Met Office

FLOODFORECASTINGCENTRE

a working partnership between Environment Agency | Met Office

Multi Hazard, Impact Based forecasting and warning services: an introduction

In this session

- Understand what makes a weather warning effective
- Use Met Office in the UK and its National Severe Weather Warning Service (NSWWS) as an example
- Develop the concept of impact based forecasting and risk based warnings

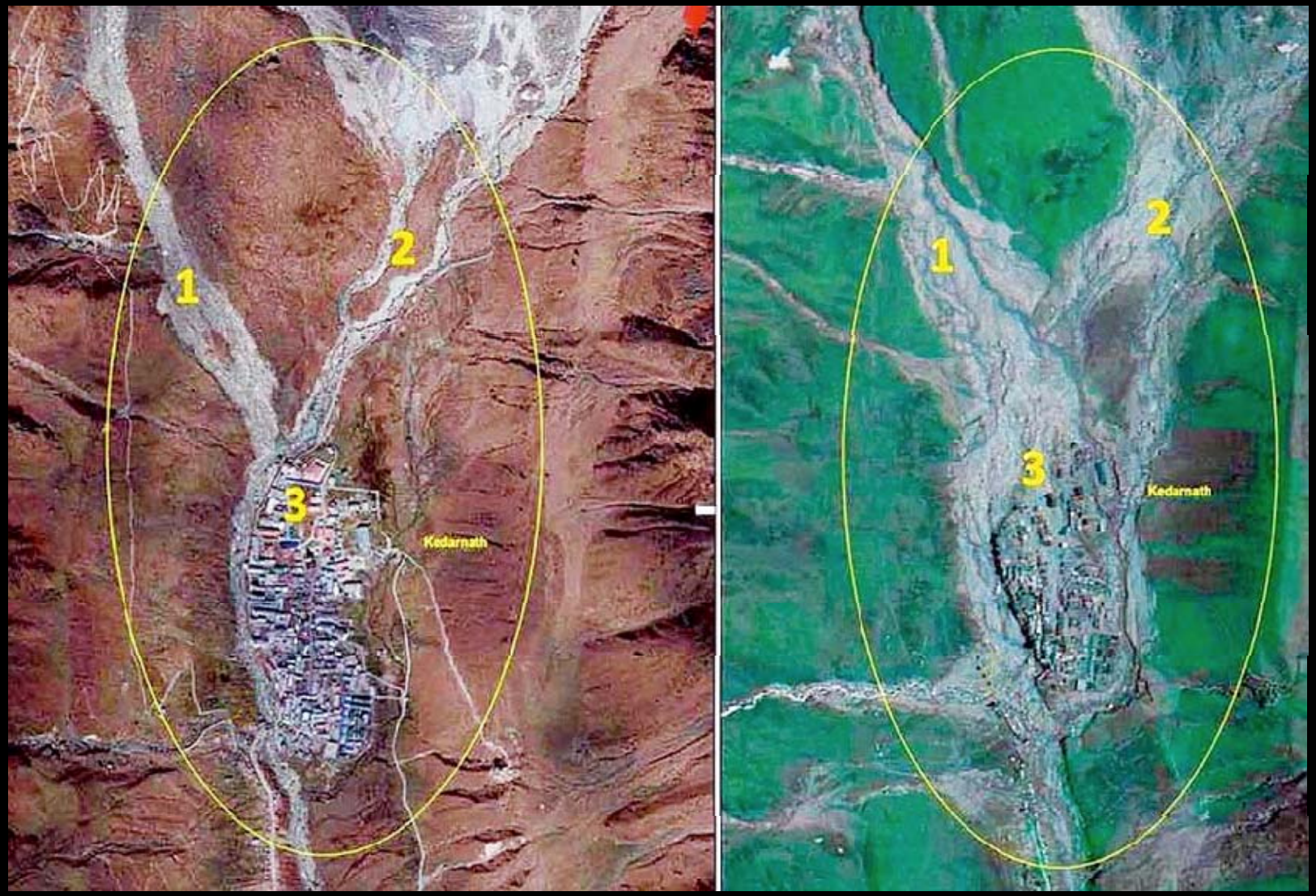
Case Study – India, June 2013…..

