



EUROPEAN COMMISSION  
JOINT RESEARCH CENTRE

22 October 2018, 17:30 UTC

# Tropical Cyclones WILLA and VICENTE

GDACS Red Alert for Mexico  
21 Oct 2018 - ongoing

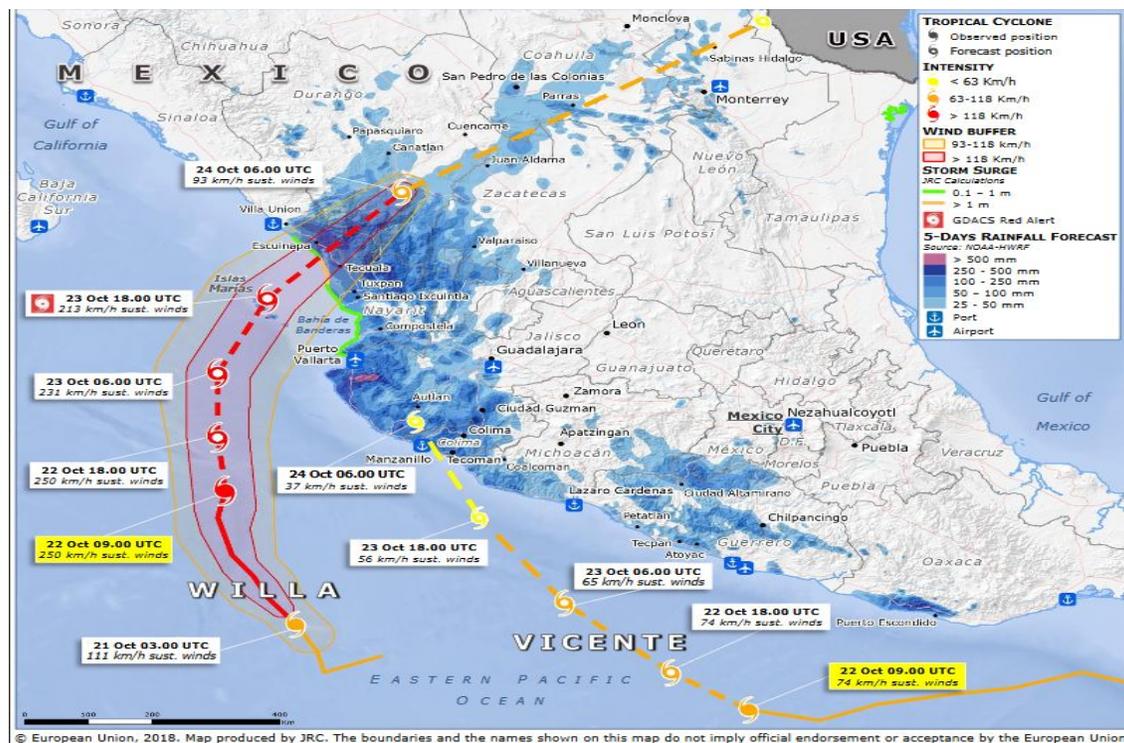


Figure 1 - TCs WILLA and VICENTE in MEXICO  
(as of 22 Oct 2018, 12:00 UTC)

## 1 Executive Summary

- As of 22 October 15:00 UTC, two Tropical Cyclone systems are active in the eastern North Pacific (**WILLA** and **VICENTE**) and are moving towards the coast of **Mexico**. In this report, an analysis of the possible impact of these two TCs is presented.
- WILLA** is currently a **Category 5 Hurricane** and is forecast to reach the **Islas Marias** and the coast of Nayarit / Sinaloa States (Mexico) on 23 October afternoon/evening (UTC), as a

dangerous **Category 4** (max. sustained winds up to **250 km/h**). After the landfall it is forecast to move inland over central and northern Mexico, weakening.

- In the meantime, a Tropical Storm, VICENTE, is moving off the coast of south-western Mexico, and is forecast to reach the coast of Jalisco/Colima (approx. 400 km south of the landfall area of WILLA) at the same time of the landfall of WILLA.
- **Very strong winds, heavy rainfall (risk of flash floods and landslides) and storm surge** could affect several areas of south-western, central and north-eastern Mexico, during the passage of WILLA, especially the states of **Nayarit**, including **Islas Marias, Jalisco and Sinaloa** on 23-24 October. In addition, VICENTE could produce additional rainfall that could worsen the situation.
- Preparedness actions are taking place, as local authorities closed the schools by today 22 Oct in several municipalities of the state of Sinaloa and the national civil protection provided on 22 Oct at 05:00 local time, a “GREEN” alert for specific areas of Isla Marias, Sinaloa, Nayarit and Jalisco and “BLUE” for further surrounding areas.
- 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 WILLA on 21 October and a Green Alert for VICENTE.

## 2 Situation Overview

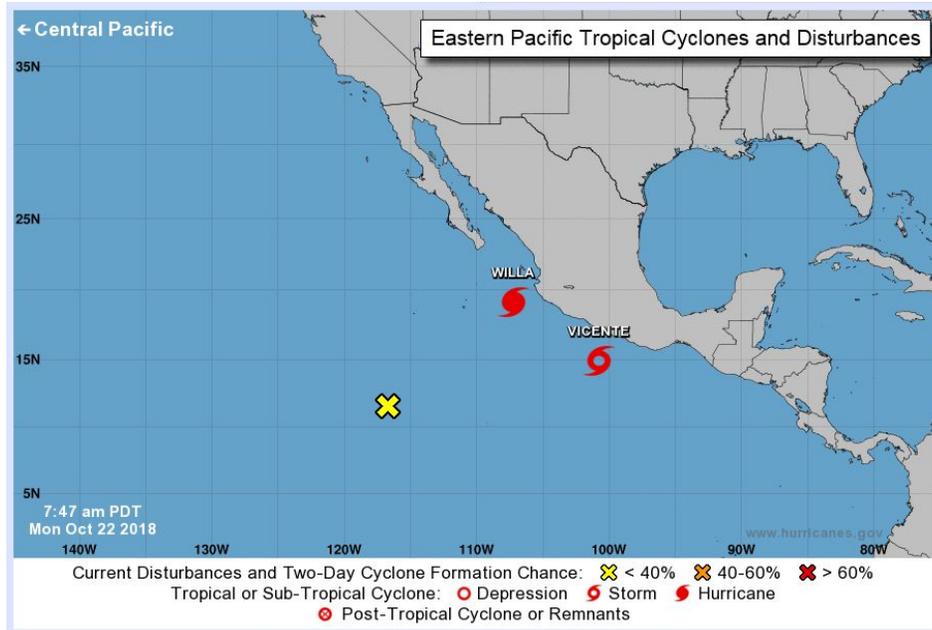
### 2.1 Meteorological Situation

#### 2.1.1. Active TC systems in the area

As of 22 October 15:00 UTC, two Tropical Cyclone systems are active in the Eastern North Pacific Ocean (**WILLA, VICENTE**) and another one could developed (20% of chance of formation) over the next 48 h (see Figure 2). In this report, an analysis of the possible impact of WILLA and VICENTE is presented upon a request of the ERCC. At the moment the most powerful and threatening tropical cyclone is the first one and most of the description below is related to it, however VICENTE could produce additional rainfall that could worsen the situation.

