EUROPEAN COMMISSION
JOINT RESEARCH CENTRE

6 July 2018,16:30 UTC

Tropical Cyclone MARIA

Japan, China

GDACS Tropical Cyclone Red Alert
6 July 2018 - ongoing

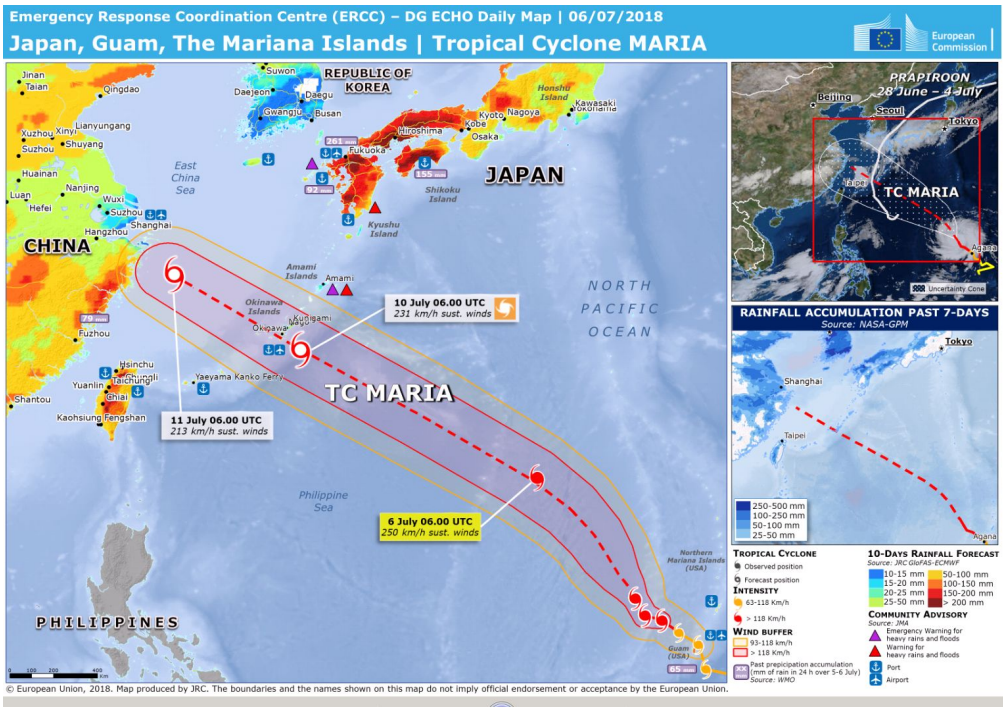


Figure 1 *- TC MARIA Japan (as of 6 July 2018, 16:30 UTC)*

1 Executive Summary

- Tropical Cyclone **MARIA** formed over the Pacific Ocean on 2nd July and started moving north-west, strengthening. On 6 July at 6:00 UTC, its centre was located over the sea approx. 1800 km south-east of **Okinawa** group of islands(Japan) and it had maximum sustained winds of 250 km/h (**Cat. 5 Cyclone Saffir Simpson scale**).
- Over the next 48 hours, it is expected to keep heading northwest toward **Okinawa** as a very intense Typhoon (equivalent to Category **4-5** in the Saffir Simpson Scale). Heavy rain may continue to affect several areas of The Marianas and excessive rainfall and flash flooding remain possible especially across **Guam** and **Rota**.

- The Japan Meteorological Agency has issued advisory messages for Okinawa islands, warnings for heavy rain in Mijyako Chiho island, Amami group of island, the whole Kyushu island and southwestern Honshu island with some prefectures in Emergency Warning due to possible floods .
- The Joint Research Centre (JRC) is following the event through the information automatically collected and analysed in the Global Disasters Alerts and Coordination System (GDACS). GDACS issued a RED alert for TC MARIA in Japan on 5th July but the large uncertainty in the track, the large leading time and the low vulnerability of Japan, suggested to manually downgrade it to ORANGE; on 6th July, persisting the strong wind forecast, the alert level became **RED**.

2 Situation Overview

2.1 Meteorological Situation

Tropical Cyclone MARIA

- **PAST**: Tropical Cyclone MARIA formed over the Pacific Ocean on 2nd July and started moving north-west, strengthening.
- **CURRENT**: On On 6 July at 6:00 UTC, its centre was located approx. 1750 km south-east of Okinawa Island (Japan) with maximum sustained winds of 259 km/h (**Cat. 5 Cyclone Saffir Simpson scale**). .
- **FORECAST** (as of On 6 July at 6:00 UTC): Over the next 48 hours, it is expected to keep heading northwest toward Okinawa as a very intense Typhoon (equivalent to Category 4-5 in the Saffir Simpson Scale).
- **HAZARDS:** Heavy rains, strong winds and storm surge could affect Okinawa area and Ryukyu islands on 10-11 July. Heavy rains could also will affect southern and eastern areas of the People's Republic of China (and Shanghai is on the expected track) if the cyclone will continue moving in the same direction.
- **UNCERTAINTY**: TC MARIA is still high as 4 days from reaching the Okinawa island and the uncertainty on the intensity is still high.

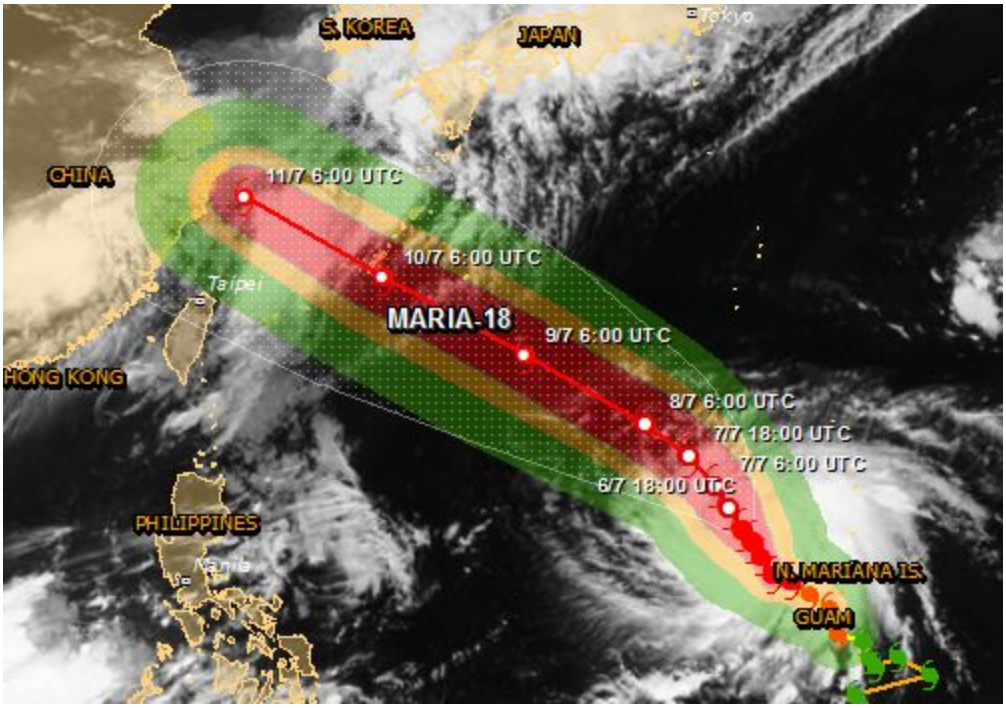
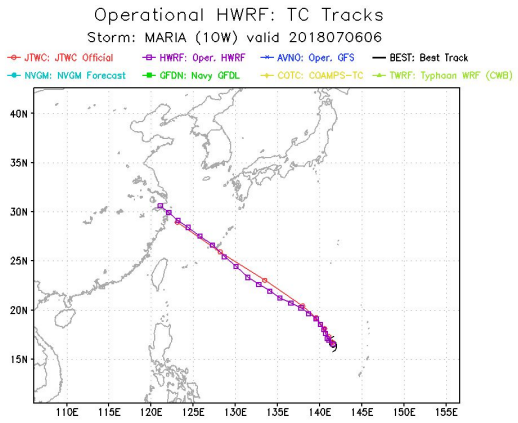


