



EUROPEAN COMMISSION
JOINT RESEARCH CENTRE

29 June 2018, 16:30 UTC

Tropical Cyclone PRAPIROON

Japan, Republic of Korea, Democratic People's Republic of Korea

GDACS Tropical Cyclone Orange Alert

29 June 2018 - ongoing

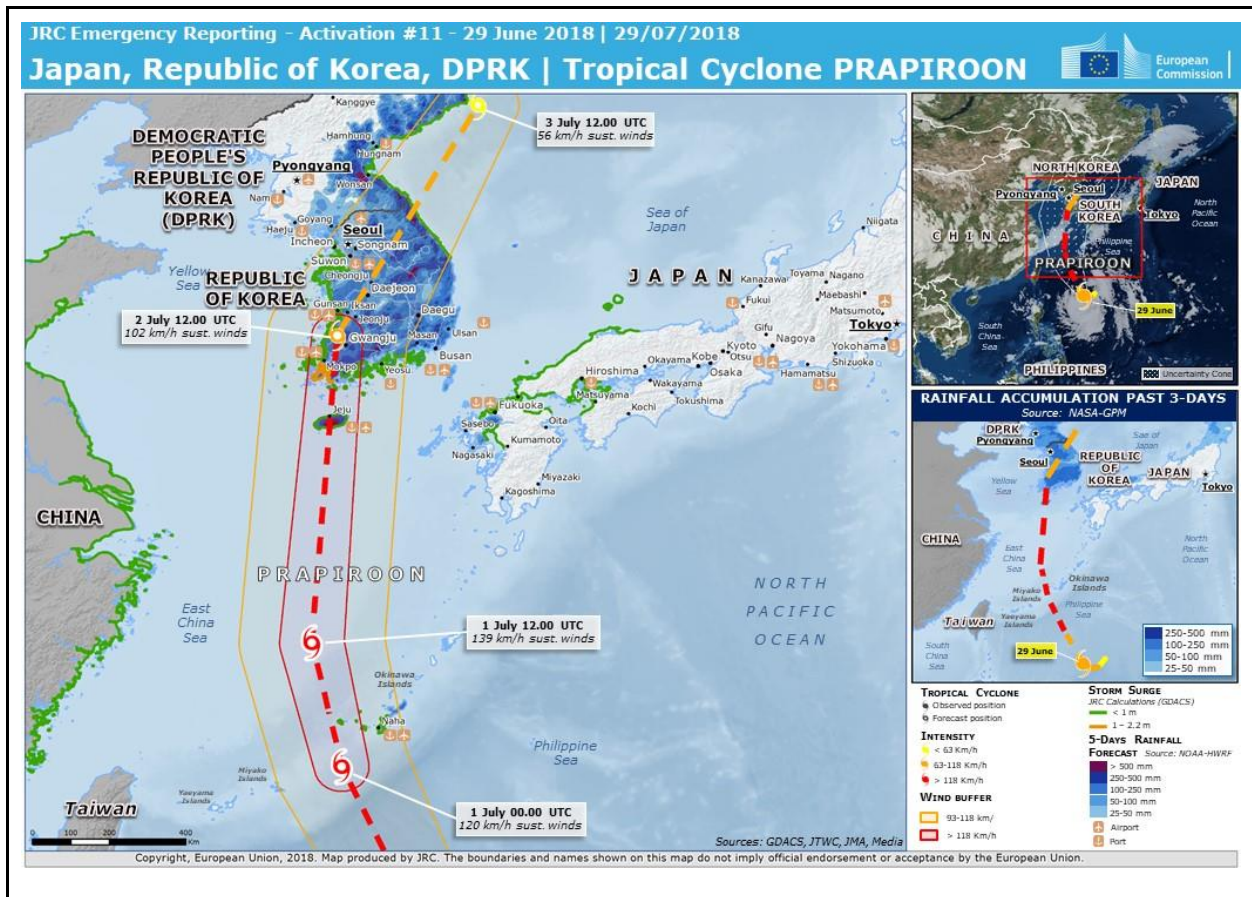


Figure 1 - TC PRAPIROON Japan, Republic of Korea, Democratic People's Republic of Korea (as of 29 June 2018, 16:30 UTC)

1 Executive Summary

- Tropical Cyclone **PRAPIROON** formed over the Philippine Sea on 28 June and started moving north-west, strengthening. On 29 June at 12:00 UTC, its centre was located over the sea approx. 700 km south-east of **Okinawa** Island (Japan) and it had maximum sustained winds of 84 km/h (**Tropical Storm**).
- Over the next 24 h, it is forecast to continue moving north-west towards Okinawa Island, possibly strengthening into a Typhoon. It is forecast to pass between Okinawa and Miyako island on 1 July and reach southern Republic of Korea, including Jeju Island, on 2 July with max with max. sustained winds of 120-140 km/h. However the **uncertainty** of the forecast track/intensity is still **high**.
- Heavy rains, strong winds and storm surge could affect Okinawa on 30 June - 1 July and Republic of Korea (including Jeju Island) on 1-3 July. Heavy rains could also affect southern and eastern areas of the Democratic People's Republic of Korea (DPRK).
- 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 PRAPIROON in Republic of Korea, Democratic People's Republic of Korea on 29 June morning. This alert was downgraded to ORANGE late in the afternoon of the same day, based on the new forecast.

2 Situation Overview

2.1 Meteorological Situation

Tropical Cyclone PRAPIROON

- **PAST:** Tropical Cyclone PRAPIROON (named FLORITA in the Philippines) formed over the Philippine Sea on 28 June and started moving north-west, strengthening.
- **CURRENT:** On 29 June at 06:00 UTC, its centre was located approx. 700 km south-east of Okinawa Island (Japan) with maximum sustained winds of 83 km/h (Tropical Storm).
- **FORECAST** (as of 29 June, 12:00 UTC TC data): PRAPIROON is forecast to pass Okinawa on 1 July (with max. sustained winds of 140 km/h), reach Jeju Island and the southern coast of South Jeolla (south-western Republic of Korea) on 2 July morning (UTC) with max with max. sustained winds of 120-140 km/h. Then it is forecast to cross the Republic of Korea, weakening and possibly reaching the southern and eastern areas of the Democratic People's Republic of Korea (DPRK) on 2-3 July, weakened into a Tropical Storm or Tropical Depression. However the uncertainty of the forecast track is still high.
- **HAZARDS:** Heavy rains, strong winds and storm surge could affect Okinawa and Kyushu Prefecture on 29 June - 2 July and the whole Republic of Korea (including Jeju

Island) on 1-3 July. Heavy rains could also affect southern and eastern areas of the Democratic People's Republic of Korea (DPRK).