GDACS ALERT	TC NAME	CATEGORY (SSHS)		EXPOSED COUNTRY	EXPOSURE PERIOD	LANDFALL
		Peak	Landfall			
	<b>WILLA</b>	Cat. 5 Hurricane	Cat. 4 Hurricane	Mexico	23-24 Oct	Islas Marias Nayarit/Sinaloa States (23 Oct)
	<b>VICENTE</b>	Tropical Storm	Tropical Storm	Mexico	22-24 Oct	Jalisco/Colima states (23 Oct)

**Table 1** - Active Tropical Cyclones in the Eastern North Pacific basin (as of 22 Oct. 15:00 UTC).

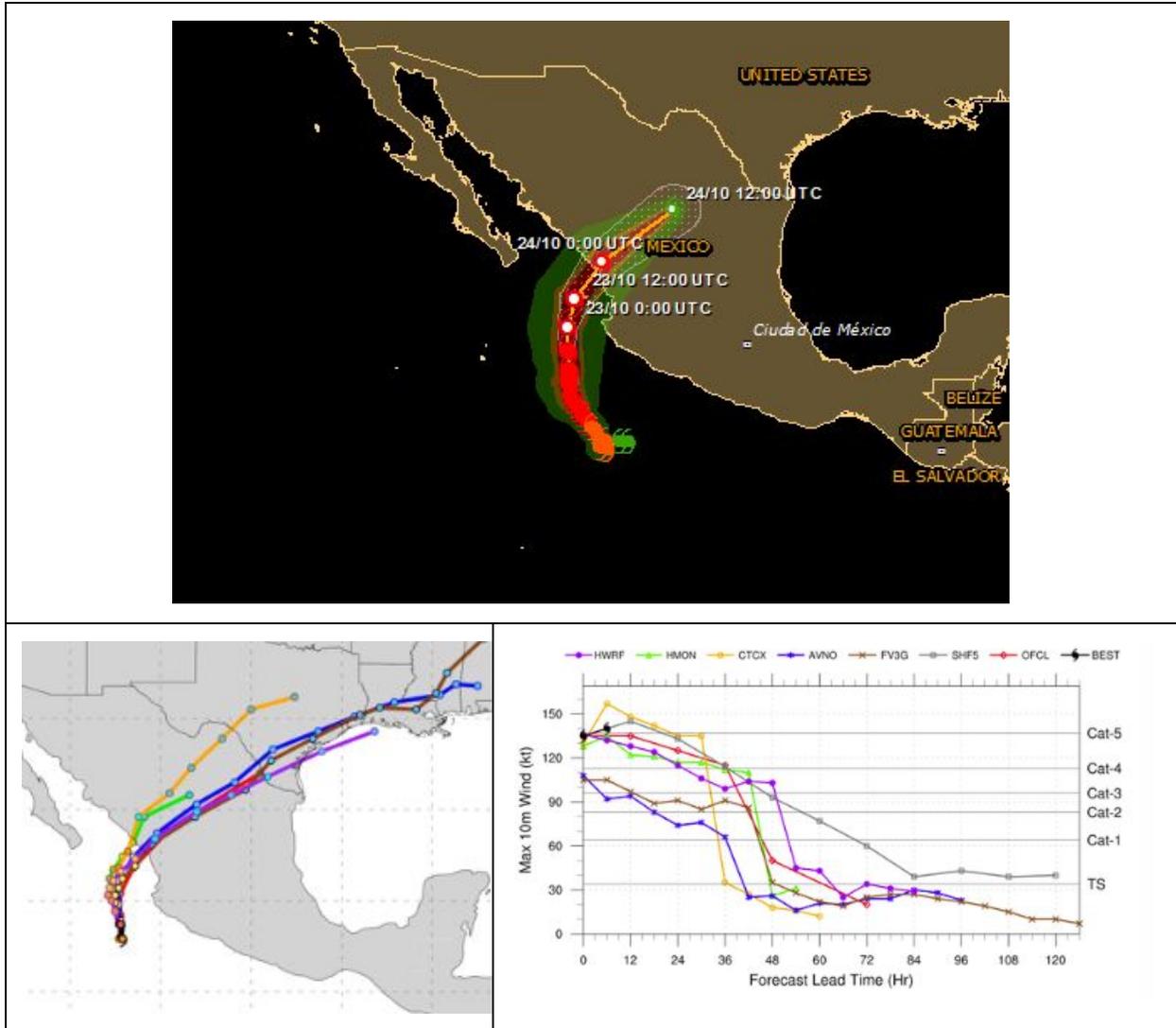


**Figure 2 - Tropical Cyclones and Disturbances in the Eastern North Pacific basin (as of 22 Oct 2018, 15:00 UTC, source: NOAA-NHC)**

### 2.1.2. Tropical Cyclone WILLA

- **PAST:** Tropical Cyclone WILLA formed over the east Pacific Ocean on 20 October and started moving west, then north, significantly strengthening and becoming **Major Hurricane**<sup>1</sup>.
- **CURRENT:** On 22 October at 15:00 UTC, its centre was located approx. 280 km south-southwest of Las Islas Marias (Mexico) with maximum sustained winds of **260 km/h (Category 5 Hurricane)**.
- **FORECAST** (as of 22 October, 15:00 UTC TC data): it is forecast to start slightly weakening on 23 October, but still remaining an intense Major Hurricane. It could reach the Islas Marias on 23 October afternoon (UTC) and the coast of Nayarit/Sinaloa States (Mexico) in the evening (UTC), still as a dangerous Category 4 Hurricane (max. sustained winds up to 250 km/h). Possible landfall area along the mainland Mexican coasts: between San Blas (Nayarit) and Mazatlán (Sinaloa). After the landfall it could move over central and north-eastern Mexico, weakening into a Tropical Depression.
- **UNCERTAINTY:** It is forecast to cross the Isla Marias and reach the south-western Mexican coast, probably between San Blas (Nayarit) and Mazatlan (Sinaloa) on 23 October afternoon/evening (UTC) a Category 4 Hurricane, but there is still some uncertainty on the track/landfall time and intensity: most of the models agreed that it will be a Category 4 during the landfall (for some of them close to Category 5). Small changes in strength might be expected before the center reaches the coast (see figure below).

<sup>1</sup> **Major Hurricane:** A tropical cyclone with maximum sustained winds of 178 km/h or higher, corresponding to a Category 3, 4 or 5 on the Saffir-Simpson Hurricane Wind Scale (<http://www.nhc.noaa.gov/aboutshws.php>).



**Figure 3 - TC WILLA uncertainty track/intensity (as of 22 Oct, 15:00 UTC).**  
 Sources: GDACS, JRC (TOP), NOAA-HWRF (BOTTOM)

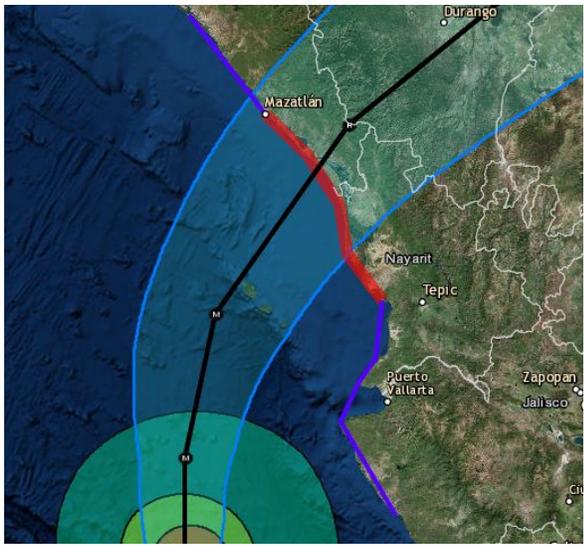
2.1.3. Tropical Cyclone VICENTE

- **PAST:** Tropical Cyclone VICENTE formed over the eastern Pacific Ocean, close to the coasts of Guatemala on 19 October, and moved north-west over the ocean, parallel to the coast of Mexico, slightly strengthening, becoming a Tropical Storm.
- **CURRENT:** On 22 October at 15:00 UTC, its centre was located approx. 590 km south-east of Manzanillo (Mexico), with max. sustained winds of 75 km/h (Tropical Storm).
- **FORECAST** (as of 22 October, 15:00 UTC TC data): Over the next 24 h, it is forecast to move northwest over the eastern Pacific Ocean, weakening and its center is expected to reach the coast of Colima state on 23 October evening (UTC), as a Tropical Depression. Afterwards it is forecast to continue moving inland, weakening and dissipating. There is still uncertainty on the track/intensity.

2.1.4. Warnings in effect

As of 22 October, 15:00 UTC (NOAA-NHC), there are the following warnings/watches in effect for TC WILLA:

TC WILLA - MEXICO	
Hurricane Warning (Red Line)	Tropical Storm Warning (Violet line)
* San Blas to Mazatlan, including Las Islas Marias	* Playa Perula to San Blas * North of Mazatlan to Bahia Tempehuaya



**Table 2** - TC WILLA Warnings/Watches in effect (source: NOAA-NHC, as of 22 Oct, 15:00 UTC)

There are no active warnings/watches (NOAA-NHC) in effect for TC VICENTE yet.

As of 22 October, 09:00 local time, according to the National Weather Service of Mexico, intense thunderstorms during the next 3hr could affect Sinaloa, Nayarit, Jalisco, Colima, Michoacán, Guerrero and Veracruz zones (<http://smn.cna.gob.mx/es/pronosticos/avisos/aviso-de-potencial-de-tormentas>).