Figure 2 *- TC MARIA in the Pacific Ocean (as of 6th July, 12:00 UTC)*



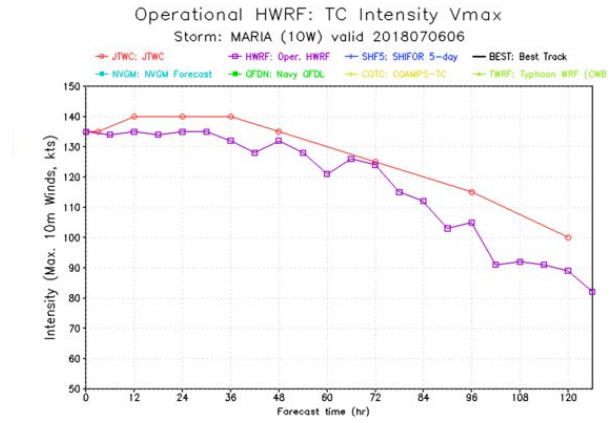
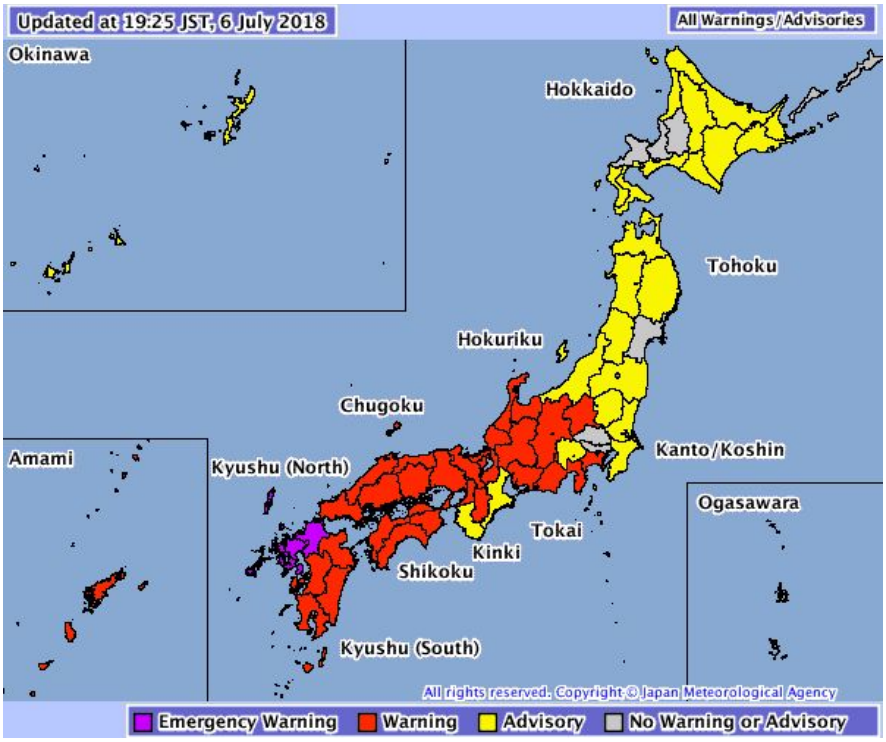


Figure 3 *- HWRF NOAA operational forecast: trajectories and estimated maximum winds based on 20180706 06 UTC*

Warnings in effect

At the time of writing, the Japanese Meteorological Agency issued Advisory Messages for the Okinawa island and Warning for one location, Kumejima (island). The expected effects are heavy rain, high waves and thunderstorms. Heavy rain Warning Message is active also for large part of south Japan, with risk of inundation and floods.



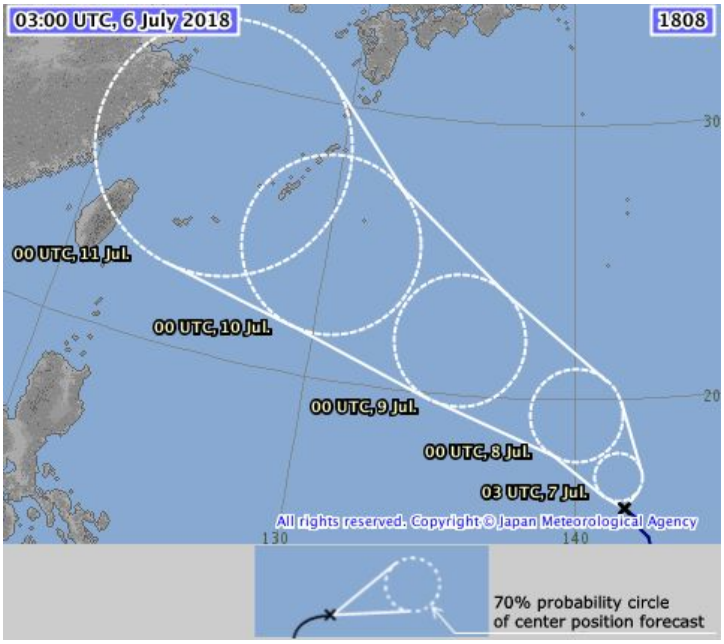


Figure 4 *- Advisory messages and 5 days track from JMA; landfall on Okinawa island is expected between 10th and 11th July.*

2.2 Humanitarian impact

Up to now no humanitarian impact, TC MARIA is still over the sea, so no impact yet.

The population of the provinces potentially affected in Japan and China (the countries potentially most affected according to the last forecast available) is shown in the table below.

Affected provinces

Region Province	Country	Population
Okinawa	Japan	1.2 million people
Zhejiang	China	45.9 million people

Figure 5 *- Population of the potentially affected provinces (source:GDACS)*

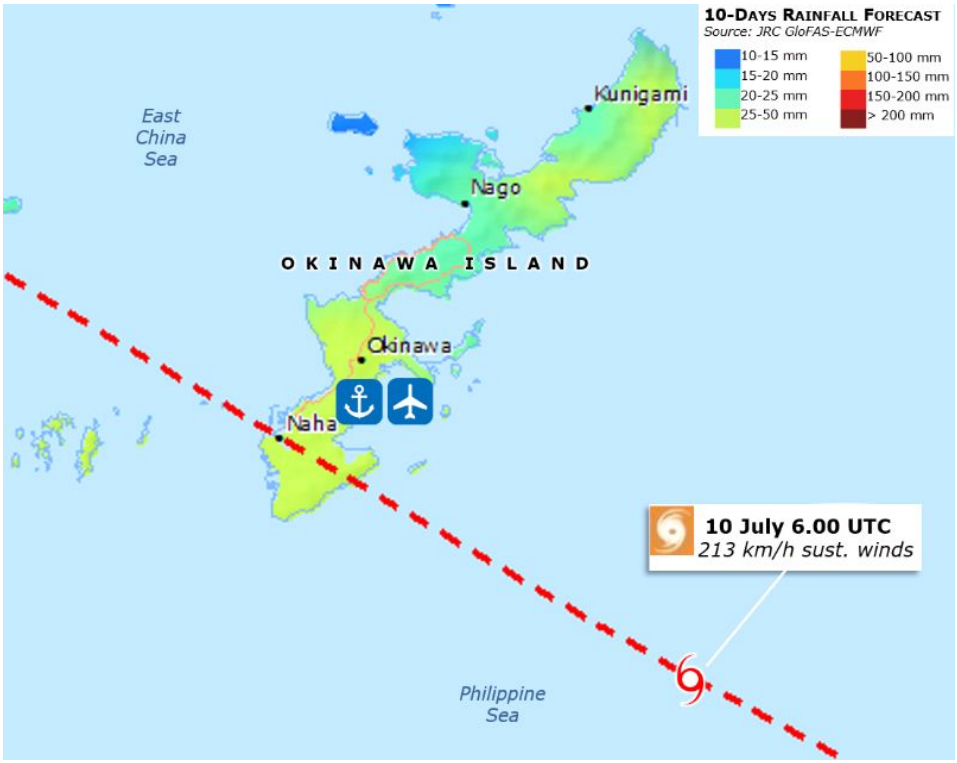


Figure 6 *- Detail of the Okinawa island and indication of the expected rainfall*

3 JRC contributions

In the period after the end of ARISTOTLE services and the beginning of the new 24h service that is being prepared, JRC supplies ERCC with a similar service during working hours.