- **UNCERTAINTY:** TC PRAPIROON is forecast to reach the south-western coast of the Korean Peninsula on 2 July, but there is still a large uncertainty on the area of the landfall. Some models provide different track (more to the west) with a possible landfall along the western coast of the Republic of Korea or in south-western DPRK. The maximum sustained winds velocity during the expected landfall has also some variability, it is between 50 and 80 knots (93-150 km/h).

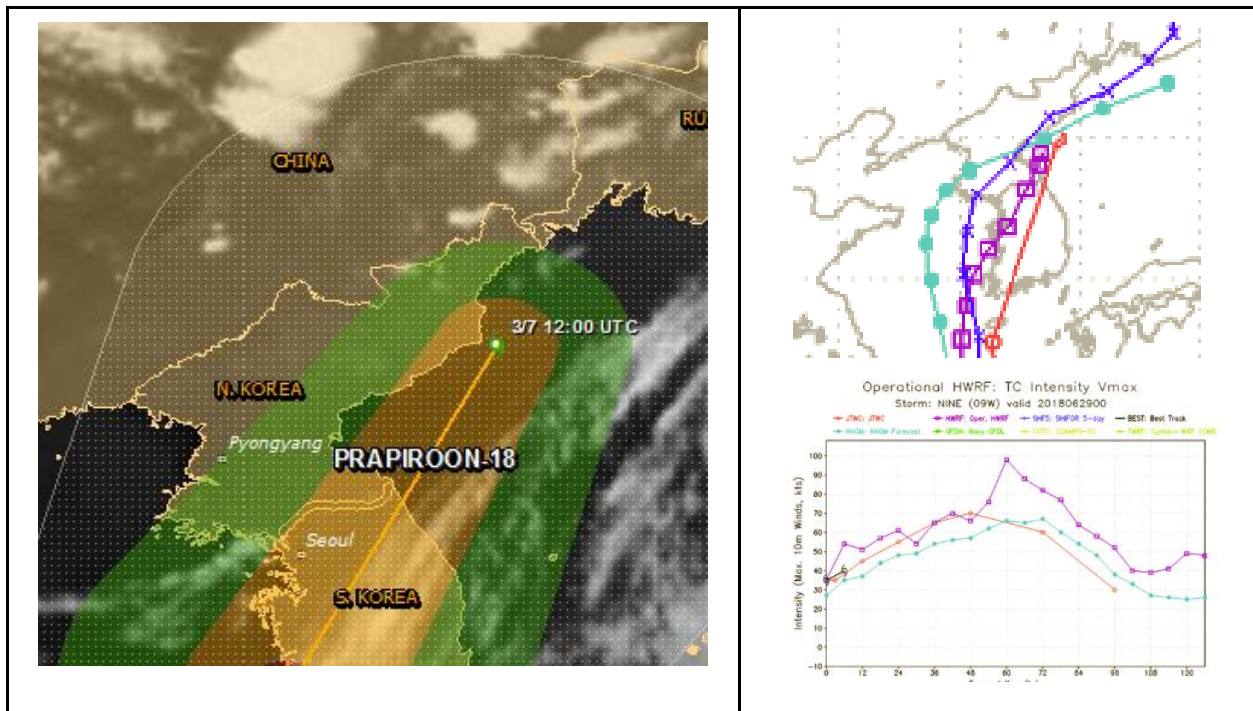


Figure 2 - TC PRAPIROON in Republic of Korea, Democratic People's Republic of Korea
(as of 29 June, 12:00 UTC)

Warnings in effect

As of 29 June, 12:00 UTC, no warnings in effect in the areas possibly affected by TC PRAPIROON. In Okinawa and Kyushu (Japan), there are weather advisories (high waves and thunderstorms) in effect.

2.2 Humanitarian impact

Up to now no humanitarian impact, TC PRAPIROON is still over the sea, approx 700 km south-west of Okinawa and 1600 km south-east of Republic of Korea.

The population of the provinces potentially affected of the Republic of Korea (the country potentially most affected according to the last forecast available) is shown in the table below.

Affected provinces

Region Province	Country	Population
Cheju-do	Korea, Republic of	510000 people
Cholla-namdo	Korea, Republic of	-
Kwangju-jikhalsi	Korea, Republic of	1.1 million people
Cholla-bukto	Korea, Republic of	-

Figure 3 - Population of the potentially affected provinces (source:GDACS)

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 PRAPIROON since 29 June for the ECHO Daily Flash reports, available at <http://erccportal.jrc.ec.europa.eu/ECHO-Flash>.

GDACS System

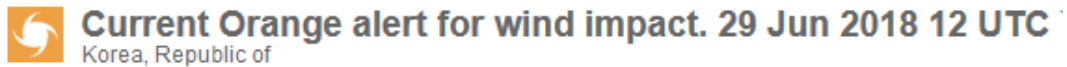
JRC is responsible for the operation of GDACS (www.gdacs.org) that plays a major role in alerting the international community to humanitarian emergencies during natural disasters. The alerts of GDACS (Green, Orange, Red) are elaborated based on the severity of the event, the population involved and the 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 has issued the first **ORANGE** Alert for this event in the Republic of Korea and DPRK on 28 June and it has increased the alert level to **RED** on 29 June morning (UTC). This alert was downgraded to **ORANGE** late in the afternoon of the same day, based on the new forecast.

According to the latest bulletin (29 June, 12:00 UTC), the GDACS alert level is now ORANGE (for high winds) for this event in Republic of Korea, with more than 3.3 million people potentially affected by cyclone strength winds (> 120 km/h). The possible impact due to winds, rainfall and storm surge are shown below, while the automatic GDACS report for TC PRAPIROON can be found at this address: <http://www.gdacs.org/report.aspx?name=PRAPIROON-18>.



