/08/2016	296	4,854.00	5,000,000.00
<i>China</i>	<i>Flood</i>	<i>28/06/2016</i>	<i>289</i>	<i>60,000,000.00</i>	<i>22,000,000.00</i>
China	Flood	18/07/2016	289	375,000.00	4,500,000.00
<i>India</i>	<i>Flood</i>	<i>15/07/2016</i>	<i>254</i>	<i>1,600,000.00</i>	<i>350,000.00</i>
Zimbabwe	Flood	15/10/2016	246	128.00	100,000.00
<i>Sri Lanka</i>	<i>Flood</i>	<i>14/05/2016</i>	<i>203</i>	<i>301,602.00</i>	<i>1,200,000.00</i>
India	Flood	09/07/2016	184	100,000.00	160,000.00

Table 6-1. Ten most severe natural disasters by number of fatalities in 2016 (events covered by Charter activations are indicated in bold and italics. (Source: EM-DAT: The Emergency Events Database - Université catholique de Louvain (UCL) - CRED, D. Guha-Sapir - www.emdat.be, Brussels, Belgium, filtered according to the type of disasters covered by the Charter).

Top 15 Disasters – Number Killed – 2009-2016				
<i>The text in italic indicates that the Charter was activated</i>				
Date	Country/District	Type	# Killed	#Affected people
<i>12/01/2010</i>	<i>Haiti</i>	<i>Earthquake</i>	<i>222,570</i>	<i>3,700,000</i>
<i>11/03/2011</i>	<i>Japan</i>	<i>Earthquake and tsunami</i>	<i>19,848</i>	<i>368,820</i>
<i>25/4/2015</i>	<i>Nepal</i>	<i>Earthquake</i>	<i>8,831</i>	<i>5,639,722</i>
<i>8/11/2013</i>	<i>Philippines</i>	<i>Tropical cyclone</i>	<i>7,354</i>	<i>16,106,807</i>
<i>12-27/06/2013</i>	<i>India</i>	<i>Flood</i>	<i>6,054</i>	<i>504,473</i>
<i>14/04/2010</i>	<i>China P Rep</i>	<i>Earthquake</i>	<i>2,968</i>	<i>112,000</i>
<i>28/07/2010</i>	<i>Pakistan</i>	<i>Flash flood</i>	<i>1,985</i>	<i>2,0359,496</i>
<i>4-5/12/2012</i>	<i>Philippines</i>	<i>Tropical cyclone</i>	<i>1,900</i>	<i>6,246,664</i>
<i>07/08/2010</i>	<i>China P Rep</i>	<i>Landslide</i>	<i>1,765</i>	<i>4,7200</i>
<i>29/05/2010</i>	<i>China P Rep</i>	<i>General flood</i>	<i>1,691</i>	<i>134,000,000</i>
<i>15/12/2011</i>	<i>Philippines</i>	<i>Tropical cyclone</i>	<i>1,439</i>	<i>1,150,300</i>
<i>30/09/2009</i>	<i>Indonesia</i>	<i>Earthquake</i>	<i>1177</i>	<i>679,402</i>
07/09/2009	India	Flood	992	1,886,000
<i>11/01/2011</i>	<i>Brazil</i>	<i>General flood</i>	<i>900</i>	<i>45,000</i>
<i>05/08/2011</i>	<i>Thailand</i>	<i>General flood</i>	<i>813</i>	<i>9,500,000</i>

Table 6-2. Fifteen most severe disasters by number of fatalities (2009-2016) (events covered by Charter

activations are indicated in bold and italics). (Source: EM-DAT: The Emergency Events Database - Université catholique de Louvain (UCL) - CRED, D. Guha-Sapir - www.emdat.be, Brussels, Belgium, 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 2016.