The JRC provides updated information on TC MARIA since 29 June for the ECHO Daily Flash reports, available at http://erccportal.jrc.ec.europa.eu/ECHO-Flash.

GDACS System

JRC is responsible for the operation of GDACS (www.gdacs.org) that plays a major role in alerting the international community to humanitarian emergencies during natural disasters. The alerts of GDACS (Green, Orange, Red) are elaborated based on the severity of the event, the population involved and the vulnerability of the countries (see Annex). GDACS also sends e-mail and SMS alerts to subscribed recipients.
The JRC is closely following this event because of the strength of this Tropical Cyclone and the vulnerability of the country. The present report was done at the request of the ERCC.

Event alert

GDACS issued a **RED** alert for TC MARIA in Japan on 5th July but the large uncertainty in the track and the long time to reach Japan, suggested to manually downgrade it to **ORANGE**; on 6th July the alert was again estimated **RED** and remained like that because the lead time is smaller than 3 days.

The expected impact due to winds, rainfall and storm surge are shown below, while the automatic GDACS report for TC MARIA can be found at this address: http://www.gdacs.org/report.aspx?name=MARIA-18.

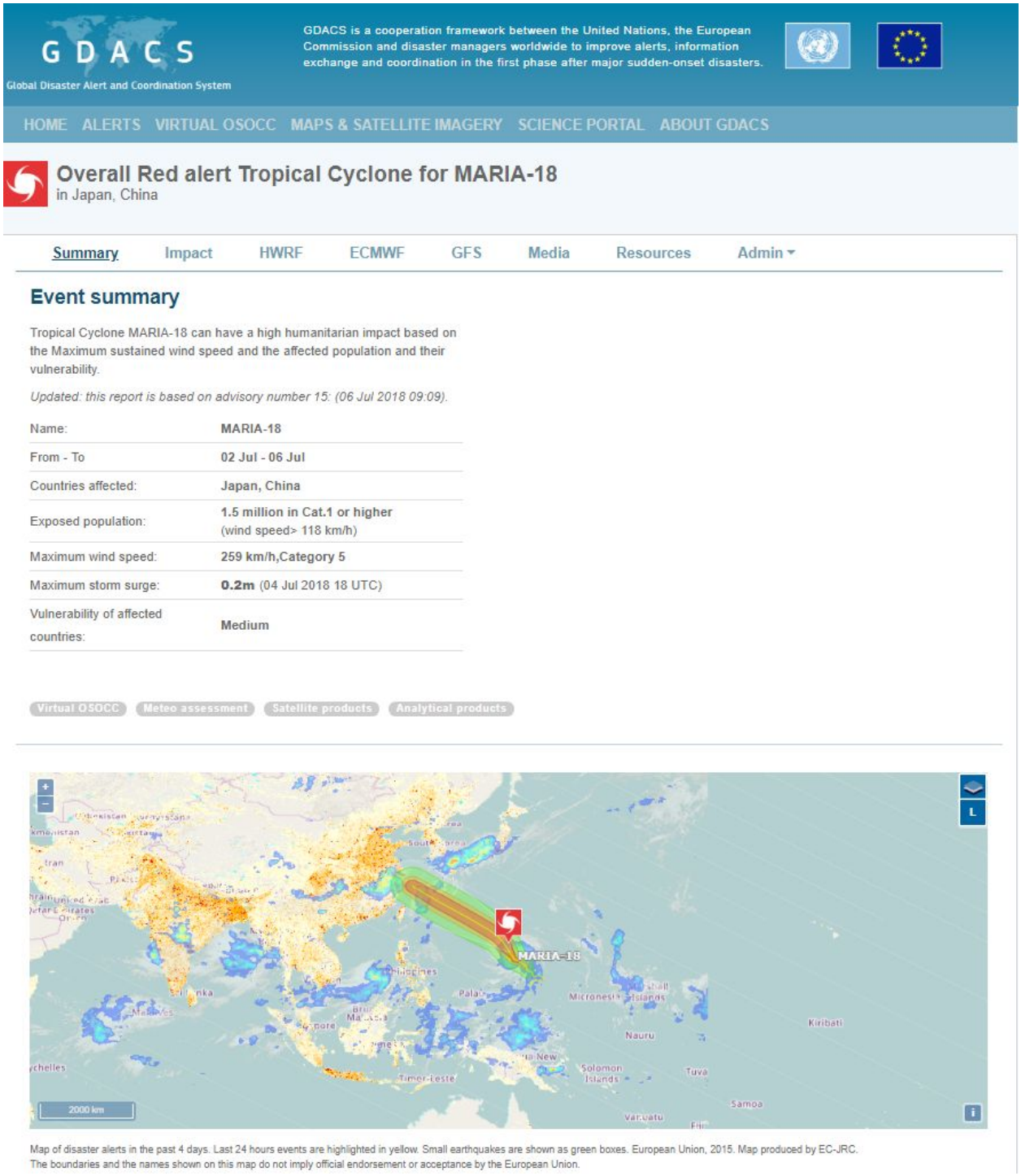


Figure 7 *- Automatic GDACS impact estimation (as of 6 July 2018 6:00 UTC).*

Bulletin Timeline

Advisory	Alert color	Date (UTC)	Category	Wind speed	Population in Tropical Storm	Population in Cat.1 or higher	Location (lat, lon)
1		02 Jul 2018 18:00	Tropical depression	**46 km/h** (29 mph)	no people	no people	9.9, 146
2		03 Jul 2018 00:00	Tropical depression	**46 km/h** (29 mph)	no people	no people	10.4, 145.8
3		03 Jul 2018 06:00	Tropical depression	**46 km/h** (29 mph)	no people	no people	11.1, 148.5
4		03 Jul 2018 12:00	Tropical depression	**46 km/h** (29 mph)	no people	no people	11.8, 147.3
5		03 Jul 2018 18:00	Tropical depression	**46 km/h** (29 mph)	no people	no people	11.4, 146.5
6		04 Jul 2018 00:00	Tropical depression	**46 km/h** (29 mph)	no people	no people	11.7, 146.3
7		04 Jul 2018 06:00	Tropical depression	**56 km/h** (34 mph)	210000 people	no people	12.4, 146.1
8		04 Jul 2018 12:00	Tropical storm	**65 km/h** (40 mph)	160000 people	no people	12.6, 145.2
9		04 Jul 2018 18:00	Tropical storm	**102 km/h** (63 mph)	210000 people	<1000 people	13.6, 144.9
10		05 Jul 2018 00:00	Tropical storm	**111 km/h** (69 mph)	210000 people	no people	14.1, 144.1
11		05 Jul 2018 06:00	Category 1	**130 km/h** (80 mph)	160000 people	no people	14.6, 143.4
12		05 Jul 2018 12:00	Category 1	**148 km/h** (92 mph)	no people	no people	14.8, 142.7
13		05 Jul 2018 18:00	Category 3	**204 km/h** (126 mph)	no people	no people	15.5, 142.3
14		06 Jul 2018 00:00	Category 5	**259 km/h** (161 mph)	no people	no people	16, 142
15		06 Jul 2018 06:00	Category 4	**250 km/h** (155 mph)	no people	no people	16.5, 141.6
15		06 Jul 2018 18:00	Category 5	**259 km/h** (161 mph)	no people	no people	17.3, 141.1
15		07 Jul 2018 06:00	Category 5	**259 km/h** (161 mph)	no people	no people	18.1, 140.6
15		07 Jul 2018 18:00	Category 5	**259 km/h** (161 mph)	no people	no people	19.2, 139.6
15		08 Jul 2018 06:00	Category 4	**250 km/h** (155 mph)	2000 people	no people	20.4, 138
15		09 Jul 2018 06:00	Category 4	**231 km/h** (143 mph)	1.4 million people	1.2 million people	23, 133.5
15		10 Jul 2018 06:00	Category 4	**213 km/h** (132 mph)	91.6 million people	1.4 million people	25.9, 128.2
15		11 Jul 2018 06:00	Category 3	**185 km/h** (115 mph)	no people	no people	28.9, 123.1

Actual track of the current bulletin
The alert for forecast greater than 3 days is limited to Orange level.