More information can be found at:

<http://smn.cna.gob.mx/es/pronosticos/avisos/aviso-de-ciclon-tropical-en-el-oceano-pacifico>

<http://smn.cna.gob.mx/files/pdfs/comunicados-de-prensa/Comunicado612-18.pdf>

## 2.2 Impact Analysis of the tropical cyclones

The possible impact (strong winds, heavy rains and storm surge) of Hurricane WILLA and Tropical Storm VICENTE in Mexico over the next few days are shown below.

Note: This section is focused mainly on WILLA, since it is the most significant event, however it should be noted that VICENTE could produce additional rainfall that could worsen the situation.

### 2.2.1. Tropical Cyclone WILLA

**OVERVIEW:** Very strong winds, heavy rains (risk of flash floods and landslides) and storm surge could especially affect the areas of **Nayarit, including Islas Marias, Jalisco and Sinaloa** on 23-24 October. Heavy rains and strong winds could also affect other areas of south-western, central and north-eastern Mexico on 24-25 October.

*The major risk is related to the **heavy rains** that could produce flash floods and landslides across several areas of Mexico (especially south-western and west-central Mexico), also worsened by the passage of VICENTE, and to the **very strong winds** and storm surge that could affect the **Islas Marias** and the **landfall area** in southwestern **mainland Mexico**.*

#### Wind

- Hurricane Force strong winds (up to 250 km/h, with higher gusts) could affect the Islas Marias and the coastal areas of Nayarit and Sinaloa, between San Blas to Mazatlan on 23-24 October. Tropical Storm winds could also affect the coastal areas of Jalisco and the other areas of Nayarit and Sinaloa. The Hurricane-force winds could extend outward up to 45 km from the center and the Tropical-Storm-force winds up to 165 km (see [NOAA-NHC](#)).

*Potentially most affected areas:* especially the Islas Marias, coastal areas of Nayarit, southern Sinaloa and north-western Jalisco.

#### Rainfall

- **MEXICO:** WILLA is expected to produce very heavy rains (see table below) over several areas of south-western, central and north-eastern Mexico, especially in western Jalisco, western Nayarit, including Islas Marias, and southern Sinaloa (see Table below). This amount of rainfall is higher than normal<sup>2</sup> and could cause flash flooding and landslides.

*Potentially most affected areas:* Islas Marias, Nayarit, southern Sinaloa and western Jalisco.

Areas	Forecast
Parts of western Jalisco, western Nayarit, and southern Sinaloa in Mexico	152-305 mm, local amounts of 457 mm (6-12 inches, local amounts of 18 inches)
Parts of Zacateca, Durango, southeast Chihuahua, and Coahuila	51-102 mm, local amounts of 152 mm (2-4 inches, local amounts of 6 inches)

<sup>2</sup> Mean Total Rainfall in Oct in Puerto Vallarta (Jalisco): 93.8 mm , in Mazatlan (Sinaloa): 81.5 mm

**Table 3 - Rainfall forecast and areas potentially affected (as of 22 Oct, 15:00 UTC, [NOAA-NHC](#))**

### **Storm surge**

For a detailed analysis of the Storm surge please refer to Section 3.1.

### **2.2.2. Tropical Cyclone VICENTE**

**OVERVIEW:** The major risk for TC VICENTE is related to the heavy rainfall that could affect parts of southwestern Mexico, worsening the situation due to TC WILLA.

*This Section has been focused only on the rainfall impact, since the other two impacts (wind and storm surge) are not so intense for this TC.*

### **Rainfall**

- **MEXICO: TC VICENTE** has already caused heavy rainfall in parts of Guatemala and southern Mexico (see Annex 1) and it is expected to continue producing heavy rains (see table below) over some areas of south-western Mexico, especially in Guerrero, Michoacán, Colima, and Jalisco, with the risk of flash flooding and landslides in the mountains areas.

*Potentially most affected areas:* Guerrero, Michoacán, Colima, and Jalisco.

Areas	Forecast
Guerrero, Michoacán, Colima, and Jalisco	76-152 mm, local amounts of 254 mm (3-6 inches, local amounts of 10 inches)

**Table 4 - Rainfall forecast and areas potentially affected (as of 22 Oct, 15:00 UTC, [NOAA-NHC](#))**

## 2.3 Humanitarian impact and Preparedness

Up to now no relevant humanitarian impact has been caused by the events as the TCs are still over the sea.

National Authorities (National Meteorological Service, SMN) are informing the population about the life-threatening effects of WILLA, as flash floods and mudflows:

“Recent rainfall saturated the soil in some regions, so there could be mudslides, landslides, overflows of rivers and streams or effects on roads and road sections, as well as floods in low areas and saturation of drainages in urban sites. For this reason, the population is advised to exercise extreme caution and to pay attention to the advices issued by the SMN, as well as to the recommendations of Civil Protection and of the state and municipal authorities.”

(translated from: <http://smn.cna.gob.mx/files/pdfs/comunicados-de-prensa/Comunicado612-18.pdf>)

The national civil protection provided on 22 Oct at 05:00 local time, a “GREEN” alert for Isla Marias, Sinaloa, Nayarit and Jalisco and “BLUE” for surrounding areas (more details on the specific areas at: <https://www.facebook.com/pcsinaloa/photos/pcb.714866068871949/714866048871951/?type=3&theater>)

Preparedness actions are taking place, in particular in Sinaloa State, where the local authorities closed the schools in several municipalities by today 22 Oct (public information below on the Facebook profile of the Sinaloa Civil Protection:

<https://www.facebook.com/sepycsinaloa.oficial/photos/a.1096143080531351/1581442502001404/?type=3&theater>)

### Affected countries

Country
Mexico

### Affected provinces

Region Province	Country	Population
Nayarit	Mexico	890000 people
Sinaloa	Mexico	2.3 million people
Zacatecas	Mexico	1.3 million people
Durango	Mexico	1.4 million people
Coahuila	Mexico	2.1 million people

### Affected populated places

Name	Region Province	Country	City class	Population	Distance
Escuinapa	Sinaloa	Mexico	City	28000 people	436 km
Durango	Durango	Mexico	Major city	440000 people	605 km
Miguel Auza	Durango	Mexico	City	12000 people	692 km

**Table 5 - WILLA: Population of the exposed provinces (source: GDACS, 22 Oct, 15:00 UTC)**



Figure 4 - Recommendations for the population from the Sinaloa Civil Protection (source: <https://www.facebook.com/pcsinaloa/>).

### 3 JRC / EC contributions

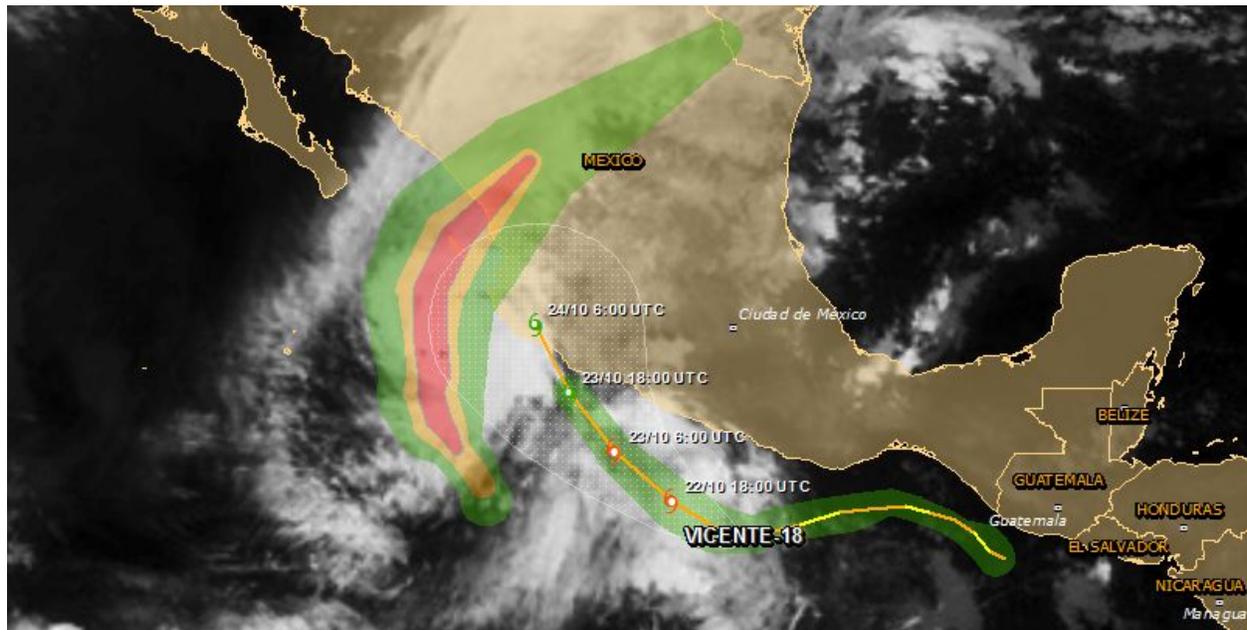


Figure 5 - Tropical Cyclone WILLA and VICENTE (source: GDACS)

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 WILLA and VICENTE for the ECHO Daily Flash reports, available at <http://ercportal.jrc.ec.europa.eu/ECHO-Flash>. ERCC requested JRC to produce an Emergency report on the situation of the two cyclones.