Current storm status

This tropical cyclone is expected to have a **medium** humanitarian impact based on the storm strength and the affected population in the past and forecasted path.

Up to 3.3 million people can be affected by wind speeds of cyclone strength or above.

Population affected by Category

1 (120 km/h) wind speeds or higher is: **3.3 million**

Maximum windspeed: **139 km/h**

Vulnerability of affected countries: **Low**

Figure 4 - Automatic GDACS impact estimation (as of 29 June 2018, 12:00 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		28 Jun 2018 12:00	Tropical depression	46 km/h (29 mph)	no people	no people	20.4, 131.5
2		28 Jun 2018 18:00	Tropical depression	56 km/h (34 mph)	no people	no people	19.7, 130.9
3		29 Jun 2018 00:00	Tropical storm	65 km/h (40 mph)	no people	no people	19.6, 130.5
4		29 Jun 2018 06:00	Tropical storm	74 km/h (46 mph)	no people	no people	19.7, 130.1
5		29 Jun 2018 12:00	Tropical storm	83 km/h (52 mph)	no people	no people	20, 129.7
5		30 Jun 2018 00:00	Tropical storm	102 km/h (63 mph)	no people	no people	20.9, 129.1
5		30 Jun 2018 12:00	Tropical storm	111 km/h (69 mph)	1.3 million people	no people	22.7, 128.1
5		01 Jul 2018 00:00	Category 1	120 km/h (75 mph)	1.4 million people	8900 people	25.3, 126.8
5		01 Jul 2018 12:00	Category 1	139 km/h (86 mph)	53.4 million people	3.3 million people	28.2, 126.1
5		02 Jul 2018 12:00	Tropical storm	102 km/h (63 mph)	66 million people	no people	35.4, 126.7
5		03 Jul 2018 12:00	Tropical depression	56 km/h (34 mph)	no people	no people	40.8, 130

Figure 5 - GDACS Alert for Tropical Cyclone PRAPIROON - Event Timeline, population affected, max. sustained winds (the Category is based on the SSHS, see Annex)

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, Republic of Korea and DPRK) is shown below.

Wind

- JAPAN: The center of PRAPIROON is expected to pass between **Miyako** and **Okinawa** islands on 30 June evening (UTC) / 1 July early morning as a Typhoon, with max. sustained winds of 120-140 km/h (equivalent to a Category 1 in the SSHS, see Annex). Strong winds (up to 140 km/h, with higher gusts) could affect these islands, including Naha city.

*Potentially most affected areas: **Miyako** and **Okinawa**.*

- REPUBLIC OF KOREA: After having passed Okinawa, it is forecast to move over the East China Sea and it could reach the island of Jeju (pop. 500 000) and the province of South Jeolla (pop. 1.9 million) 1 July evening (UTC) / 2 July early morning, with max. sustained winds of 120-140 km/h (equivalent to a Category 1 in the SSHS). After the landfall it is forecast to move north-east, crossing the whole Republic of Korea, weakening. Based on this forecast, **strong winds** (up to 140 km/h, with higher gusts) could Republic of Korea on 1-3 July, especially Jeju and the south-western provinces.

*Potentially most affected areas: **Jeju** (Cheju-do), **South Jeolla** (Cholla-namdo), **North Jeolla** (Cholla-bukto), **South Gyeongsang** (Kyongsang-namdo), **North Gyeongsang** (Kyongsang-bukto), **South Chungcheong** (Ch'ungch'ong-namdo).*

- DEMOCRATIC PEOPLE’S REPUBLIC OF KOREA: Base on the last TC bulletin, Tropical Storm force winds could still locally affect southern and eastern areas of DPRK, here is still a large uncertainty on the possible forecast.

Rainfall

- JAPAN: TC PRAPIROON 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 islands potentially mostly affected are: Okinawa and Miyako

Climatological Information	June	July
Mean Total Precipitation		
Naha	247 mm	141 mm

- REPUBLIC OF KOREA: according to the last forecast, it is forecast to produce very heavy rainfall (**over 250 mm**) over Jeju island and most of the republic of Korea, during its passage on 1-3 July, with the risk of floods and flash floods. The areas potentially most affected are: whole REPUBLIC OF KOREA, especially **Jeju, South and North Jeolla, South and North Gyeongsang**. The total rainfall accumulation produced by TC PRAPIROON is expected to be above the monthly average rainfall, especially in Jeju, that is about 230 mm in July (see map below)

Climatological Information	June	July
Mean Total Precipitation		
Jeju	190 mm	232 mm
Gwangju	190 mm	282 mm
Seoul	133 mm	328 mm

- DEMOCRATIC PEOPLE’S REPUBLIC OF KOREA: There is still a large uncertainty on the possible forecast. Base on the last data available, the major risk for DPRK is related to the possible heavy rain that could affect several areas of DPRK on 2-4 July, especially the eastern areas (locally over 250-500 mm), with the risk of floods and flash floods.

Climatological Information	June	July
Mean Total Precipitation		
Pyongyang	90 mm	275 mm

Storm Surge

According to the latest JRC HyFlux2 storm surge calculation (using as input the data of the bulletin of 29 June 06:00 UTC), the areas potentially most affected are in south-western Republic of Korea with a maximum of:

- 2.0 m in Changdong on 2 July morning (UTC)

These values could still change due to the track/intensity uncertainty.