***Figure 8** - GDACS Alert for Tropical Cyclone MARIA - Event Timeline, population affected, max. sustained winds (the Category is based on the SSHS, see Annex). It can be noted that last 2 rows in the list, have a lead time larger than 3 days: for these forecast the maximum alert level is Orange, even if the conditions are related to a Red alert.*

Impact estimation

The TCs have three dangerous effects (strong winds, heavy rains and storm surge). The possible impact of these effects in the affected countries (Japan) is shown below.

Wind

- JAPAN: The center of MARIA is expected to pass on **Okinawa** islands on 10 July evening (UTC) / 11 July early morning as a Tropical Cyclone, with max. sustained winds of 210-215 km/h

(equivalent to a Category 4 in the SSHS, see Annex). Strong winds (up to 213 km/h, with higher gusts) could affect the island.

Potentially most affected areas: **Okinawa**.

Rainfall

- JAPAN: TC MARIA is expected to produce locally heavy rains (up to 250 mm, HWRF) in Okinawa and Miyako islands during its passage on 30 June-1 July.

The area potentially to be mostly affected is the island of Okinawa. Details of climatological parameters are provided (see Tables below) for Okinawa but also for Taipei (Taibei) and Shanghai.

Climatological Information Mean Total Precipitation in mm	June	July
Naha (Okinawa Island)[1]	247	141
Taipei - Taibei (Taiwan - Republic of China)	288	202
Wenzhou (China)	246	178
Shanghai (China)	152	128

Climatological Information Mean Number of Precipitating Days	June	July
Naha (Okinawa Island)	11	9
Taipei - Taibei (Taiwan - Republic of China)	-	-
Wenzhou (China)	18	15
Shanghai (China)	14	12

Details of anticipated (forecast) weather conditions including total precipitation and wind speed maxima over the islands of Okinawa and Kumejima are provided in Annex 4 that contains also details for Taipei (Taibei), Wenzhou and Shanghai based on the ECMWF (European Center for Medium-Range Weather Forecasts) model platforms.

[1] http://worldweather.wmo.int/en/city.html?cityId=186

Storm Surge

The storm surge calculation is performed until 10 July 6:00 and the cyclone has just reached the Okinawa area at that time. Therefore the maximum value of the storm surge could still increase.

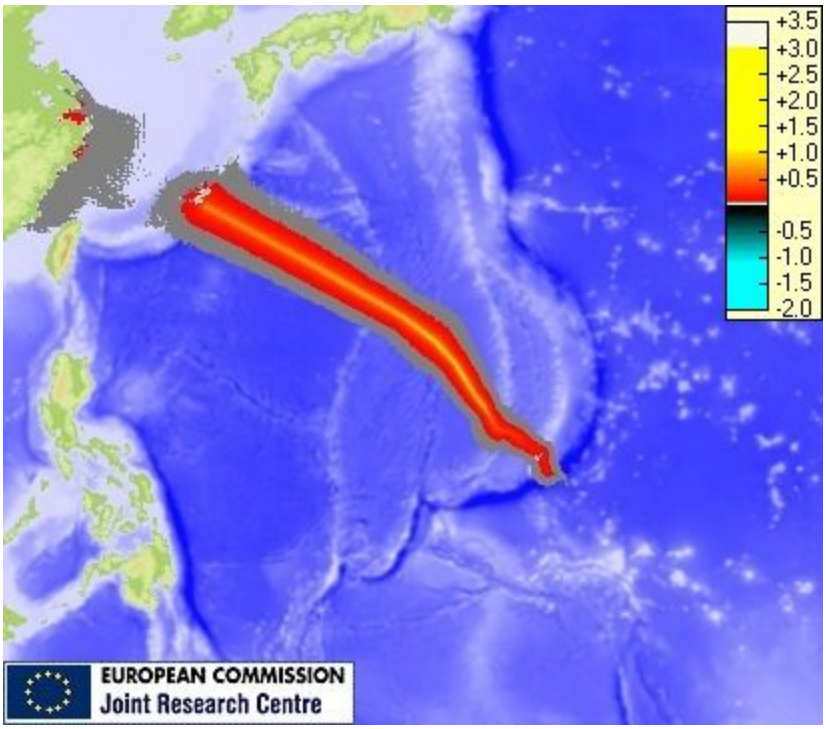


Figure 9 *- Expected sea level along the track of MARIA-18*

The list below indicates a maximum storm surge in the order of 0.5 m in Henna, Ishikawa and Kin, on Okinawa islands, Japan.

Date	Name	Country	Alert	Storm surge height (m)
10 Jul 2018 06:00:00	Henna	Japan		0.5m
10 Jul 2018 06:00:00	Ishikawa	Japan		0.5m
10 Jul 2018 06:00:00	Kin	Japan		0.5m
10 Jul 2018 06:00:00	Ichi	Japan		0.4m
10 Jul 2018 06:00:00	Atsuta	Japan		0.4m
10 Jul 2018 06:00:00	Fusozaki	Japan		0.4m
10 Jul 2018 06:00:00	Obo	Japan		0.3m
10 Jul 2018 06:00:00	Ogimi	Japan		0.3m
10 Jul 2018 06:00:00	Nago	Japan		0.3m
10 Jul 2018 06:00:00	Nakaza	Japan		0.3m
10 Jul 2018 06:00:00	Teima	Japan		0.2m
10 Jul 2018 06:00:00	Itoman	Japan		0.2m
10 Jul 2018 06:00:00	Kaata	Japan		0.2m
10 Jul 2018 06:00:00	Nakao	Japan		0.2m
10 Jul 2018 06:00:00	Kadena	Japan		0.2m

It should be noted that the JRC storm surge calculations don't include wave, tide and river effects. It is important to note that in the area of a delta river, the storm surge may be higher. The torrential rains that may affect the mountains areas during the passage of a Tropical Cyclone may increase the river flow and its outflow could be blocked by the incoming storm surge. This could create floods in the surrounding areas of the cities close to a delta river.

4 Other information

4.1 Copernicus EMS activation

No activation of Copernicus EMS system up to now.

4.2 Virtual OSOCC Activation

None.