### **GDACS System for WILLA and VICENTE**

JRC is responsible for the operation of GDACS ([www.gdacs.org](http://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 based on the severity of the event, the population involved and the vulnerability of the countries (see Annex 2). GDACS also sends e-mail and SMS alerts to subscribed recipients.

The JRC is closely following TC **WILLA** because of the strength and the possible impact, and it is following **VICENTE** since the landfall area is very close to the one of **WILLA**.

#### Event alert

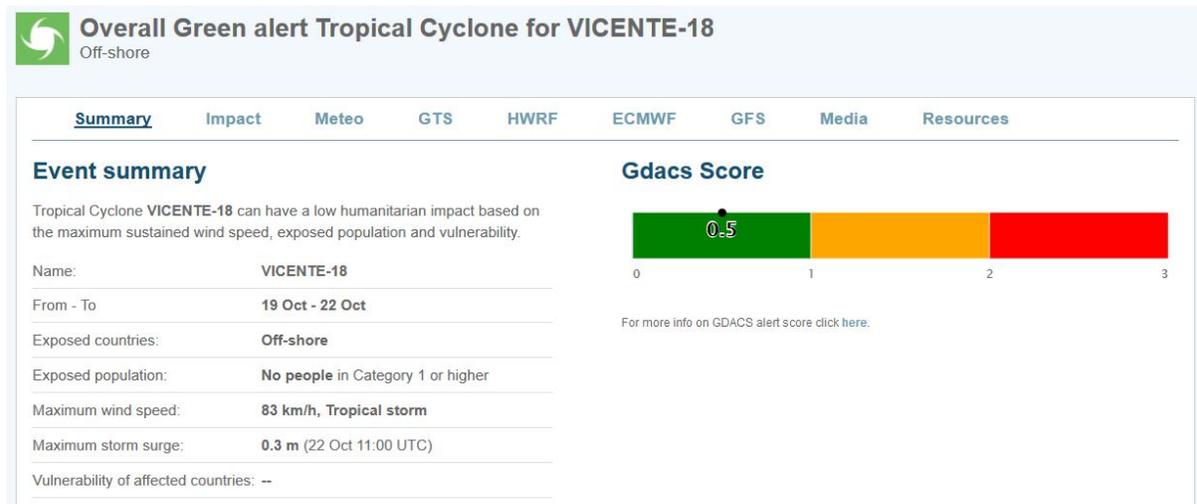
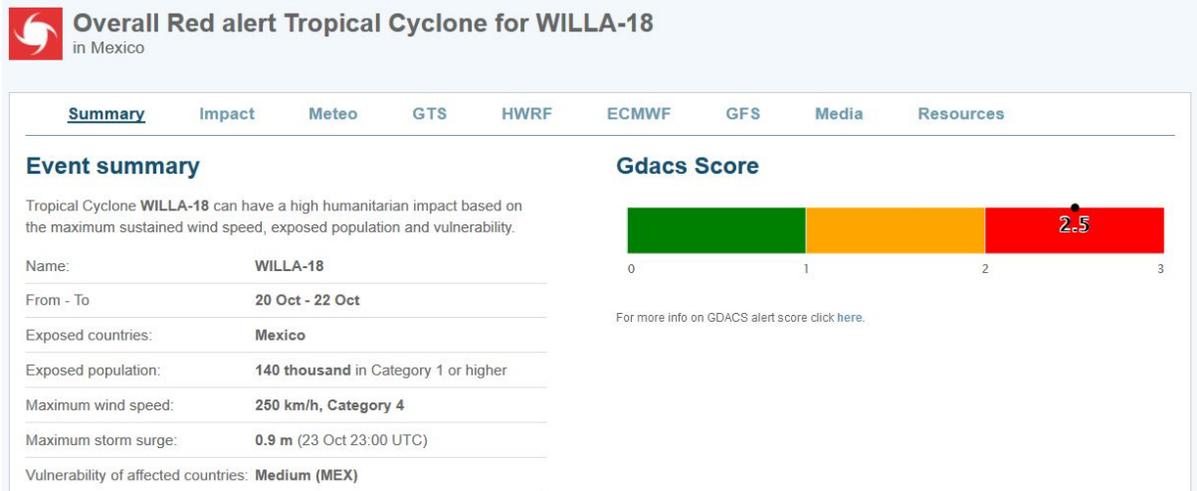
**WILLA:** GDACS has issued the first **ORANGE** Alert for this event in Mexico on 20 October at 21:00 UTC, reclassified as **RED** alert on 21 October at 15:00 UTC, depending on the variation of the forecasted track (different number of exposed people) and intensity.

According to the latest bulletin (22 Oct, 15:00 UTC), the GDACS alert level is RED (for high winds) for this event in Mexico with 870 000 people in Category 1 or higher strength winds (> 120 km/h).

**VICENTE:** the GDACS alert level for VICENTE has been always **GREEN**.

The possible impact due to winds, rainfall and storm surge for these two TCs are shown below, while the automatic GDACS reports can be found at these addresses:

- WILLA: <http://www.gdacs.org/report.aspx?name=WILLA-18>.
- VICENTE: <http://www.gdacs.org/report.aspx?name=VICENTE-18>



**Figure 6 - Automatic GDACS impact estimation (as of 22 Oct 2018, 15:00 UTC). WILLA (Top), VICENTE (Bottom).**

## JRC Emergency Reporting - Activation #24 - 22 October 2018

### Bulletin Timeline

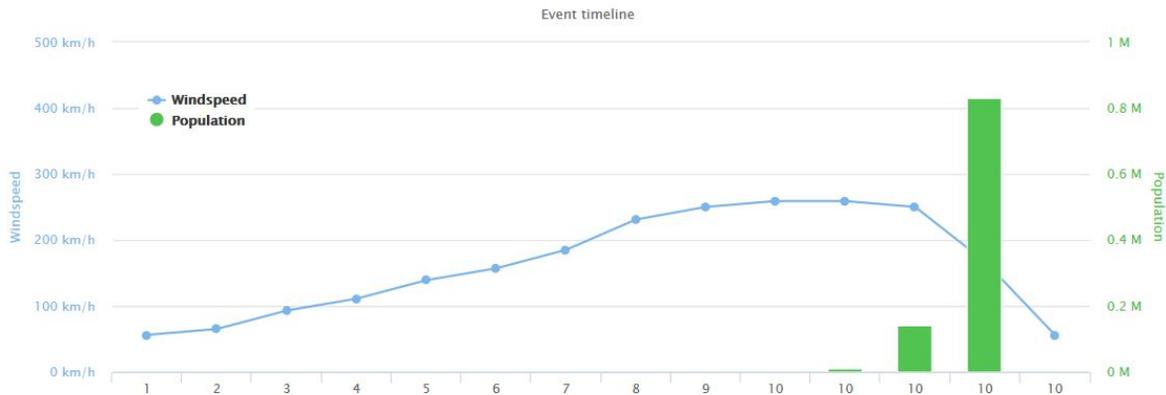
Advisory	Alert color	Date (UTC)	Category	Wind speed	Population in Tropical Storm	Population in Cat.1 or higher	Location (lat, lon)
1		20 Oct 2018 09:00	Tropical depression	56 km/h (34 mph)	no people	no people	15.1, -104.9
2		20 Oct 2018 15:00	Tropical storm	65 km/h (40 mph)	no people	no people	14.8, -105.7
3		20 Oct 2018 21:00	Tropical storm	93 km/h (57 mph)	no people	no people	15.2, -105.8
4		21 Oct 2018 03:00	Tropical storm	111 km/h (69 mph)	no people	no people	15.7, -106.1
5		21 Oct 2018 09:00	Category 1	139 km/h (86 mph)	no people	no people	16.2, -106.5
6		21 Oct 2018 15:00	Category 2	157 km/h (98 mph)	no people	no people	16.6, -106.7
7		21 Oct 2018 21:00	Category 3	185 km/h (115 mph)	no people	no people	17, -107
8		22 Oct 2018 03:00	Category 4	231 km/h (143 mph)	no people	no people	17.7, -107.2
9		22 Oct 2018 09:00	Category 4	250 km/h (155 mph)	no people	no people	18.2, -107.1
10		22 Oct 2018 15:00	Category 5	259 km/h (161 mph)	11000 people	no people	19.1, -107.2
10		23 Oct 2018 00:00	Category 5	259 km/h (161 mph)	420000 people	62000 people	20.1, -107.2
10		23 Oct 2018 12:00	Category 4	250 km/h (155 mph)	2.6 million people	130000 people	21.4, -106.9
10		24 Oct 2018 00:00	Category 2	167 km/h (103 mph)	3.7 million people	830000 people	23.1, -105.6
10		24 Oct 2018 12:00	Tropical depression	56 km/h (34 mph)	no people	no people	25.4, -102.5

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

### Wind

Up to 870000 people can be affected by wind speeds of cyclone strength or above.