Moreover 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

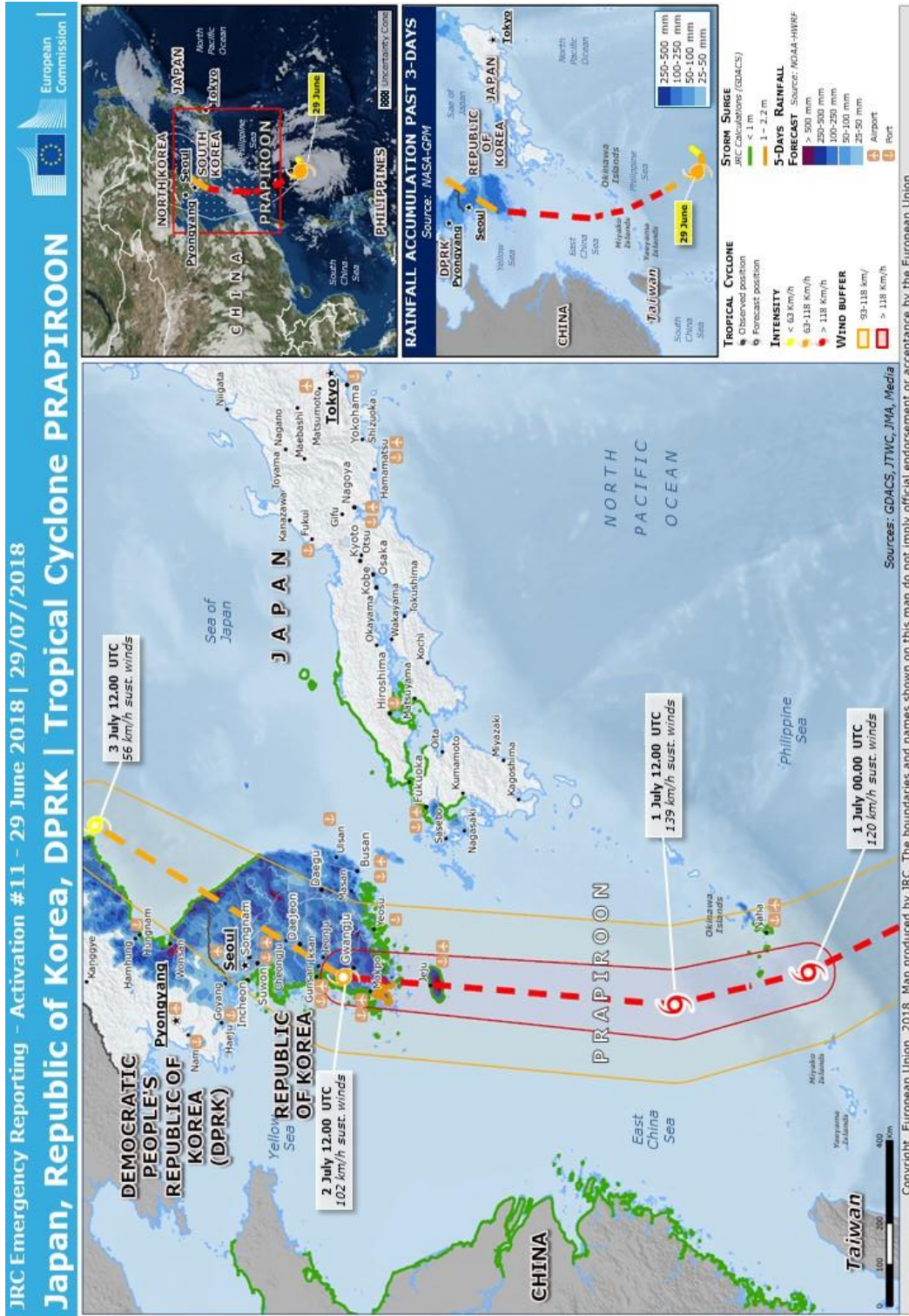
Contact points within JRC: Disaster Risk Management Unit

- Ian Clark, ian.clark@ec.europa.eu
- Tom De Groeve, tom.de-groeve@ec.europa.eu
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For updated information on the disaster, please consult the following web sites:




- GDACS: <http://www.gdacs.org>
- ERCC portal: <http://ercportal.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>
 - Republic of Korea: <http://web.kma.go.kr/eng/index.jsp>
 - Democratic People's Republic of Korea:
- WMO Severe weather Information Centre: <http://severe.worldweather.org/>
- 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



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](http://www.gdacs.org/Documents/GDACS%20Guidelines%202014%20FINAL.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 <i>Major Hurricane</i>	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 <i>Major Hurricane</i>	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 <i>Major Hurricane</i>	≥ 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>

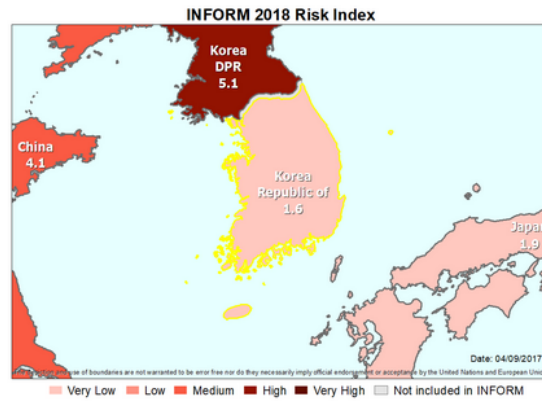
Annex 3 - INFORM

SOUTH KOREA



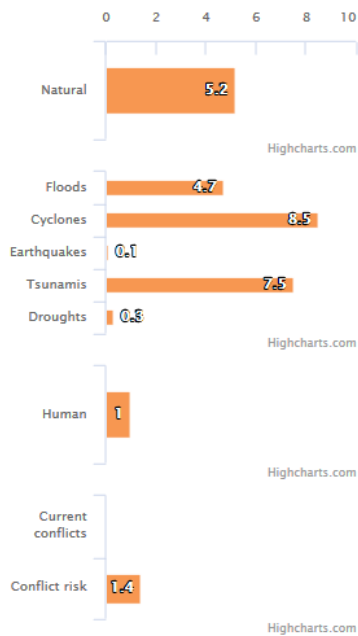
Eastern Asia
High income

	Value	Rank	Trend
INFORM Risk	1.6	168	—
Hazard & Exposure	3.4	98	—
Vulnerability	0.6	189	—
Lack of Coping Capacity	1.9	173	—