4.3 International Charter activation

None.

5 Expected Updates

The report will be updated if relevant changes will be identified.

6 References and contact points within JRC

Contact points within JRC: Disaster Risk Management Unit
- Alessandro Annunziato, alessandro.annunziato@ec.europa.eu
- Thomas Petroliagkis, thomas.petroliagkis@ec.europa.eu
- Pamela Probst, pamela.probst@ec.europa.eu
- Chiara Proietti, chiara.proietti@ec.europa.eu

- Ian Clark, ian.clark@ec.europa.eu
- Tom De Groeve, tom.de-groeve@ec.europa.eu

For updated information on the disaster, please consult the following web sites:

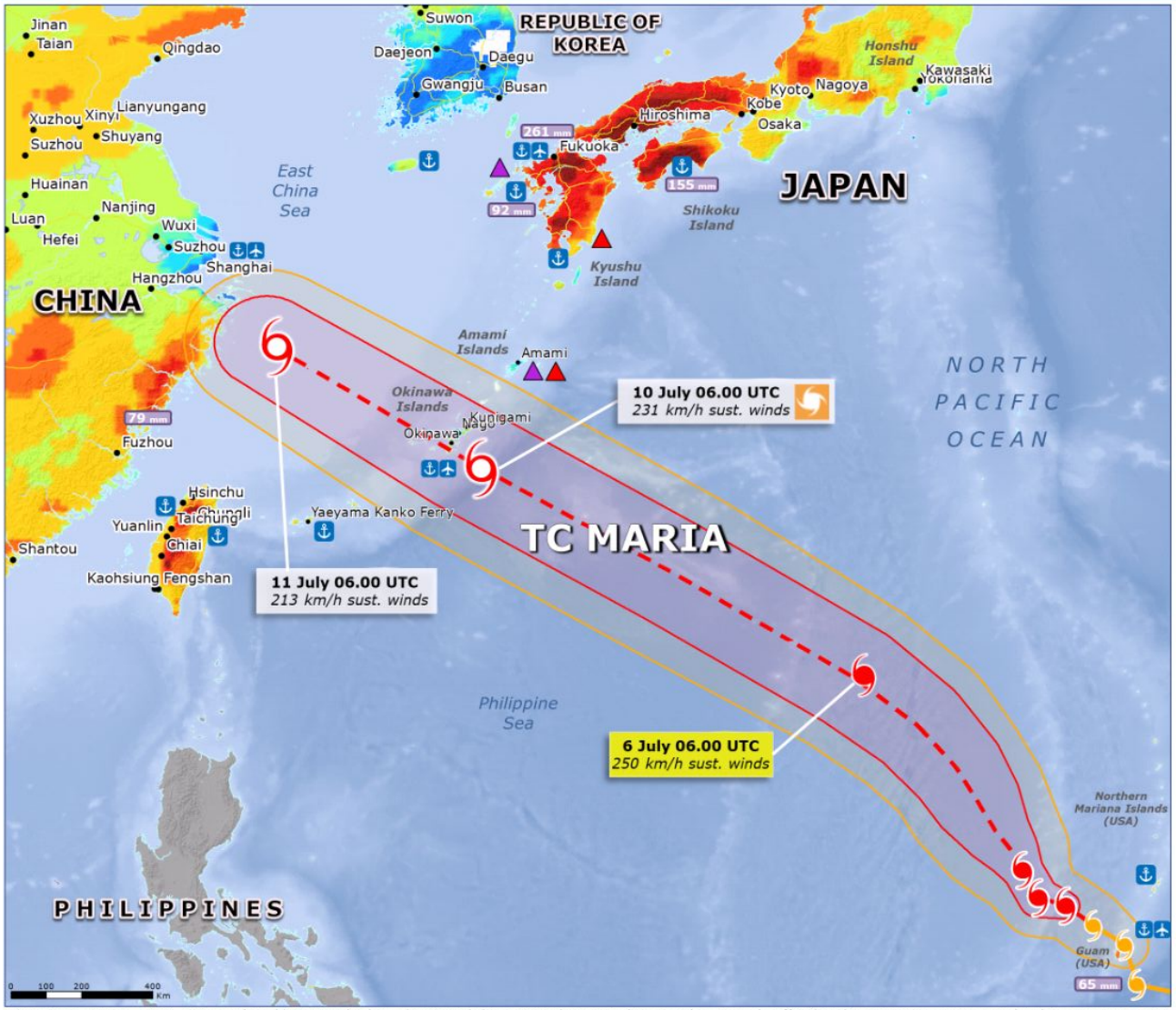
- GDACS: http://www.gdacs.org
- ERCC portal: http://erccportal.jrc.ec.europa.eu/
- Copernicus EMS: http://emergency.copernicus.eu/mapping/list-of-components/
- National Meteorological service:
    - Japan: http://www.jma.go.jp/jma/indexe.html
- WMO Severe weather Information Centre: http://severe.worldweather.org/
- Stars & Stripes: https://www.stripes.com/news/super-typhoon-10w-maria-19-1.535690
- Regional Specialized Meteorological Centres (RSMCs) and Tropical Cyclone Warning Centres (TCWCs):
    - http://www.jma.go.jp/en/typh/
- NOAA-HWRF (Hurricane Weather Research and Forecasting system): http://www.emc.ncep.noaa.gov/gc_wmb/vxt/HWRF/index.php

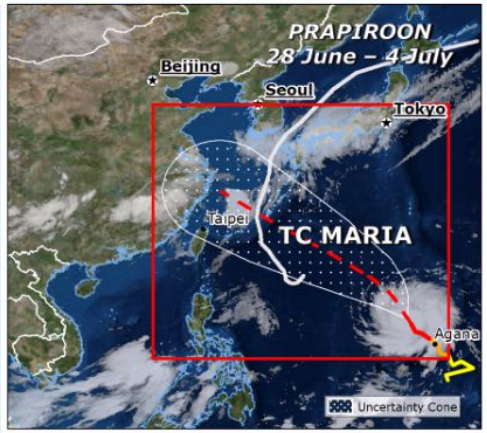
Annex 1 - Detailed Map on the Tropical Cyclone

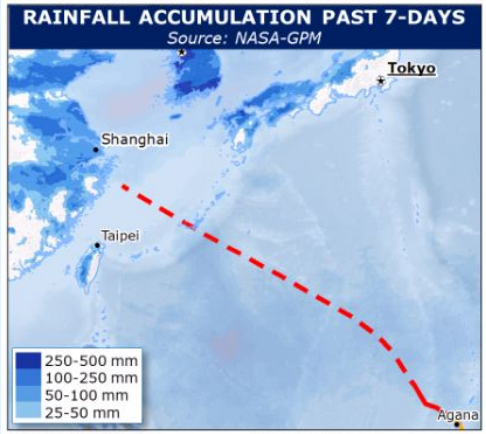
Emergency Response Coordination Centre (ERCC) – DG ECHO Daily Map | 06/07/2018

Japan, Guam, The Mariana Islands | Tropical Cyclone MARIA

European Commission







Tropical Cyclone
- Observed position
- Forecast position

Intensity
- 63-118 Km/h
- > 118 Km/h

Wind Buffer
- 93-118 km/h
- > 118 Km/h
- Past prepicipation accumulation (mm of rain in 24 h over 5-6 July) *Source: WMO*

10-Days Rainfall Forecast
Source: JRC GloFAS-ECMWF
- 10-15 mm
- 15-20 mm
- 20-25 mm
- 25-50 mm
- 50-100 mm
- 100-150 mm
- 150-200 mm
- > 200 mm

Community Advisory
Source: JMA
- Emergency Warning for heavy rains and floods
- Warning for heavy rains and floods
- Port
- Airport

Annex 2 - GDACS Alerts

JRC is responsible for the operation of GDACS, that plays a major role in alerting the international community to humanitarian emergencies during natural disasters. The alerts of GDACS (Green, Orange, Red) are elaborated based on the severity of the event, the population involved and the vulnerability of the countries. GDACS also sends e-mail and SMS alerts to subscribed recipients. A detailed description of GDACS can be found in the GDACS Guidelines available at: http://www.gdacs.org/Documents/GDACS%20Guidelines%202014_-_FINAL.PDF

GDACS ALERTS		
	**GREEN ALERT**	Moderate event, International Assistance not likely
	**ORANGE ALERT**	Potential local disasters, International Assistance might be required
	**RED ALERT**	Potentially severe disasters, International Assistance is expected to be required

Tropical Cyclones have three dangerous effects (strong winds, storm surge and heavy rain).