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

Country	Disaster type	Start date	Total deaths	Total affected	Total damage (000' US\$)	Charter activation
Ecuador	Earthquake	16/04/2016	672	389,364.00	2,000,000.00	x
Haiti	Storm	28/09/2016	546	2,100,439.00	2,000,000.00	x
Korea (the Democratic People's Republic of)	Flood	29/08/2016	538	600,000.00	61,000.00	
Italy	Earthquake	24/08/2016	296	4,854.00	5,000,000.00	
China	Flood	28/06/2016	289	60,000,000.00	22,000,000.00	
China	Flood	18/07/2016	289	375,000.00	4,500,000.00	
India	Flood	15/07/2016	254	1,600,000.00	350,000.00	x
Zimbabwe	Flood	15/10/2016	246	128.00	100,000.00	
Sri Lanka	Flood	14/05/2016	203	301,602.00	1,200,000.00	x
India	Flood	09/07/2016	184	100,000.00	160,000.00	
Sudan (the)	Flood	15/06/2016	171	200,040.00	-	x
Pakistan	Flood	09/03/2016	141	4,412.00	2,000.00	
Nepal	Flood	25/07/2016	138	10,551.00	15,000.00	
Taiwan (Province of China)	Earthquake	06/02/2016	117	525.00	700,000.00	x
Bangladesh	Flood	19/07/2016	106	1,900,000.00	150,000.00	x
Indonesia	Earthquake	07/12/2016	104	86,018.00	100,000.00	x
China	Storm	24/06/2016	102	46,000.00	302,000.00	x
Ethiopia	Flood	09/05/2016	100	490,000.00	-	
China	Storm	16/06/2016	99	45,846.00	500,000.00	
India	Storm	20/06/2016	93	-	-	
Pakistan	Flood	02/04/2016	92	77.00	-	
China	Storm	09/07/2016	75	24,900.00	1,511,160.00	
China	Flood	18/06/2016	68	165,000.00	3,000,000.00	x
Rwanda	Flood	15/01/2016	67	-	-	

China	Landslide	04/05/2016	66	237,600.00	700,000.00	
Indonesia	Landslide	17/06/2016	62	-	25,000.00	
India	Flood	25/06/2016	61	-	100,000.00	
Bangladesh	Storm	13/05/2016	59	-	-	x
Angola	Flood	29/02/2016	54	-	-	
Rwanda	Landslide	07/05/2016	54	4,000.00	-	
Mexico	Storm	06/08/2016	54	11,000.00	-	
Indonesia	Flood	20/09/2016	53	8,920.00	22,000.00	x
Congo (the Democratic Republic of the)	Flood	27/12/2016	50	10,000.00	-	
India	Flood	28/07/2016	50	2,000,000.00	150,000.00	
India	Flood	01/08/2016	50	3,000.00	-	
Niger (the)	Flood	20/06/2016	50	123,266.00	-	
United States of America (the)	Storm	23/01/2016	50	85,000,012.00	550,000.00	x
Japan	Earthquake	16/04/2016	49	298,432.00	20,000,000.00	x
United States of America (the)	Storm	07/10/2016	49	-	10,000,000.00	x
Mozambique	Flood	15/10/2016	47	165,000.00	-	
Pakistan	Flood	03/07/2016	46	410.00	-	
Fiji	Storm	20/02/2016	44	350,000.00	600,000.00	x
China	Flood	18/06/2016	42	197,000.00	410,000.00	
Myanmar	Landslide	23/05/2016	42	15.00	-	
Kenya	Flood	29/04/2016	39	10,000.00	-	
Viet Nam	Flood	09/10/2016	35	659,615.00	104,280.00	
China	Landslide	07/07/2016	35	-	-	
China	Storm	28/09/2016	35	36,000.00	830,000.00	
China	Flood	23/06/2016	34	150,000.00	675,000.00	
India	Flood	17/07/2016	34	-	-	

Table 6-3. Fifty most severe disasters by number of fatalities (listed by total damage) in 2016 (Source: EM-DAT: The Emergency Events Database - Université catholique de Louvain (UCL) - CRED, D. Guha-Sapir - www.emdat.be, Brussels, Belgium, filtered according to the type of disasters covered by the Charter)

The Charter covered 16 of the 50 most severe natural disasters in terms of fatalities recorded by EM-DAT in 2016 (21% of 2015 Charter activations), excluding droughts and extreme temperature events (Figure. 6-1 and 6-2).