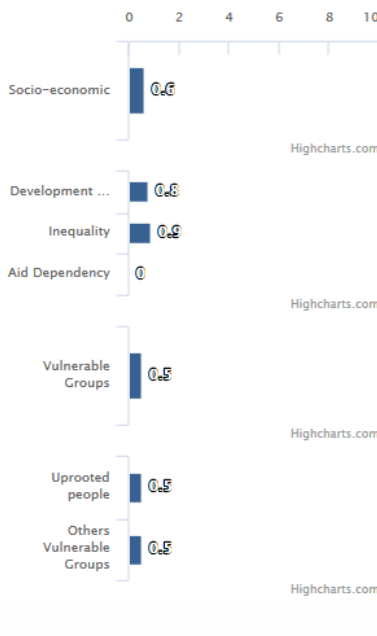


▼ RISK DIMENSIONS AND COMPONENTS

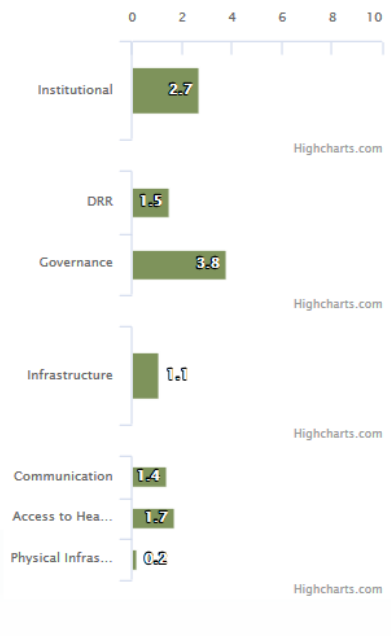
Hazard & Exposure



Vulnerability



Lack of Coping Capacity

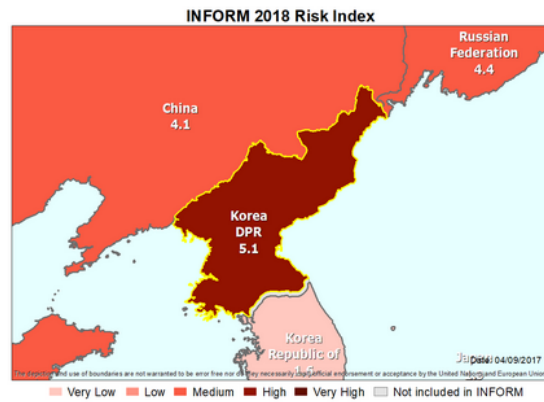


KOREA DEM. PEOPLES REP.



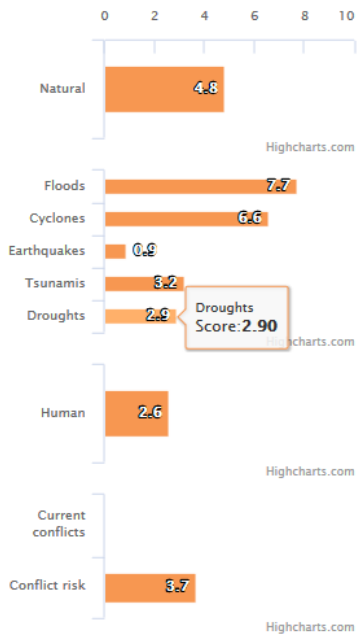
Eastern Asia
Low income

	Value	Rank	Trend
INFORM Risk	5.1	42	▲
Hazard & Exposure	3.8	81	—
Vulnerability	5.1	44	▲
Lack of Coping Capacity	6.7	32	—

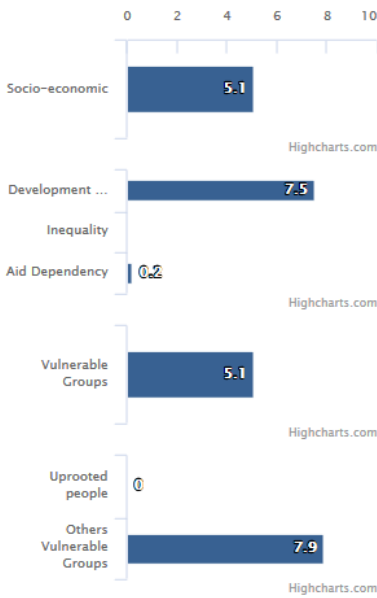


▼ RISK DIMENSIONS AND COMPONENTS

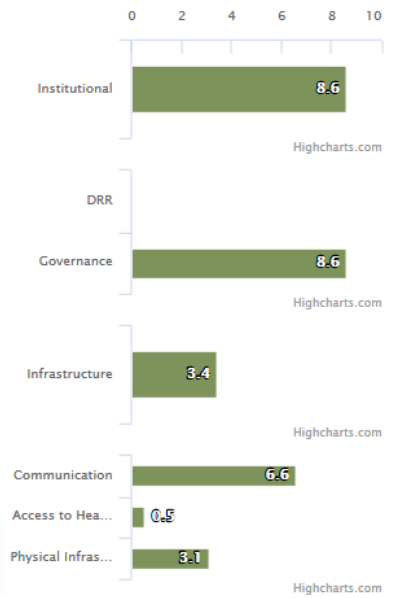
Hazard & Exposure



Vulnerability



Lack of Coping Capacity



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

1 - Product Description

Ensemble Meteograms contain information coming from both the deterministic single 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.