Wind

The GDACS alert levels for the TCs are based on the risk formula that includes:

- TC wind speed (hazard)
- Population affected
- Vulnerability of the affected country

The overall alert for a Tropical Cyclone comes from **wind effects.**

The equivalent Category based on the Saffir-Simpson Hurricane Wind Scale (SSHS) is also indicated in GDACS (see next page).

Storm Surge

Storm surge is an abnormal rise of water above the predicted astronomical tides, generated by strong winds and by a drop in the atmospheric pressure. It was implemented in the HyFlux2 code, routinely used in GDACS to model inundation due to tsunami run-up.

The GDACS alert levels are based on the maximum storm surge height:

- Green: < 1.0 m;
- Orange: 1.0m - 3.0 m;
- Red: > 3.0 m.

It should be noted that the estimation of the sea level is strongly dependent on the initial data (wind velocity and direction). The sea level change according to each bulletin that was available

JRC is preparing a new alert system that will include all the effects.

TC Classification used in GDACS

The equivalent Category based on the Saffir-Simpson Hurricane Wind Scale (SSHS) is also indicated in GDACS. The SSHS is the official scale used by NOAA-NHC for the North Atlantic TC basin and is a scale from 1 to 5, based on the hurricane's 1-min sustained wind speed and it estimates the potential property damage (see table below).

Saffir-Simpson Hurricane Wind Scale (SSHS), source NOAA-NHC		
Hurricane CATEGORY	**1-min sustained winds (km/h)**	**Types of Damage Due to Hurricane Winds**
Cat. 1	119 - 153	Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
Cat. 2	154 - 177	Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks
Cat. 3 *Major Hurricane*	178 - 208	Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes
Cat. 4 *Major Hurricane*	209 - 251	Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
Cat. 5 *Major Hurricane*	≥ 252	A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months

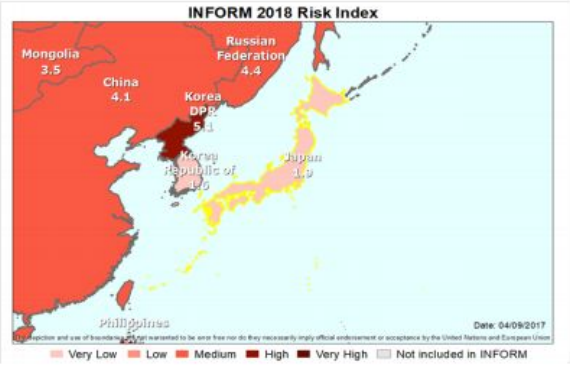
TC Classification (Saffir-Simpson Hurricane Wind Scale)
see NOAA-NHC: http://www.nhc.noaa.gov/aboutsshws.php

Annex 3 - INFORM

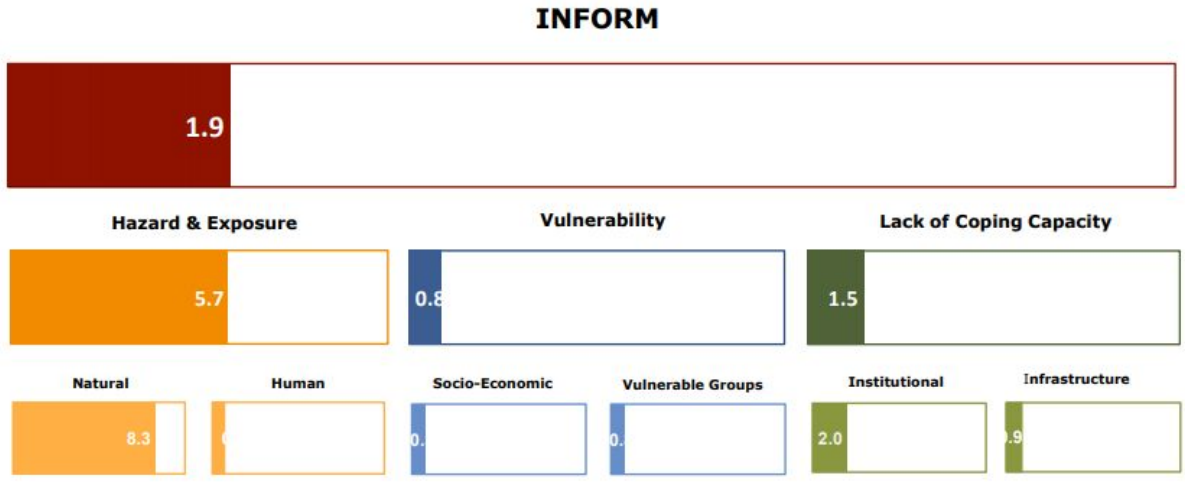
JAPAN
Eastern Asia
High income: OECD

INFORM Country Risk Profile
VERSION 2018

	Value	*Rank*	*Trend (3 years)*
INFORM Risk	**1.9**	**157**	→
Hazard & Exposure	**5.7**	**32**	→
Vulnerability	**0.8**	**184**	→
Lack of Coping Capacity	**1.5**	**179**	→



RISK PROFILE



Annex 4 - Weather forecasts for Specific Locations (Ensemble Meteograms)

1 - Product Description

Ensemble Meteograms contain information coming from both the deterministic singe model high-resolution (HIRES) operational forecast and the Ensemble Prediction System (EPS) comprising 50 ensemble (ENS) members plus one (control forecast).

The horizontal resolution of the HIRES is ~8 km whereas the resolution of ensemble members (and the control) is ~16 km. HIRES is denoted by blue, whereas the control forecast (of the ensemble) is denoted by red colour.

The values of the ensemble are contained in a box plot type of diagram that graphically depicts groups of numerical data through their quartiles while maximum and minimum values are highlighted by whiskers.