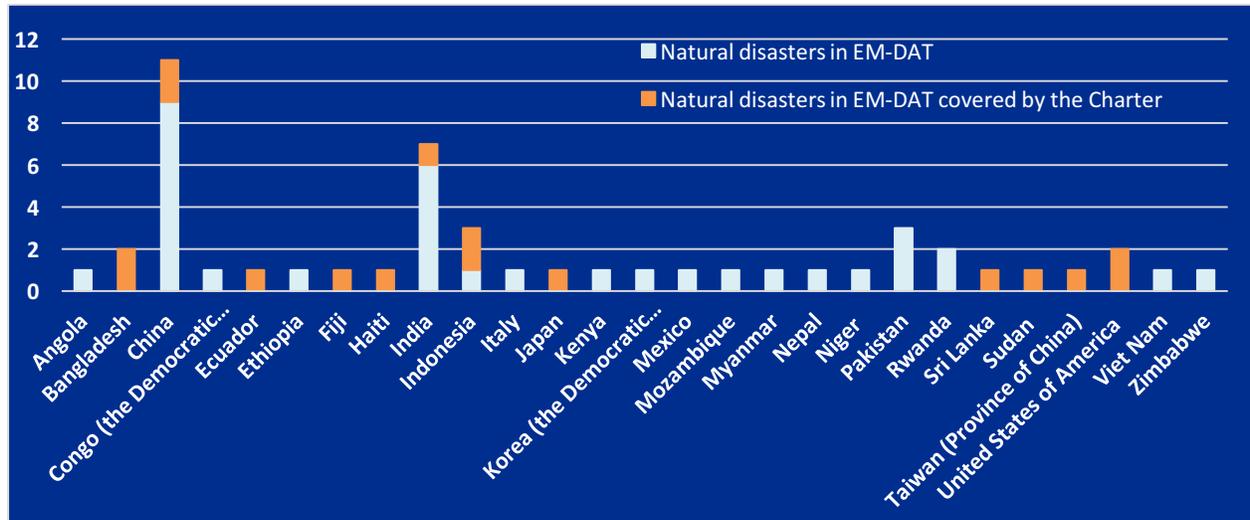


Figure 6-2. 2016 Breakdown by countries of the 50 major natural disasters (by fatalities) recorded by EM-DAT. In red, the ones covered by the Charter.

(Source: EM-DAT: The Emergency Events Database - Universite catholique de Louvain (UCL) - CRED, D. Guha-Sapir - www.emdat.be, Brussels, Belgium, filtered according to the type of disasters covered by the Charter)

For these 16 activations, requests were made by:

- Charter Authorised Users (AUs) for disasters in their countries: a flood and an ocean storm in USA, a flood and an ocean storm in China, an earthquake in Japan and a flood in India,
- AUs on behalf of other countries: ocean storm in Haiti,
- Charter Cooperating Bodies: the activations for flood in Sudan, flood in Indonesia, ocean storm in Fiji and earthquake in Ecuador were requested by UNITAR/UNOSAT; the activations for ocean storm and flood in Bangladesh, flood in Sri Lanka, earthquake in Indonesia and earthquake in Taiwan (province of China) were requested by ADRC.

This number is twice the number registered in 2015 and equivalent to the ones registered in the period 2010-2014, where the number ranged from 14 to 19 (Figure 6-1).

The Charter service was not requested for 34 out of the 50 most severe disasters events (by fatalities):

- 19 out of 34 occurred in countries with an AU (China (9), India (6), Italy and Pakistan (3)). For some of these events other satellite EO emergency response mechanisms were activated e.g. the earthquake in Italy was covered by the European Copernicus EMS service.
- 15 out of the 34 occurred in countries without an AU. All fall well within the hazard types of the Charter.
 - o 5 occurred in Asia (Myanmar, Nepal, Democratic People's Republic of Korea, Vietnam and Indonesia).
 - o 9 occurred in Africa (Angola, Democratic Republic of Congo, Ethiopia, Kenya, Mozambique, Niger, Rwanda (2) and Zimbabwe)
 - o 1 occurred in South America (Mexico).