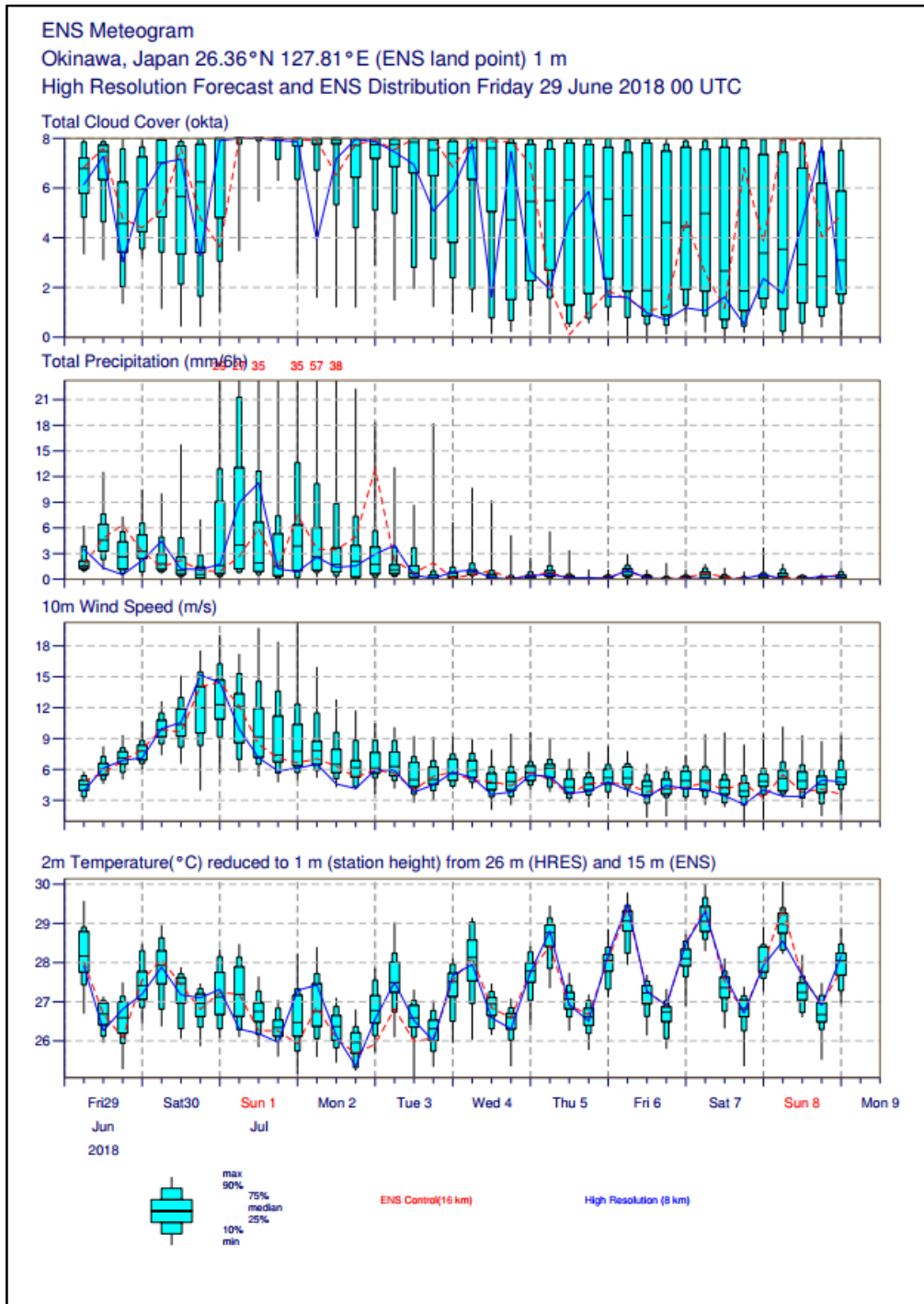
The first panel of meteogram contains the total (low - medium & high) cloudiness in octas.

The second panel refers to the total (convective and large-scale) precipitation utilising values estimated over 6-hour intervals.

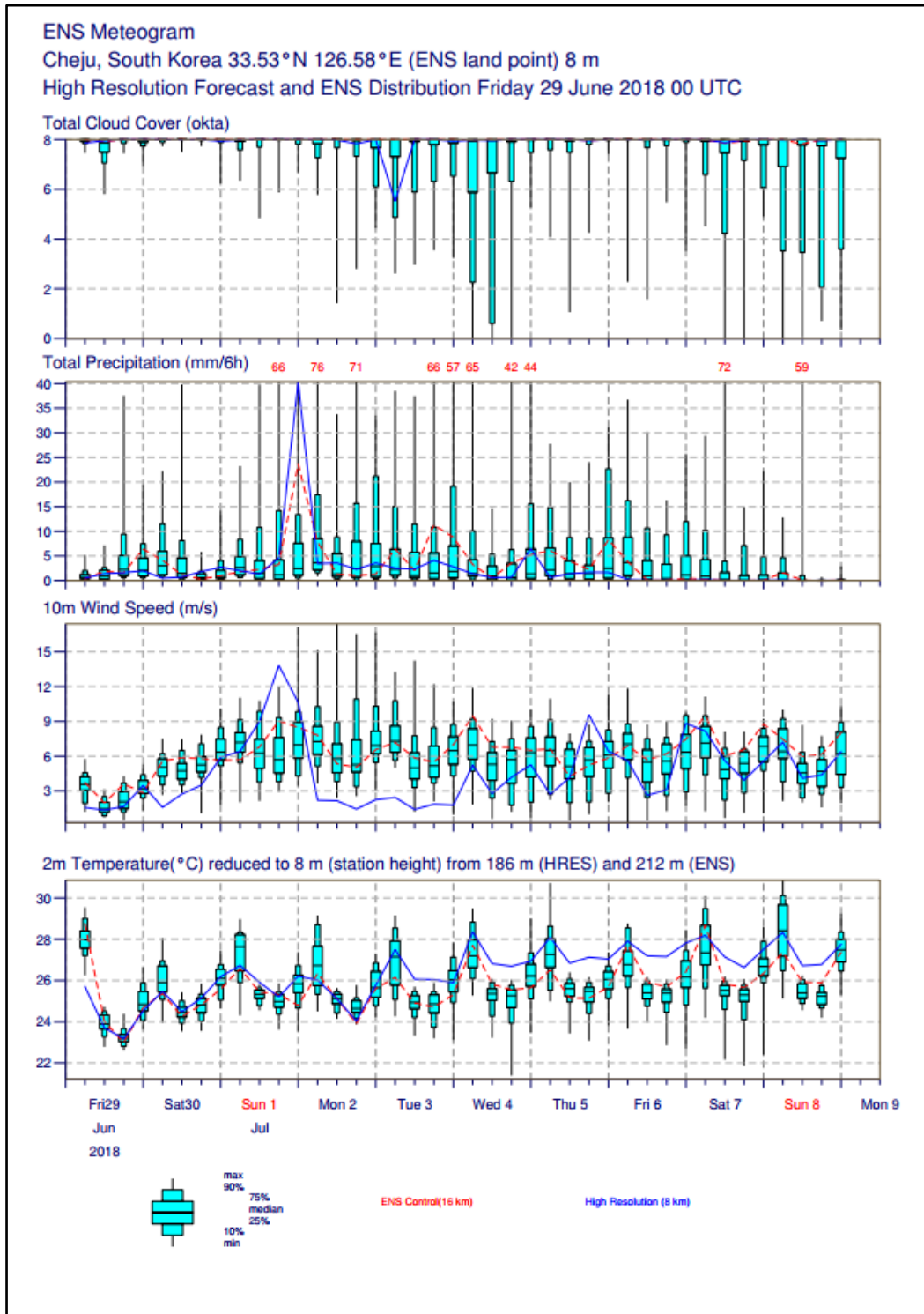
The third panel refers to the instantaneous (averaged over 10 minutes) wind speed values.