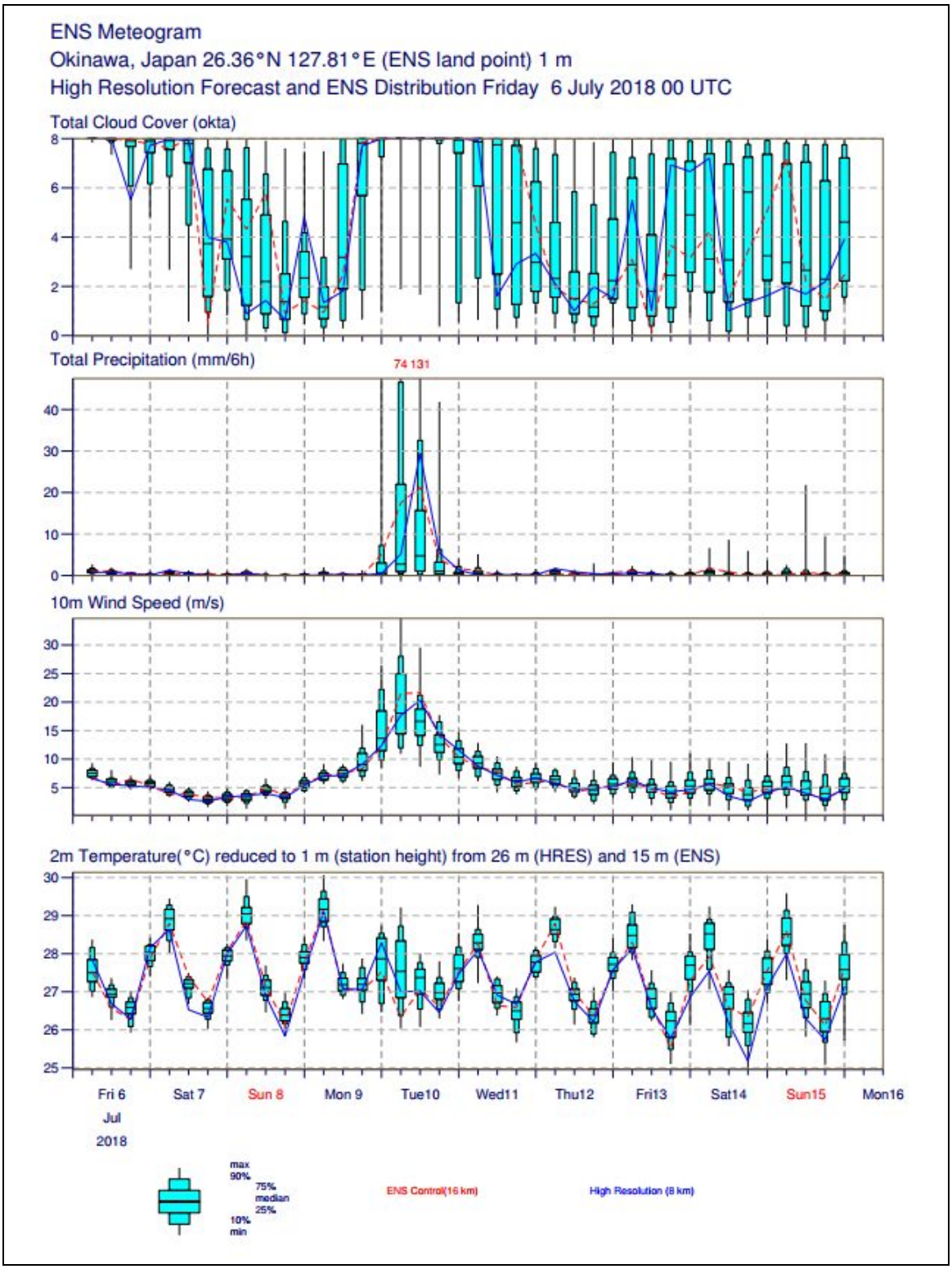
The first panel of meteogram contains the total (low - medium & high) cloudiness in octas.

The second panel refers to the total (convective and large-scale) precipitation utilising values estimated over 6-hour intervals (mm/6-hours). The third panel refers to the instantaneous (averaged over 10 minutes) wind speed values in m/s [1 m/s equals to 3.6 km/h]. The fourth panel refers to the air temperature (degrees Celsius) at 2-meter height.

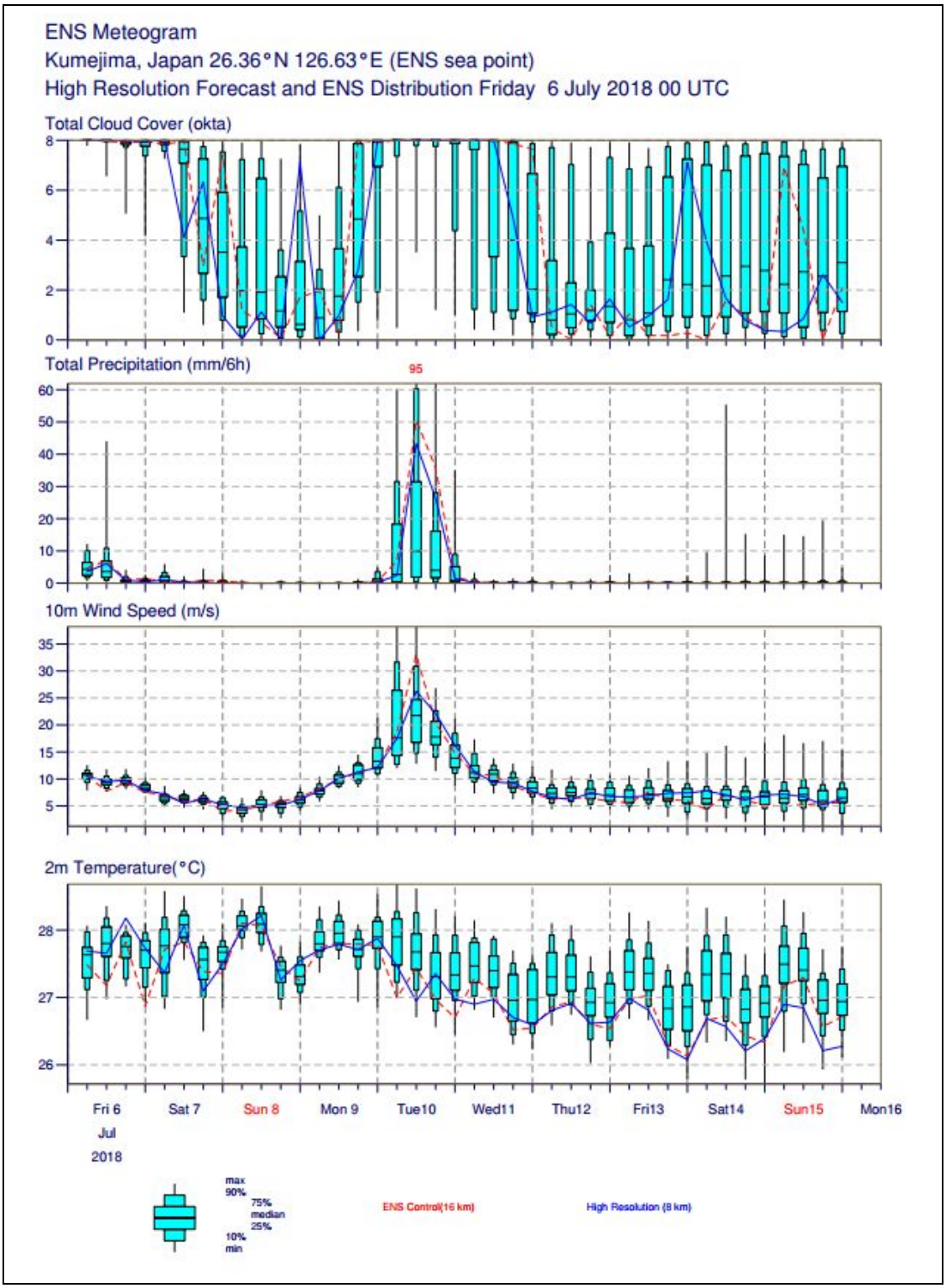
The pinpoint forecasts refer to:

- *Okinawa (Japan)*
- *Kumejima (Japan)*
- *Taipei - Taibei (Taiwan - Republic of China)*
- *Wenzhou (China)*
- *Shanghai (China)*