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

6.2 System performances assessment

The triggering time between the disaster date and the reception of the User Request Form (URF) by the On-Duty Operator (ODO) is on average 37 hours. This time span includes the process of assessing that the received request fulfils the requirements to activate the Charter.

It should also be noted that for 55% of events in 2016, the Charter was activated (by an AU or a Cooperating Body) *within 24 hours after the disaster occurrence*, as shown in Figure 6-3. The quicker the Charter is activated after the occurrence of a disaster, the more effectively it can support emergency response.

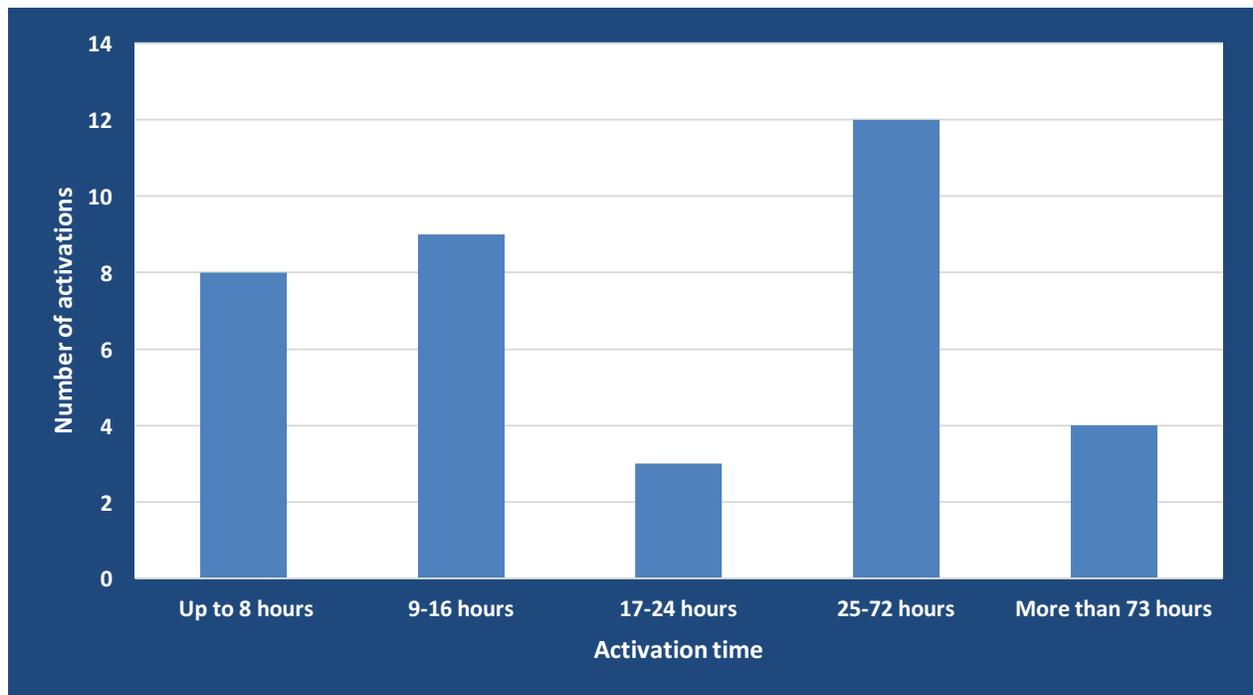


Figure 6-3. Time to activate the Charter by an AU or a Charter Cooperating Body in 2016
Statistics generated using information from 33 PM reports and the website

In 2016, the submission by the User of a request to the Charter occurred within 37 hours after the time of disaster occurrence, in average. Comparison with previous years is not possible, since up to 2015, the timeliness of the Charter was measured in days, instead of hours.

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.

The Charter activation time varies with the disaster type. As shown in Figure 6-4, for all earthquake events, a Charter activation was requested within the same day. In case of floods and ocean storms, the activation time varies from less than 8 hours to over 73 hours. For wildfires, the activation time is higher than 25 hours and for volcano eruptions the Charter it is within 72 hours. It is noted that for 65% of flood events, the Charter was activated within 24 hours. For many hazard types the time of occurrence of the disaster is not clearly defined (it sometimes requires to define a threshold about the transition from an emergency and a disaster).