Sustained wind speed and population by Category 1 winds or higher



**Figure 7 - GDACS Alert for Tropical Cyclone WILLA - Event Timeline, population exposed, max. sustained winds (Category: Saffir-Simpson Hurricane Scale, see Annex), as of 22 Oct 2018, 15:00 UTC.**

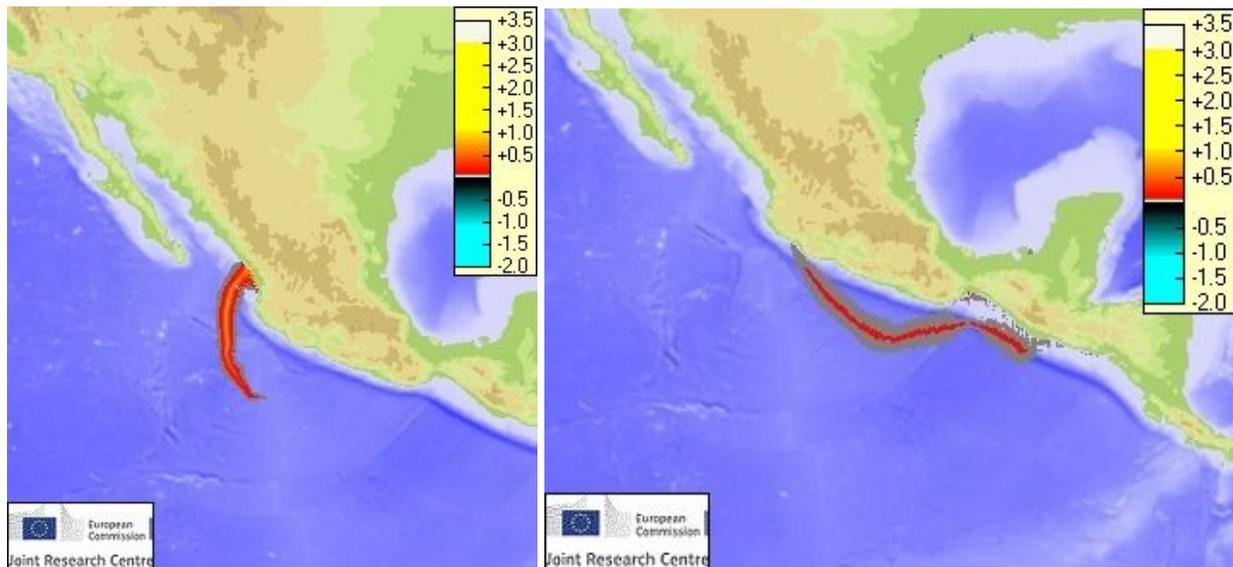
### Storm Surge Estimations

According to the JRC HyFlux2 storm surge calculation for WILLA (using as input the data of the bulletin of 22 Oct 2018 15:00 UTC) and using the standard GDACS model, the maximum value of the storm surge is

- **1.0 m** in La Puerta: on 23 Oct 2018 21:00

The evaluation of the Storm Surge for VICENTE is lower, with a maximum value of

- **0.3 m** in Huajapan: on 22 Oct 2018 11:00



**Figure 8** - Storm surge over the track of WILLA-18 (left figure) and VICENTE-18 (right figure)

The list of locations for storm surge is shown below (Fig. 9).

## JRC Emergency Reporting - Activation #24 - 22 October 2018

Date	Name	Country	Alert	Storm surge height (m)
23 Oct 2018 21:00:00	La Puerta	Mexico		1.0m
23 Oct 2018 21:00:00	Isla de Palmito del Verde	Mexico		0.9m
23 Oct 2018 21:00:00	Novillero	Mexico		0.7m
23 Oct 2018 21:00:00	Cuantla	Mexico		0.7m
23 Oct 2018 20:00:00	Cuamecate	Mexico		0.7m
23 Oct 2018 21:00:00	Jarilla	Mexico		0.6m
23 Oct 2018 20:00:00	Santa Cruz	Mexico		0.5m
23 Oct 2018 20:00:00	El Nuevo	Mexico		0.5m
23 Oct 2018 20:00:00	Toro Mocho	Mexico		0.4m
23 Oct 2018 22:00:00	Caimanero	Mexico		0.3m
23 Oct 2018 19:00:00	San Blas	Mexico		0.2m
23 Oct 2018 20:00:00	Santa Cruz	Mexico		0.2m
23 Oct 2018 21:00:00	La Palmita	Mexico		0.1m
23 Oct 2018 23:00:00	Barron	Mexico		0.1m

**Figure 9** - Reference locations for storm surge calculations using GDACS/HyFlux2 calculations .

Note: 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.

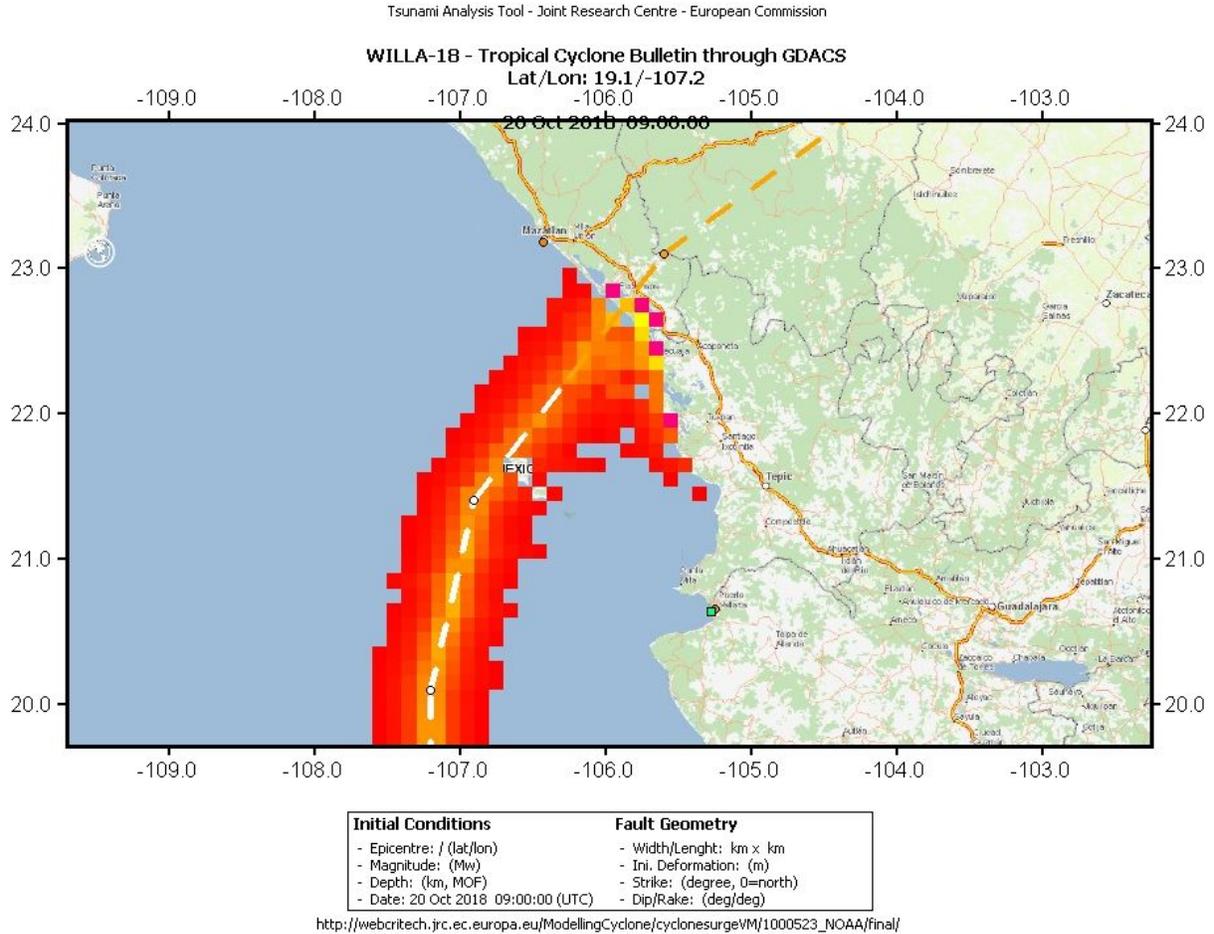


Figure 10 - Storm surge impact in the Mexican coast close to the landfall area

## 4 Other information

### 4.1 Copernicus EMS activation

Not yet activated

### 4.2 Virtual OSOCC Activation

None.