-Check

-Please share your perspectives

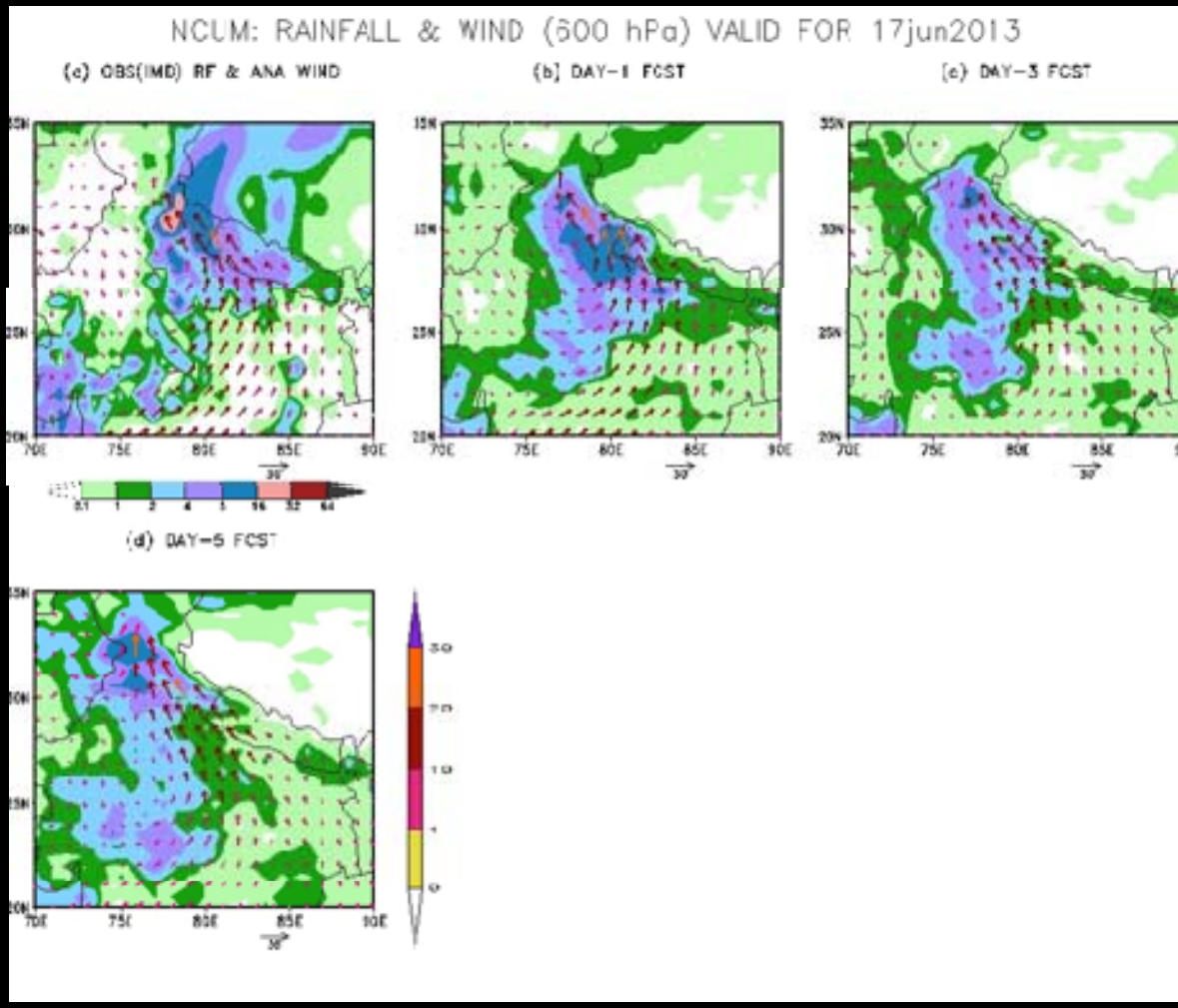
Kedarnarth Temple

Kedarnarth before and after flood



What worked well

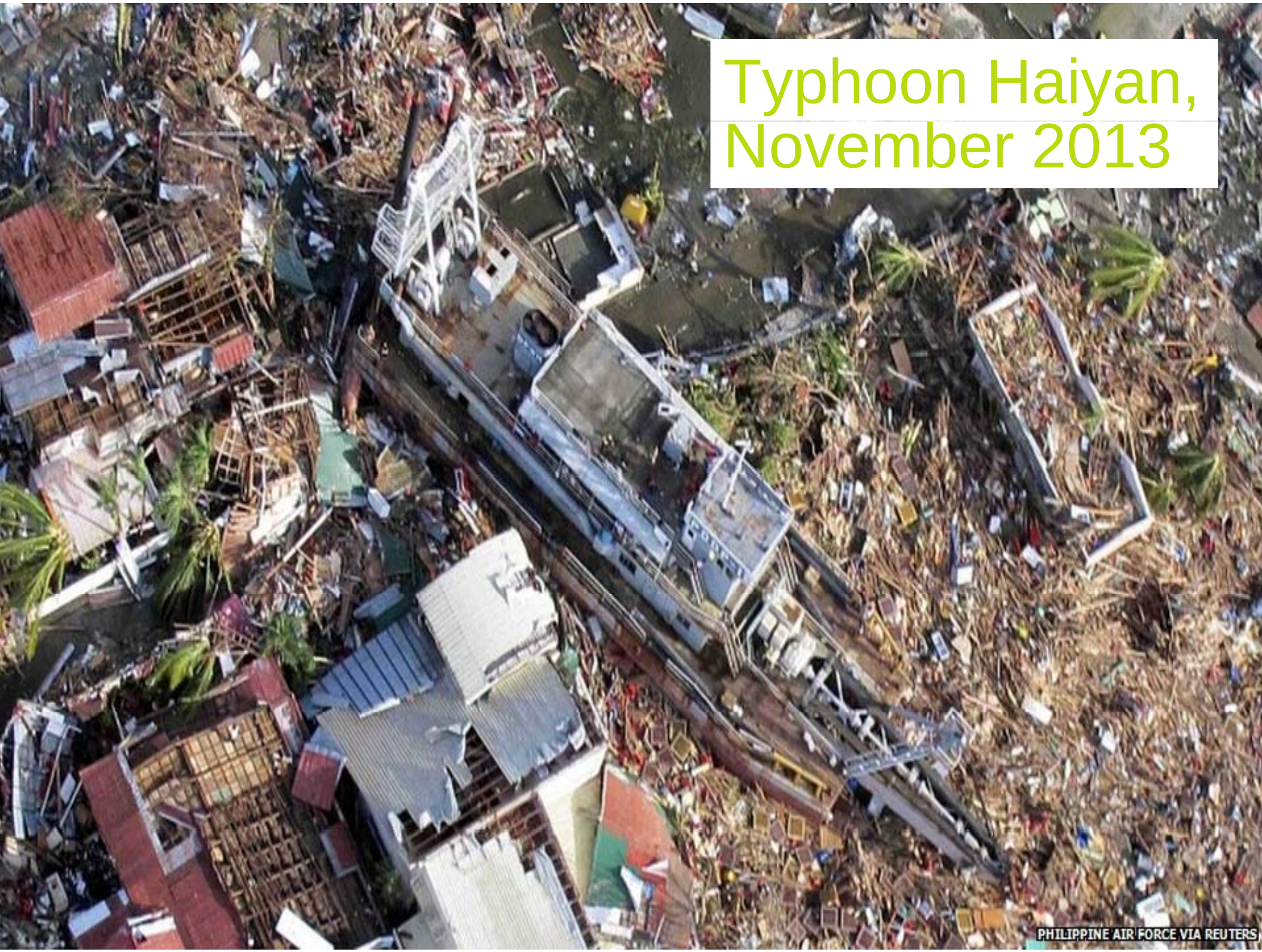
1. Good Weather forecasts of heavy rainfall three days ahead of event
2. Weather warnings issued by Indian Met Department
3. Media coverage of threat
4. Satellite remote sensing information available



What could have been better

- Warning information was not fully understood. Disaster Manager – Unable to interpret “heavy rainfall for entire state”
- Communication between central government, IMD and State Disaster Manager
- Lack of capacity to translate hazard information into impacts – therefore, impacts underestimated
- Inadequate observations to forecast events on local scale

Typhoon Haiyan, November 2013



Lets think about ‘Hazards’

Source	Primary Hazard	Secondary Hazard	Tertiary Hazard
Typhoon			

Primary hazard

Secondary hazard

WEATHER 6 APRIL 2016

Deadly floods hit Ethiopia

Months of a severe drought broken by heavy rain as torrential downpours develop along the East African Rift Valley.