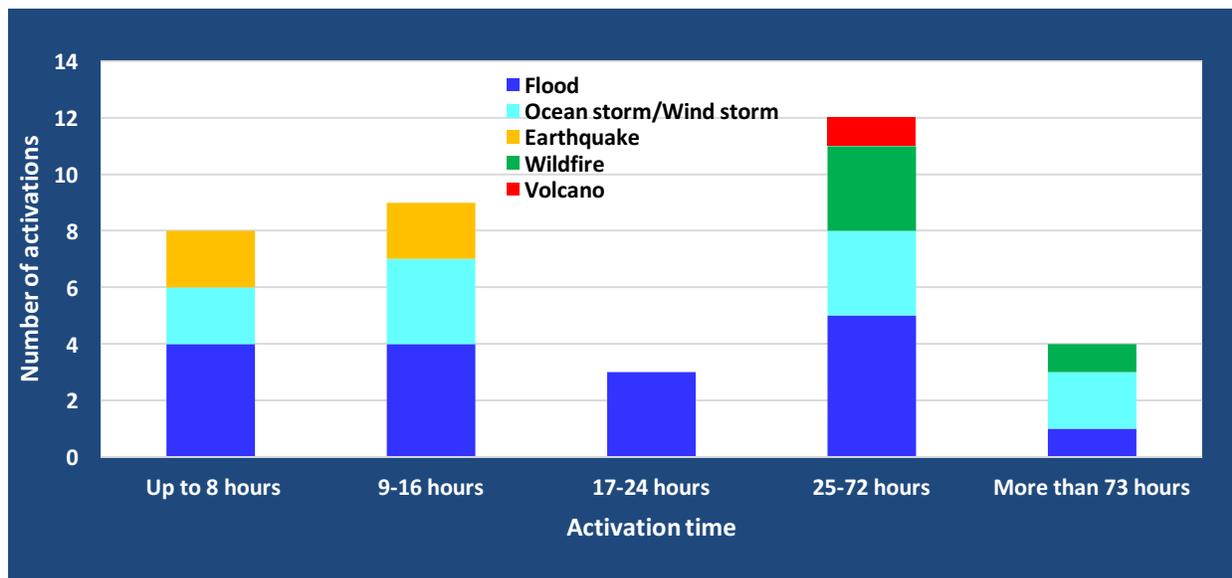


Figure 6-4. Time to activate the Charter by disaster type (2016)

Statistics generated using information from 33 PM reports and the website

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.

6.3 Assessment of products & services

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 supported by COS-2 addressed to ECO staff were held in 2016.
- Five PM trainings were held in Philippines, Argentina, Colombia, Indonesia. and UK. 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.
- 15 AU trainings were organised by ESA, CNES, DLR, ROSCOSMOS, CONAE and INPE 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 available 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 503: Flood in India

AU: ISRO, India

The Charter activation Project Manager (Panchagnula Manjurse, NRSC) stated that the activation of the Charter was very effective and the process went on fast and smoothly, according to the end-users. The data were provided in a timely manner and this service expedited the assessment of damage situation. The Charter products such as flood inundation maps showing the flood extent in Bihar state and annotated satellite image maps showing the flooding near Patna city and Bhagalpur city in Bihar were used to understand the infrastructure damages and plan the relief management.

Activation 508: Flood in Dominican Republic

AU: Comisión Nacional de Emergencias, Dominican Republic

The End User with its inter-institutional working group (EIGEO) were able to work with the Charter data and produce their own Value-Added products. DLR-ZKI produced the first two rapid mapping products and then provided support and assistance to EIGEO with handling the Charter data. Xavier Rodriguez (Comisión Nacional de Emergencias) provided the following feedback of how the data (i.e. Value-Added products) were used:

- good cooperation between the PM and the AU/EU
- Radar images were very useful
- Identify which roads were flooded or could be used for humanitarian aid
- Identify which public schools could be used as shelters for people who lost their homes
- Identify which crops were flooded (together with in situ data and land use information)
- Charter data were compared with historical flood maps for verification
- Charter products were used for monthly meetings of higher level emergency management and decision makers.