### 4.3 International Charter for Space and Major Disasters

Not yet activated

## 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](mailto:alessandro.annunziato@ec.europa.eu) (GDACS)
- Pamela Probst, [pamela.probst@ec.europa.eu](mailto:pamela.probst@ec.europa.eu) (GDACS Meteorologist)
- Chiara Proietti, [chiara.proietti@ec.europa.eu](mailto:chiara.proietti@ec.europa.eu) (Humanitarian response)
- Thomas Petroligkis, [thomas.petroligkis@ec.europa.eu](mailto:thomas.petroligkis@ec.europa.eu) (GDACS Meteorologist)
  
- Alessandra Zampieri, [alessandra.zampieri@ec.europa.eu](mailto:alessandra.zampieri@ec.europa.eu)
- Tom De Groeve, [tom.de-groev@ec.europa.eu](mailto:tom.de-groev@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/>
- National Meteorological service:
  - Mexico : <http://smn.cna.gob.mx/es/>
  
- Regional Specialized Meteorological Centres (RSMCs) and Tropical Cyclone Warning Centres (TCWCs):
  - RSMC Miami-Hurricane Center/NOAA/NWS National Hurricane Center, USA  
<http://www.nhc.noaa.gov/index.shtml>
  
- NOAA-HWRF (Hurricane Weather Research and Forecasting system):  
[http://www.emc.ncep.noaa.gov/gc\\_wmb/vxt/HWRF/index.php](http://www.emc.ncep.noaa.gov/gc_wmb/vxt/HWRF/index.php)

Annex 1 - Detailed Map on the Tropical Cyclone

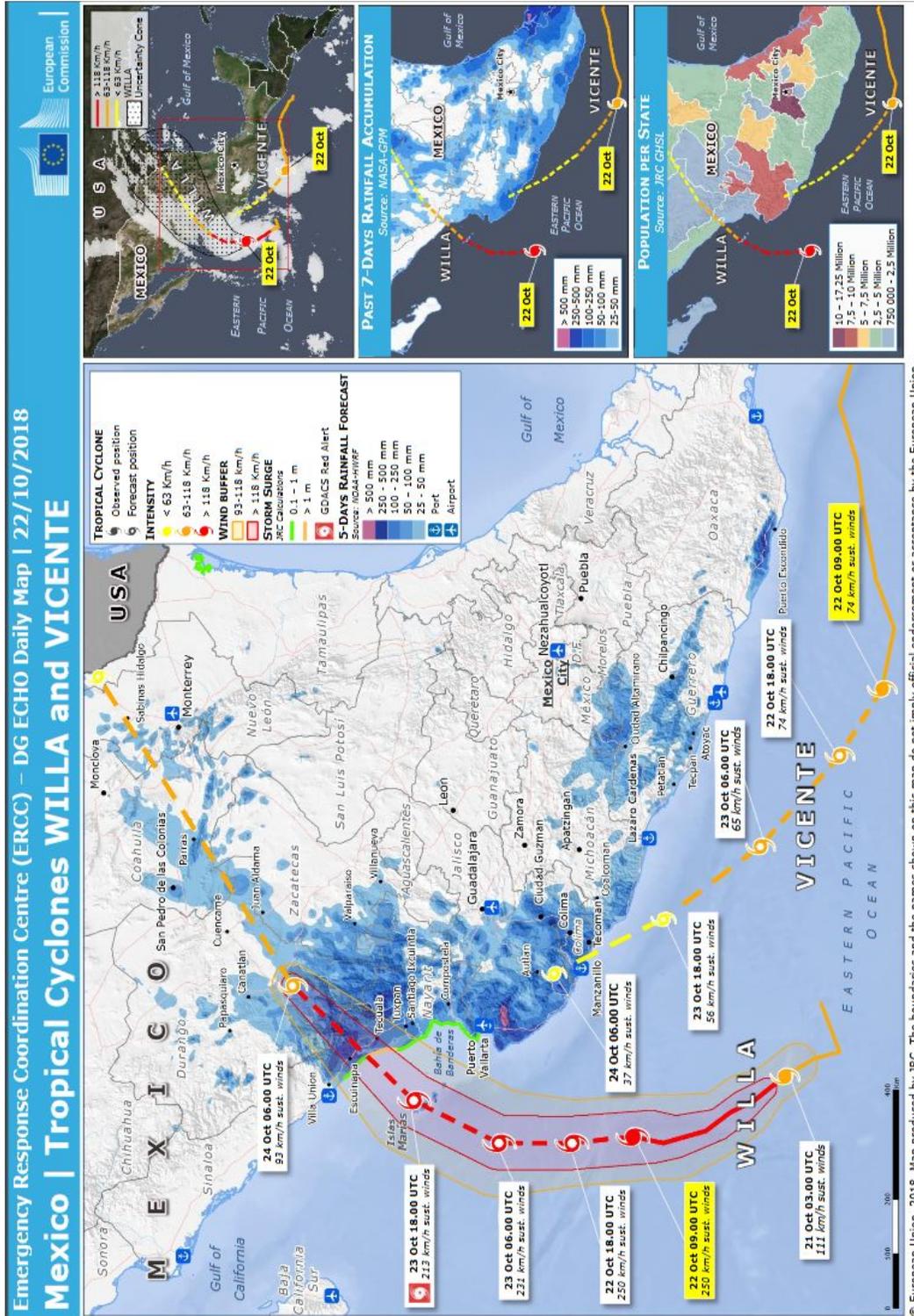


Figure A.1.1 - ECHO Daily map of 22 October 2018 - Tropical Cyclones WILLA and VICENTE

## Annex 2 - GDACS Alerts

JRC is responsible for the operation of GDACS (Global Disaster Alerting Coordination System), 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_-_FINAL.PDF)

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

Tropical Cyclones (TCs) are among the most dangerous natural disasters, causing every year extensive damage and deaths in several countries around the world. They have three destructive effects (strong wind, heavy rain and storm surge). GDACS includes the analysis of all TCs occurring worldwide.

### TC information:

JRC set up an automatic routine that includes the TC bulletins produced by the National Oceanic and Atmospheric Administration (NOAA) and the Joint Typhoon Warning Center (JTWC) into a single database, covering all TC basins. This information is used in GDACS for the wind impact, and as input for the JRC storm surge system. JRC has recently developed new tools for the analysis of the TC impacts and included new sources (NOAA Hurricane Weather Research and Forecast - HWRF and Global Forecasting System - GFS, global high resolution model of the European Centre for Medium Weather Forecast -ECMWF).

→ EAST PACIFIC: NOAA-NHC data

### Wind

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

- TC wind speed<sup>3</sup> (hazard)
- Population affected
- Vulnerability of the affected country

The equivalent Category based on the Saffir-Simpson Hurricane Wind Scale (SSHS), 1-min sustained winds, is also indicated in GDACS (see next page).

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

<sup>3</sup> GDACS, JTWC, NOAA wind information based on 1-min sustained winds; other centers: 10-min average (see: [https://www.wmo.int/pages/prog/www/tcp/documents/WMO\\_TD\\_1555\\_en.pdf](https://www.wmo.int/pages/prog/www/tcp/documents/WMO_TD_1555_en.pdf))

Recently, in order to avoid too much false alerts or flip-flop effects due to the too early forecast and change of track direction or intensity, the alert level for forecast data with more than 3 days lead time is limited to Orange Alert, even if Red Alert is estimated.