Ethiopian meteorology officials expect further floods as heavy showers are forecast over the next fe

Floods and landslides kill over 100 in Ethiopia

At least 20,000 homeless as meteorologists blame this year's particularly powerful El Nino for country's high rainfall.

By Charles Stratford

About 100 people have been killed by floods and landslides across Ethiopia that started last month, government officials say.

Typhoon -> Hazards

Source	Primary Hazard	Secondary Hazard	Tertiary Hazard
Typhoon	Strong Winds Lightning Heavy Rainfall		

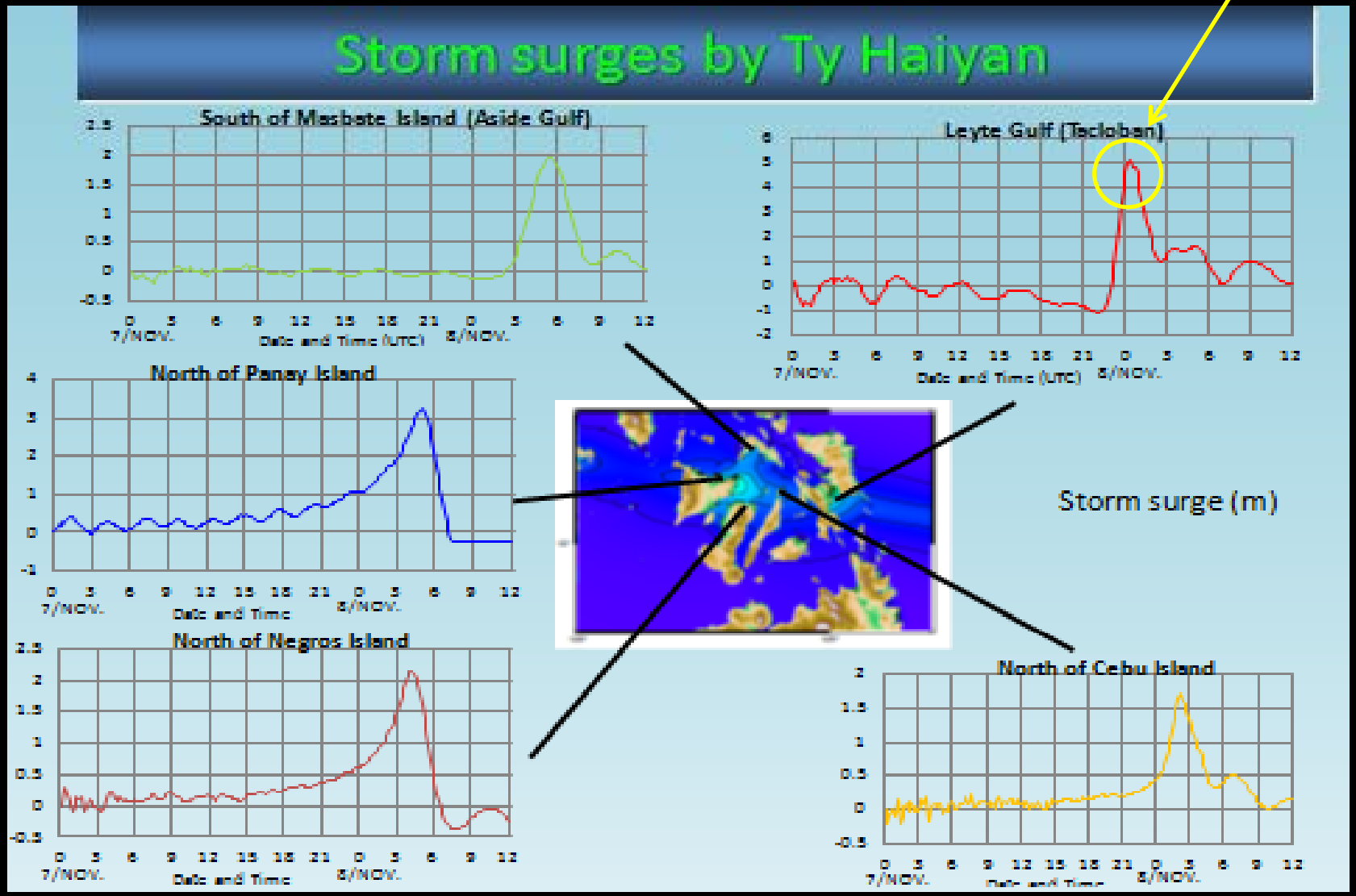
Typhoon -> Hazards

Source	Primary Hazard	Secondary Hazard	Tertiary Hazard
Typhoon	Strong Winds Lightning Heavy Rainfall	Storm Surge High Waves Flooding Tidal Locking Landslides	