The end user highlighted the importance of the Charter's support the emergency management activities of this event.

However, a few AUs have remarked that some EO based damage mapping products were sometimes too coarse to observe and estimate damages (several hazard types) and some products were not able to capture the hazard impact (e.g. in case of flash floods). Such cases could be reduced by a better filtering of requests to avoid Charter activation for events for which the contribution of satellite imagery is too limited with current EO missions. Moreover, some AUs noted that the products are of good quality but sometimes 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).

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.

Looking at the technical aspects associated to service delivery examples of recurrent users' recommendations reported by the PMs are:

- A single FTP gathering all satellite data would be very convenient.
- The website is a little overwhelming to use for accessing results.
- It is considered very important that PMs receive training and integral upgrade about the different process that are involucrate during the Charter activation: need to improve the knowledge in the COS -2 System management.
- It is needed to acquire specialized software to be able to exploit data more efficiently (the Charter should help access such tools if possible).

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 Universal Access, in particular they were active in 2016 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. 4000 followers were counted by end of 2016 (many more will actually be reached due to re-tweets of Charter messages, e.g. through Charter agency twitter accounts).
- Participation in international/regional events all over the world to promote the Charter and the Universal Access (UA) initiative.

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 2016, the following agencies took the lead function which rotates among Charter members on a six-month basis: the United States Geological Survey, USGS (October 2015 – April 2016), the Comisión Nacional de Actividades Espaciales, CONAE (April 2016 – October 2016), and the Russian Federal Space Agency, ROSCOSMOS (October 2016 – April 2017). 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 Sioux Falls, USA in April 2015, Cordoba, Argentina in April 2016 and Moscow, Russia in October 2016.

Throughout the reporting period, there were 36 activations in 24 countries, a similar figure to the yearly ‘average’ between 2007 and 2015. In total, the Charter has been triggered for 517 disasters in 119 countries since 2000. The Charter was activated for Hurricane Matthew in five countries within the first week of October 2016.

April, May and October 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.

Five Charter activations were among the 10 most severe natural disasters in 2016 as registered by CRED’s EM-DAT. The Ecuador earthquake on April 16, affecting more than 380,000 and killing 673 people and Hurricane Matthew in the Caribbean and USA, affecting more than 2,000,000 and killing 601 people have been recorded as the most catastrophic events. Apart from this event, 2016 was evaluated as a moderate year concerning the impact of natural disaster events in terms of fatalities and damages. A total of 9,200 people lost their lives globally.

ABAE has been fully integrated into the Charter. The Charter conducted the official signature ceremony, that marked the accession of ABAE to the Charter during the 36th Board meeting in Moscow, Russia on 17-20 October 2016.

Following the request of the UAESA to become Charter member, supported by the MBRSC, representatives from UAESA will introduce their organization during the 37th Charter Board meeting in Oxford, UK on 24-28 April 2017.

Universal Access (UA) is gradually progressing. UA allows disaster risk management organizations worldwide to be granted Authorized User (AU) status. Belarus, Iraq, El Salvador, Guatemala and Uruguay have had their national users granted Charter access in 2016. Other candidates are under assessment or training. 53 countries and the EC have dedicated AUs reaching the total of 63 user organizations able to directly request Charter activations by the end of 2016. Charter members have continued to promote UA and the Charter as a whole through their participation in different international events held in 2016.

The Charter also continued its 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. For 2016, the Charter supported six requests from the CEOS flood pilot.

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). Within 2017, it will generate helpful statistics to support Charter reporting.

Five Project Manager training sessions were organized by JAXA, USGS, CONAE, DLR, CNES, UKSA/DMCii and ESA to strengthen the network of Charter PMs. An on-line refresher training course is also available.

The Charter website is available in English and some pages are available in French, Chinese, Japanese and Spanish. It allows direct access to COS-2 to authorized staff. Within 2017, the translation of the web pages in Spanish and French, will be completed. <https://www.disasterscharter.org/web/guest/home> Two Charter newsletters were issued in 2016. 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.