### 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.

### 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 1-min sustained wind speed and it estimates the potential property damage (see Table A.2.1).

<b>Saffir-Simpson Hurricane Wind Scale (SSHS), source NOAA-NHC</b>		
<b>Hurricane CATEGORY</b>	<b>1-min sustained winds (km/h)</b>	<b>Types of Damage Due to Hurricane Winds</b>
<b>Cat. 1</b>	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.
<b>Cat. 2</b>	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
<b>Cat. 3</b> <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
<b>Cat. 4</b> <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.
<b>Cat. 5</b> <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

**Table A2.1** -TC Classification (Saffir-Simpson Hurricane Wind Scale), used in GDACS.  
(see NOAA-NHC: <http://www.nhc.noaa.gov/aboutsshws.php>)

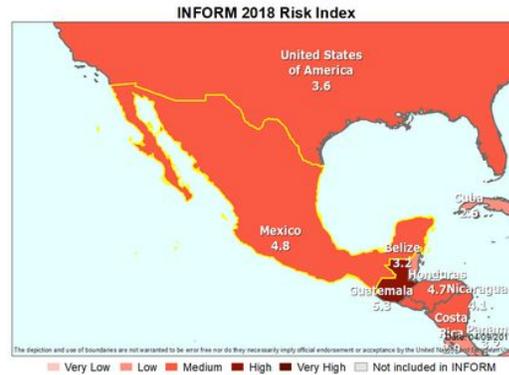
## Annex 3 - INFORM

### MEXICO



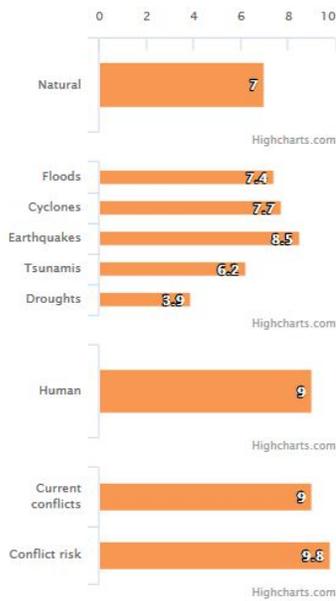
Central America  
Upper middle income

	Value	Rank	Trend
<b>INFORM Risk</b>	<b>4.8</b>	<b>51</b>	—
<b>Hazard &amp; Exposure</b>	<b>8.2</b>	<b>7</b>	—
<b>Vulnerability</b>	<b>3.1</b>	<b>96</b>	—
<b>Lack of Coping Capacity</b>	<b>4.4</b>	<b>101</b>	—

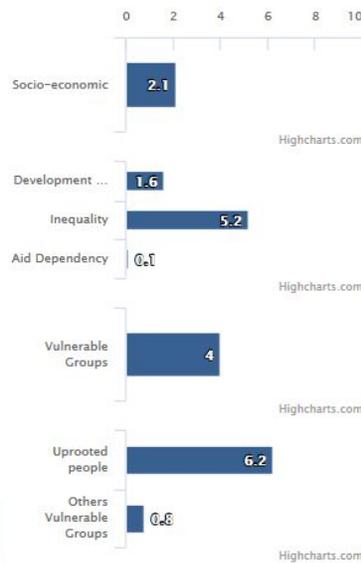


#### ▼ RISK DIMENSIONS AND COMPONENTS

##### Hazard & Exposure



##### Vulnerability



##### Lack of Coping Capacity



## Annex 4 - Historical TCs in the area

The official hurricane season for the Eastern Pacific Basin is between May 15th and to November 30th.

The most significant recent TCs that affected the Pacific coast of Mexico over the last years are shown in the table below, while the track are reported in the figures below.

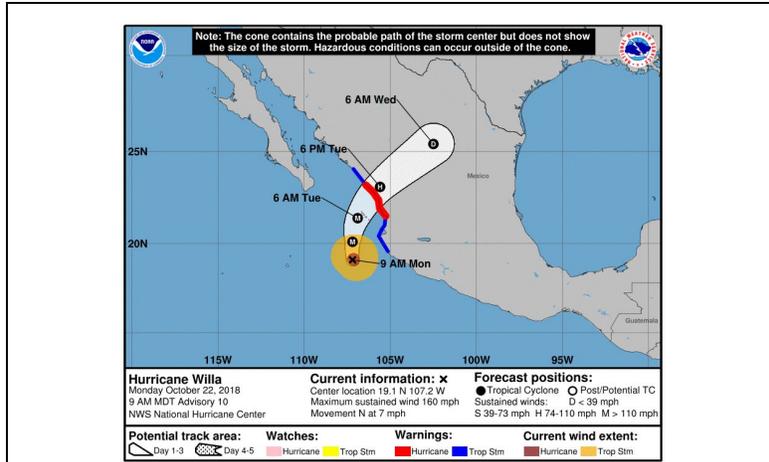
TC Name	Dates active	Category at peak intensity	Landfall	Fatalities	GDACS Alert
PATRICIA <sup>4</sup>	2015, 20-24 Oct	Cat5 Hurricane	Along a sparsely populated part of the coast of southwestern Mexico	2 direct 4 indirect	RED Population affected by Category 1 (120 km/h) wind speeds or higher: 410 000 Maximum windspeed: 324 km/h
MANUEL <sup>5</sup>	2013, 13-19 Sep	Cat1 Hurricane	High terrain of the states of Jalisco and Colima and West of Culiacán, Mexico	104 direct 19 indirect  At least 97 direct deaths occurred in the state of Guerrero, many of which occurred when a mud slide destroyed nearly half of the village of La Pintada.	ORANGE Population affected by Category 1 (120 km/h) wind speeds or higher: 150 000 Maximum windspeed: 121 km/h

**TC WILLA - 21 Oct 2018 - ongoing<sup>6</sup> (source: NOAA)**

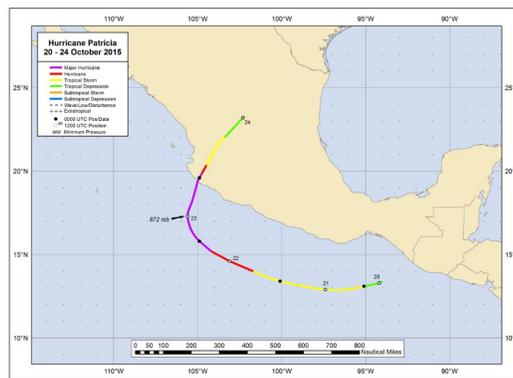
<sup>4</sup> [https://www.nhc.noaa.gov/data/tcr/EP202015\\_Patricia.pdf](https://www.nhc.noaa.gov/data/tcr/EP202015_Patricia.pdf)

<sup>5</sup> [https://www.nhc.noaa.gov/data/tcr/EP132013\\_Manuel.pdf](https://www.nhc.noaa.gov/data/tcr/EP132013_Manuel.pdf)

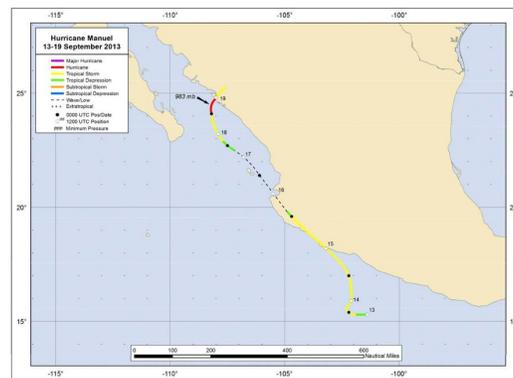
<sup>6</sup> [https://www.nhc.noaa.gov/refresh/graphics\\_ep4+shtml/145740.shtml?cone#contents](https://www.nhc.noaa.gov/refresh/graphics_ep4+shtml/145740.shtml?cone#contents)



**TC PATRICIA - 2015, 20-24 Oct (source: NOAA)**



**TC MANUEL - 2013, 13-19 Sep (source: NOAA)**



# Annex 5 - Tropical Cyclone Strike Probability for TC WILLA and VICENTE (based on ECMWF HRES & Ensemble Prediction System)

## 5.1 - Product Description

These charts show the evolution of the position and intensity of tropical cyclones (TCs) in the ECMWF (European Centre for Medium-Range Weather Forecasts) high-resolution (HRES) and ensemble forecasts (comprising 50 plus one control equal probable members) based on the Ensemble Prediction System (EPS). They provide a measure of the uncertainty in the latest ECMWF forecast based on 22 Oct 2018 00 UTC. These products are generated for all TCs that have been officially observed at the initial time of the forecast. The main characteristics of Strike Probabilities are shown below (Fig. A5.1).