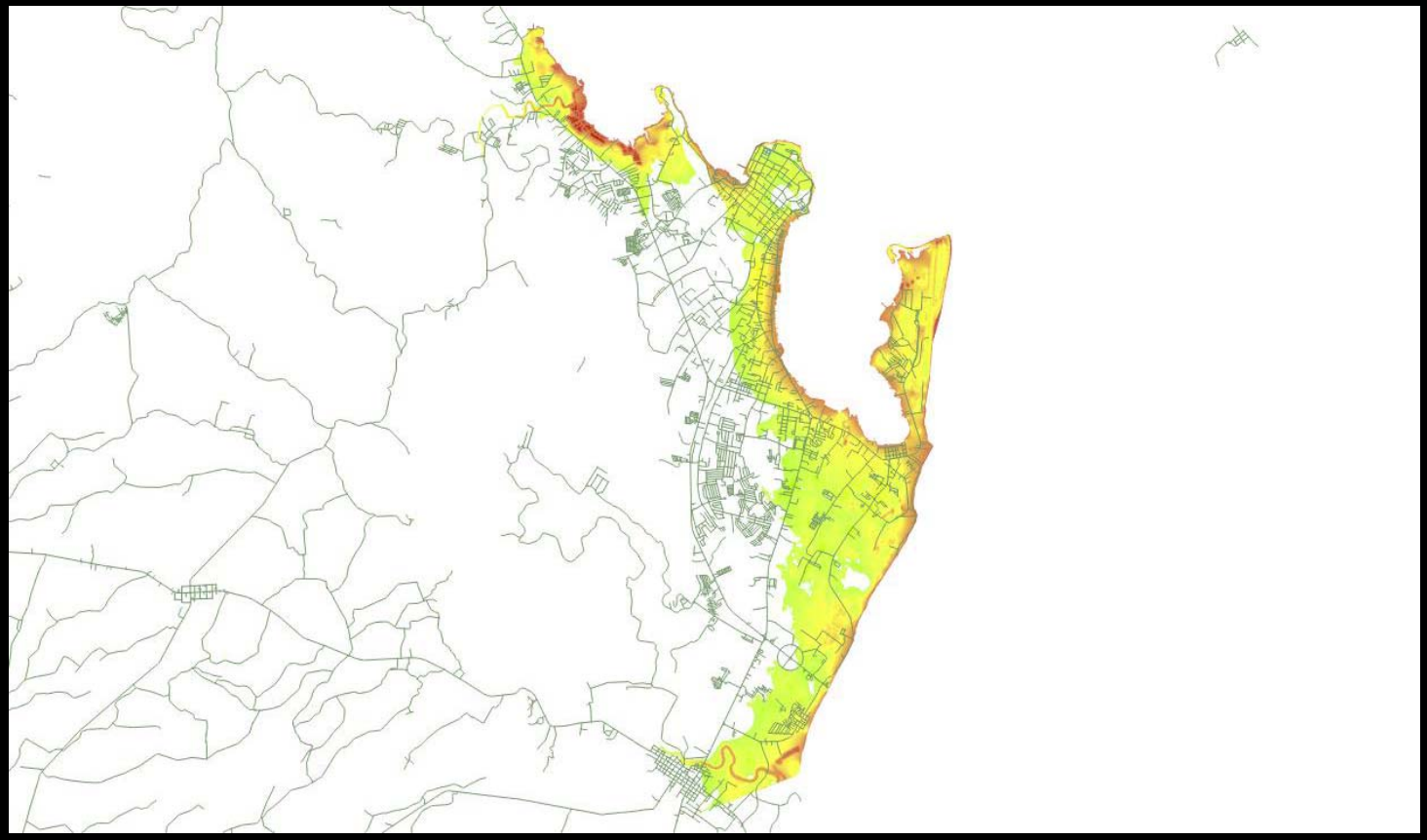
Typhoon -> Hazards

Source	Primary Hazard	Secondary Hazard	Tertiary Hazard
Typhoon	Strong Winds Lightning Heavy Rainfall	Storm Surge High Waves Flooding Tidal Locking Landslides	Health Disease Poor Water Quality Etc