The fourth panel refers to the temperature at 2 meters height.

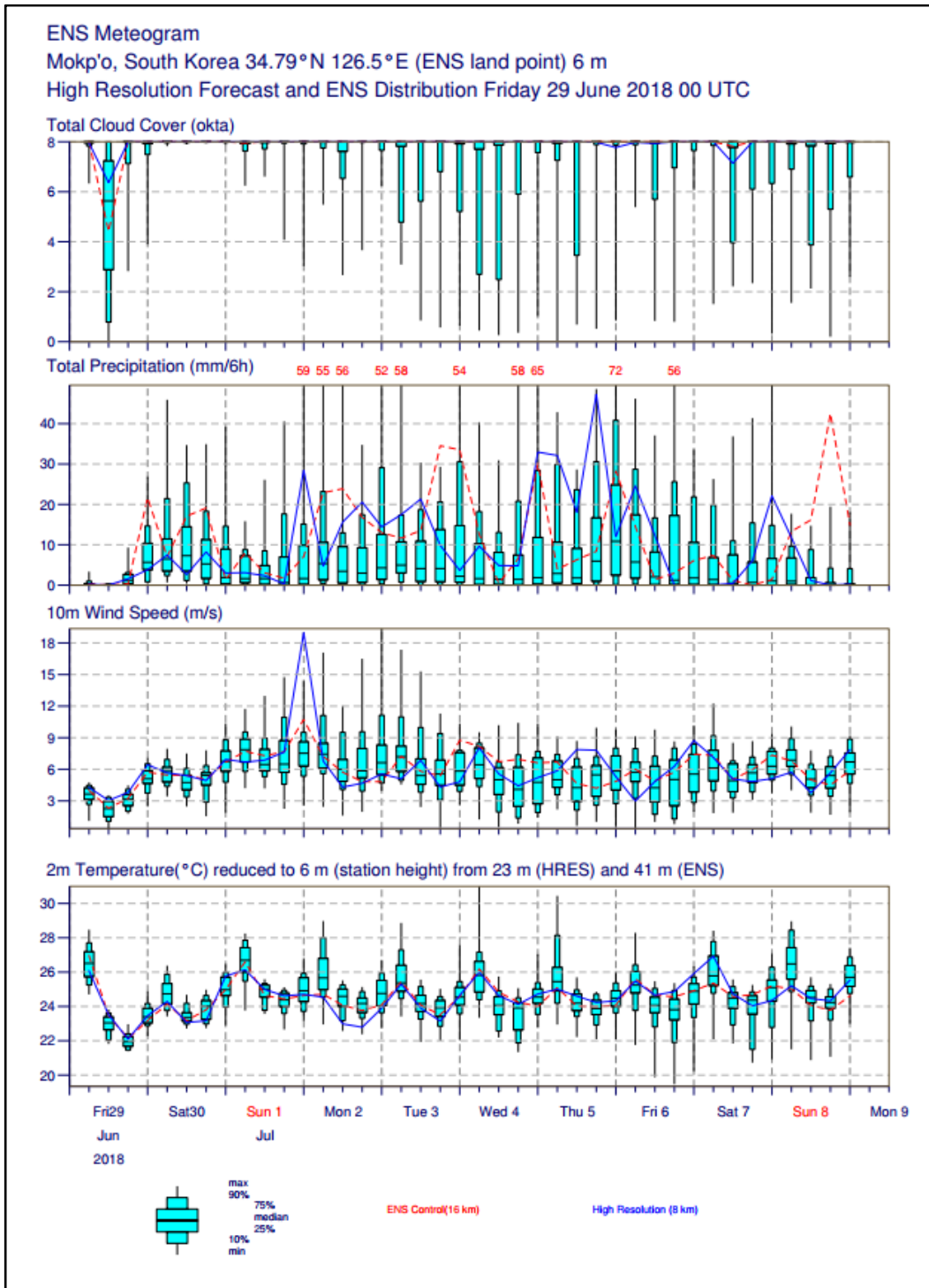
2 - Meteogram for Okinawa (Japan)