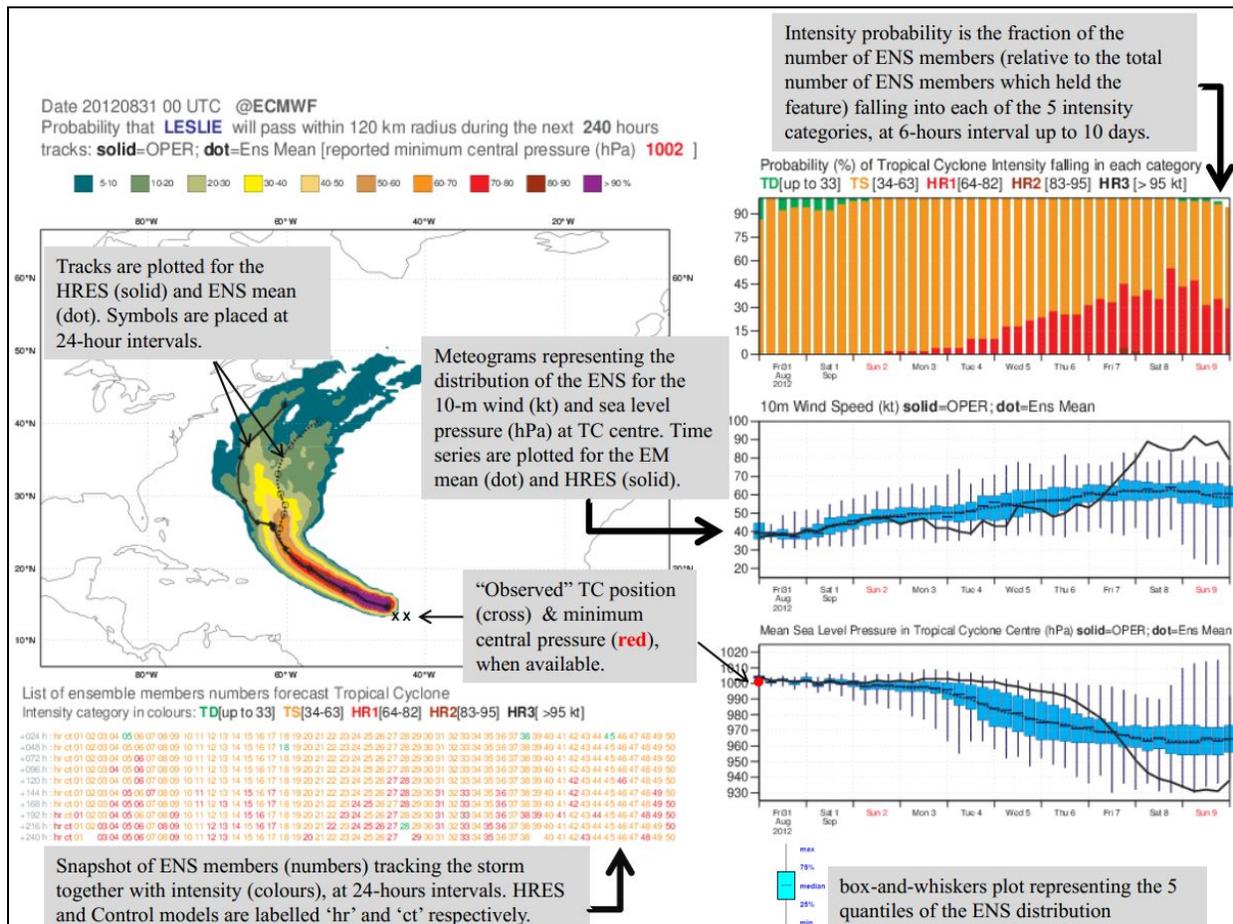
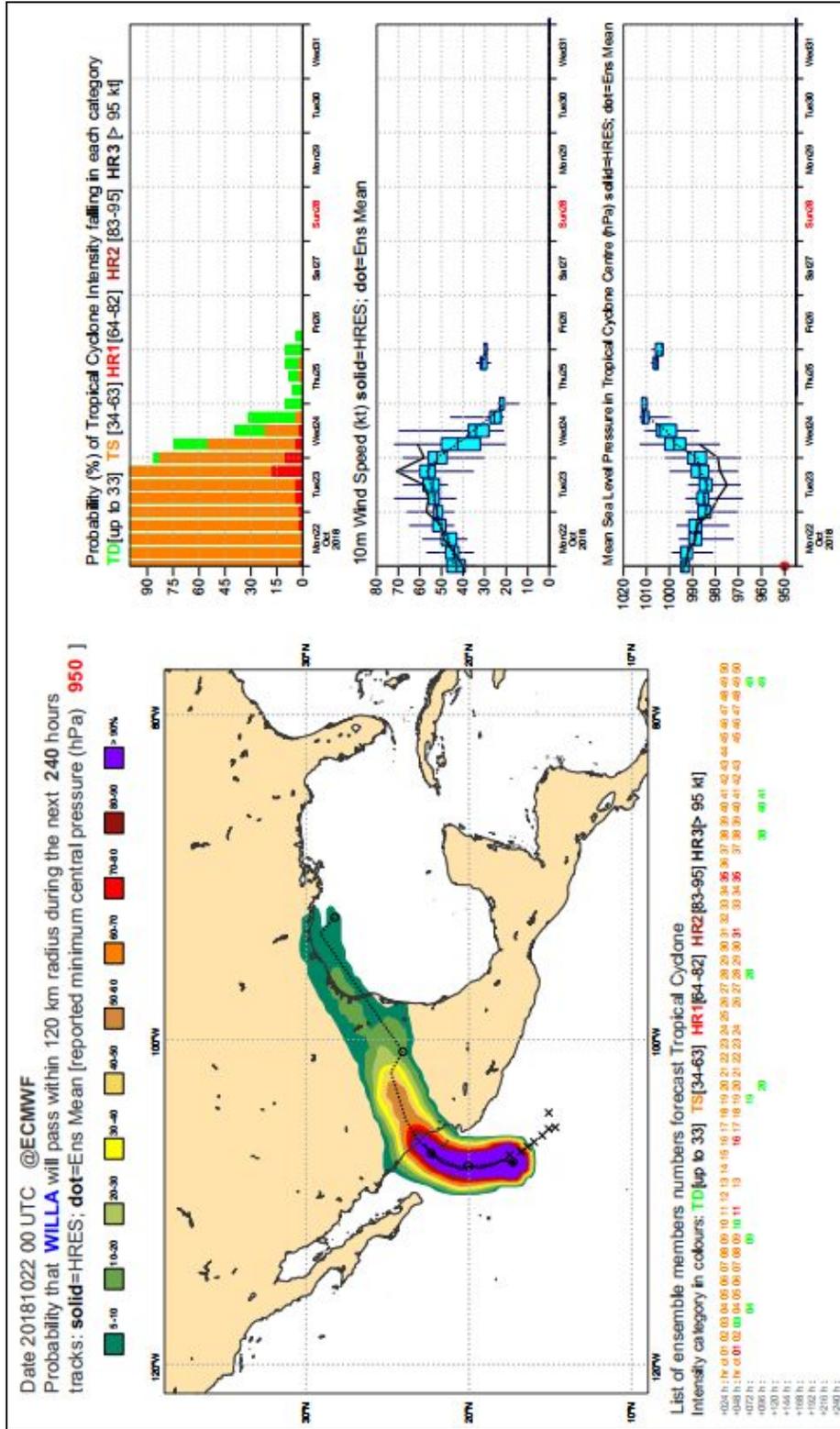


Figure A5.1 - Main characteristics of Strike Probabilities (Map).

For a quick-look graphical guide to interpreting these products see [https://www.ecmwf.int/sites/default/files/tracks\\_example.pdf](https://www.ecmwf.int/sites/default/files/tracks_example.pdf). A detailed explanation about the ECMWF Tropical Products and the tracking algorithm can be found at [https://www.ecmwf.int/sites/default/files/TC\\_ShowGuide.pdf](https://www.ecmwf.int/sites/default/files/TC_ShowGuide.pdf).

Current Annex 5 contains Strike Probabilities for TC WILLA (5.2) and TC VICENTE (5.3).

5.2 - Strike Probabilities for TC WILLA



### 5.3 - Strike Probabilities for TC VICENTE