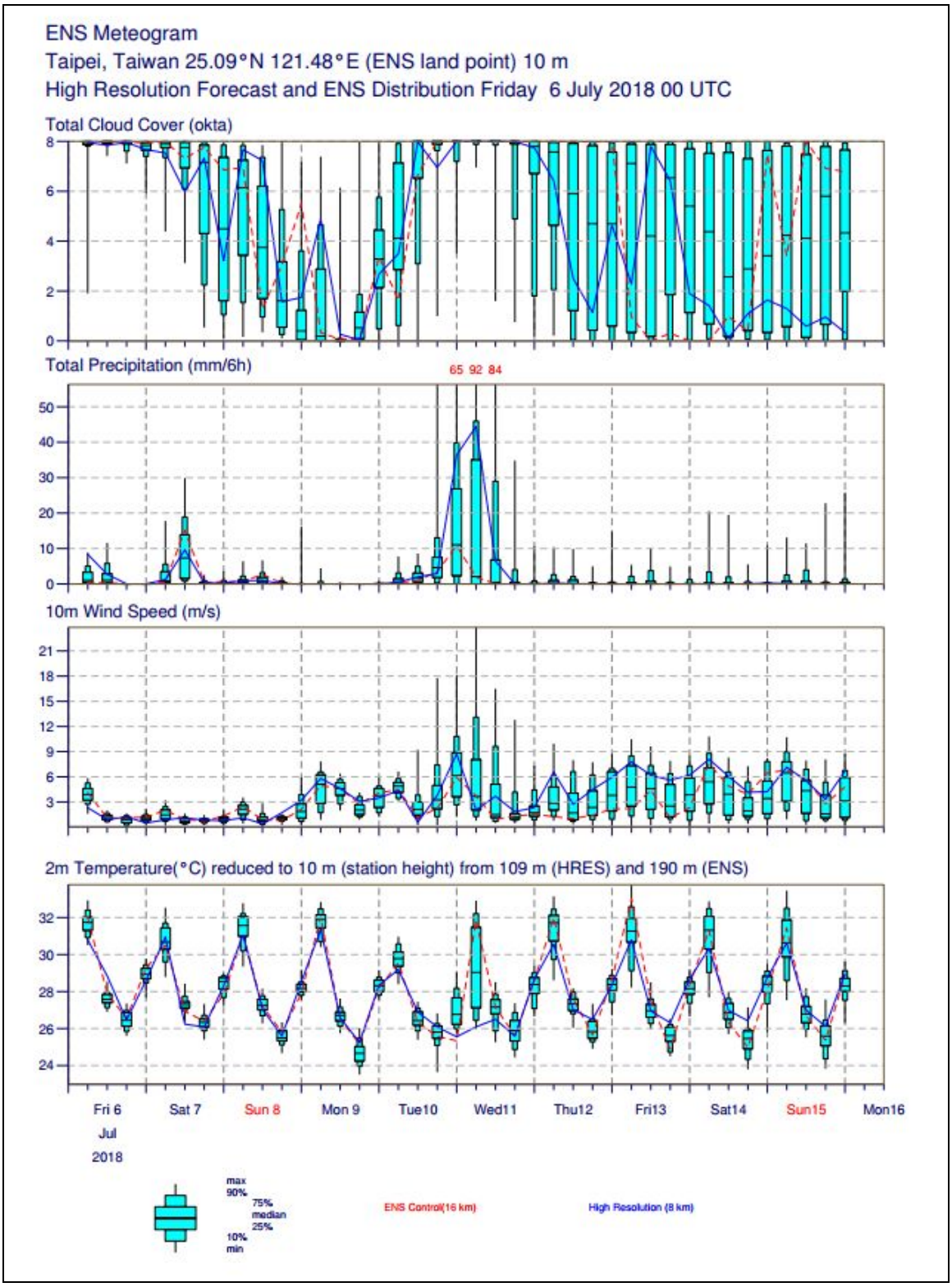
2 - Meteogram for Okinawa (Japan)



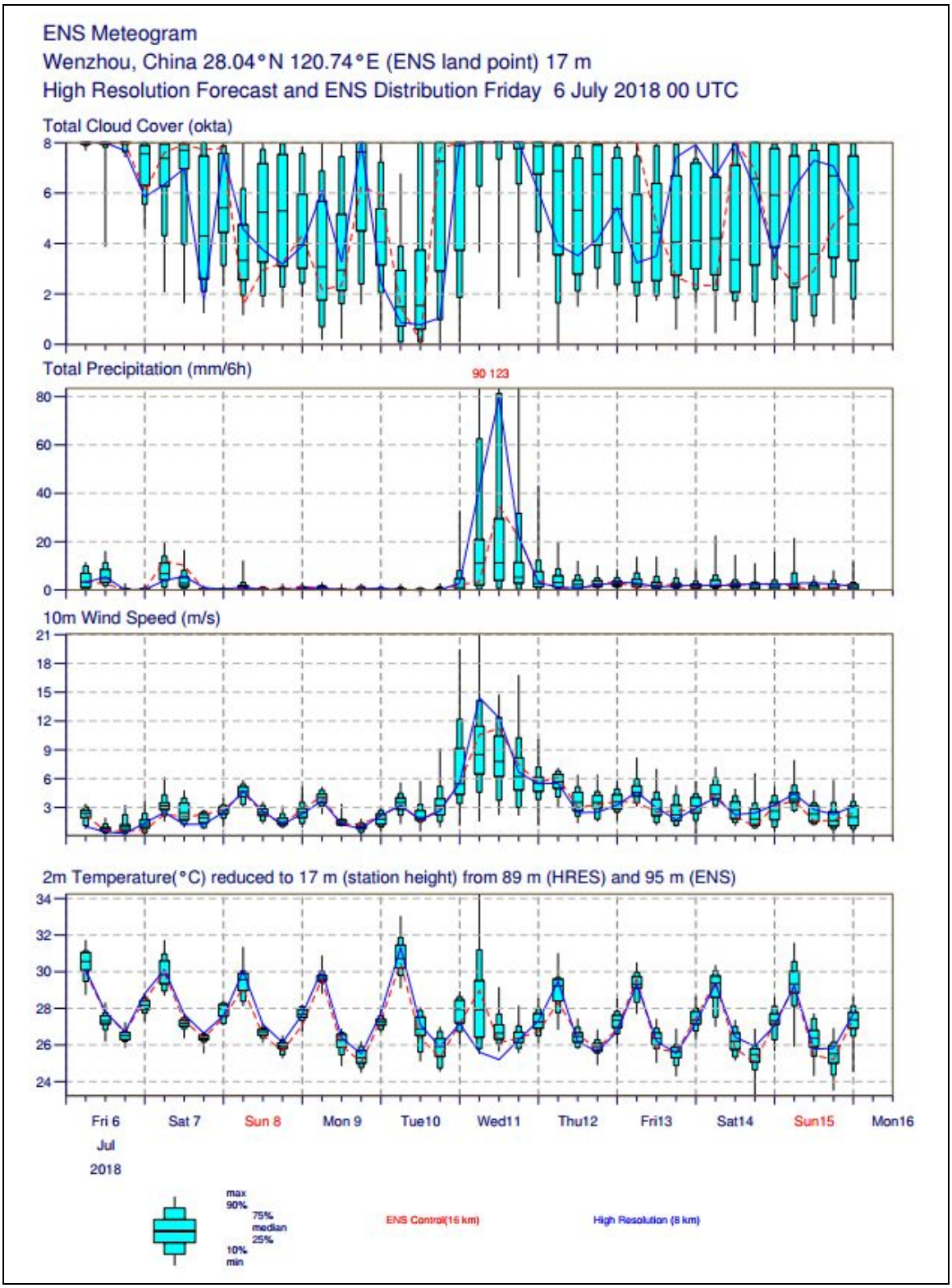
3 - Meteogram for Kumejima (Japan)



4 - Meteogram for Taipei - Taibei (Taiwan - Republic of China)



5 - Meteogram for Wenzhou (China)



6 - Meteogram for Shanghai (China)