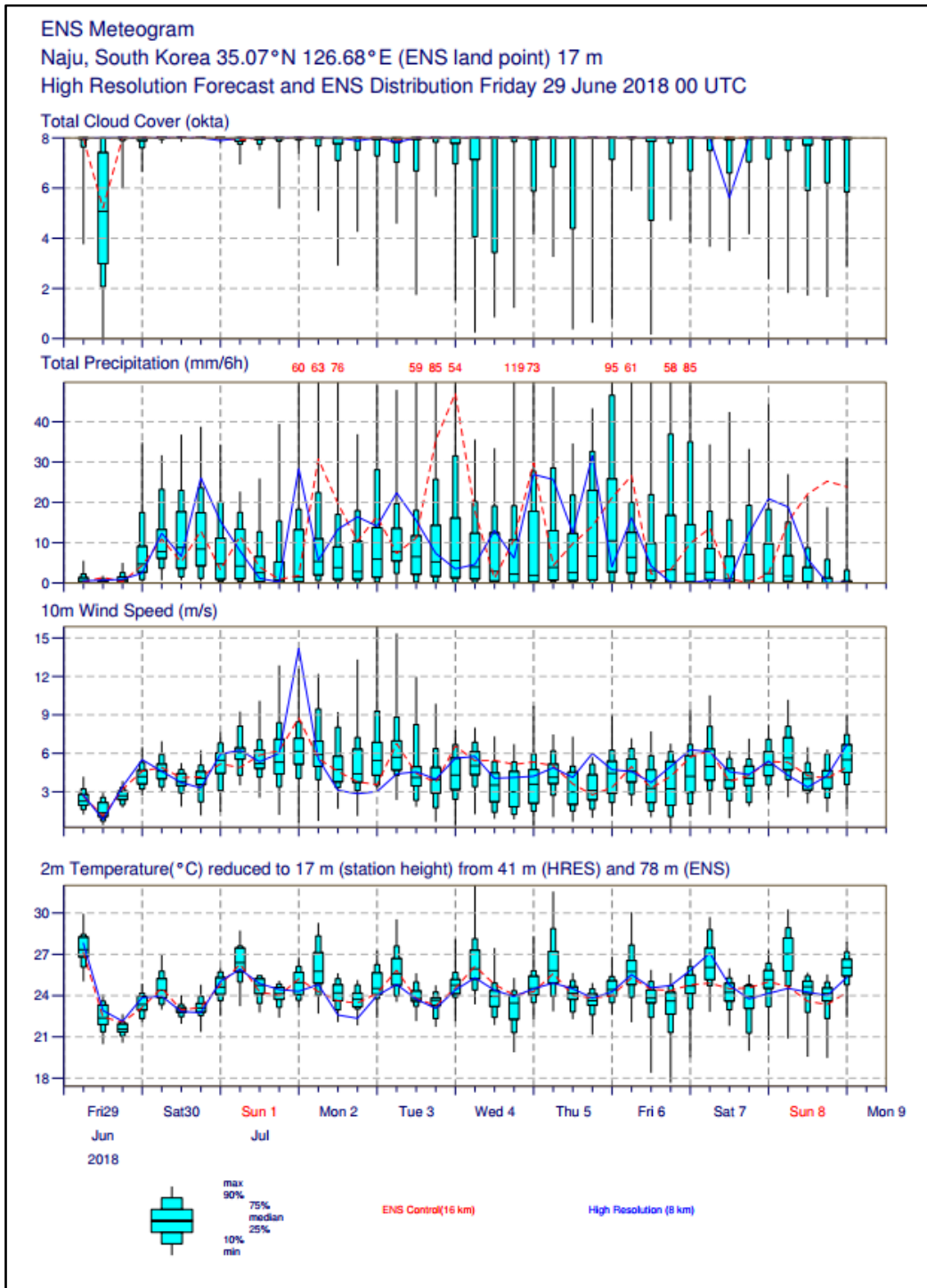
3 - Meteogram for Jeju island (Cheju - Republic of Korea)



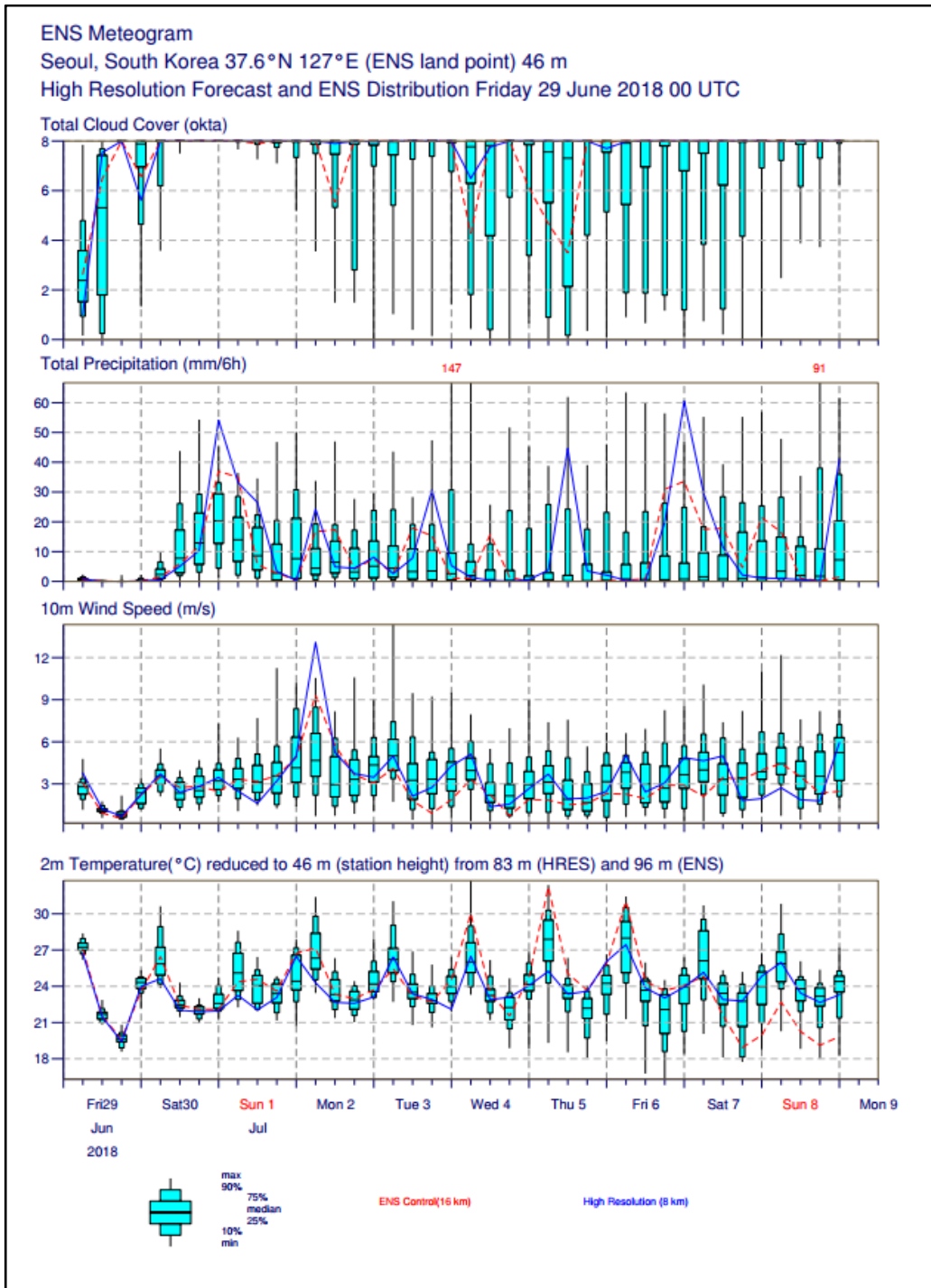
4 - Meteogram for Mokpo (Republic of Korea)



5 - Meteogram for Naju (Republic of Korea)



6 - Meteogram for Seoul (Republic of Korea)



7 - Meteogram for Pyongyang (Democratic People's Republic of Korea)