Typhoon -> Storm Surge



Typhoon -> Secondary
Flood inundation



Typhoon -> Tertiary

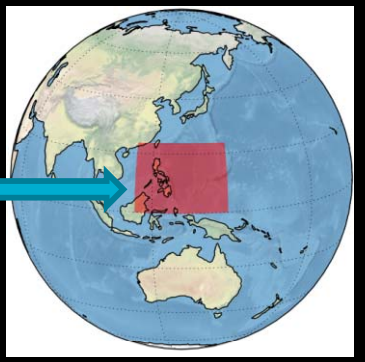
Health and increased vulnerability

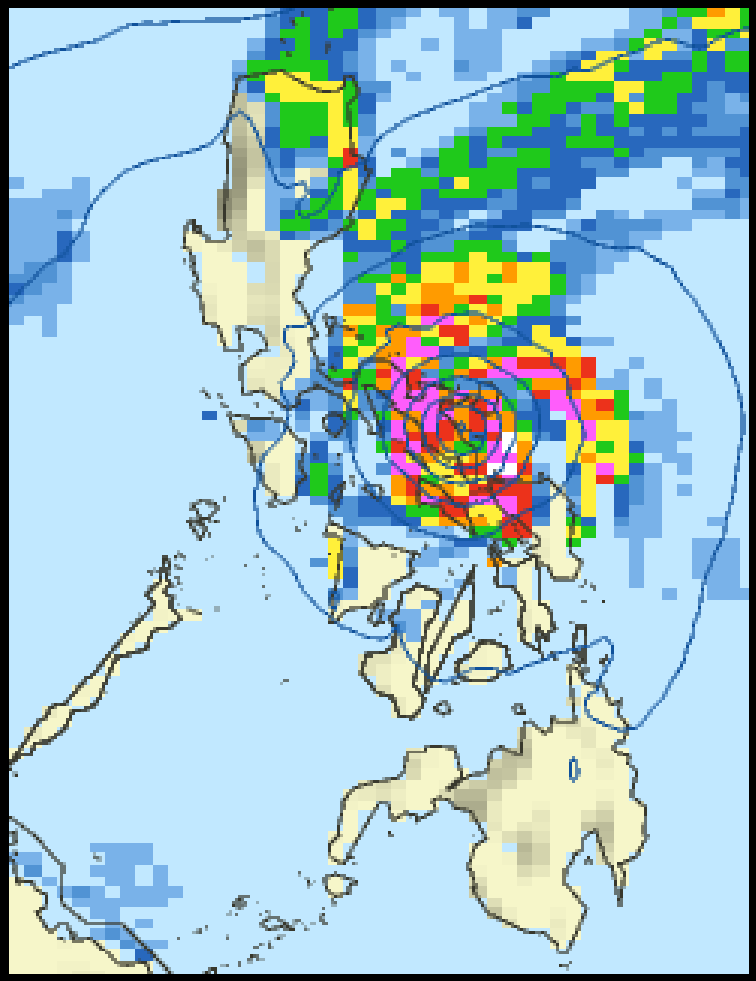

Typhoon Hagupit,
December 2014

Typhoon Hagupit

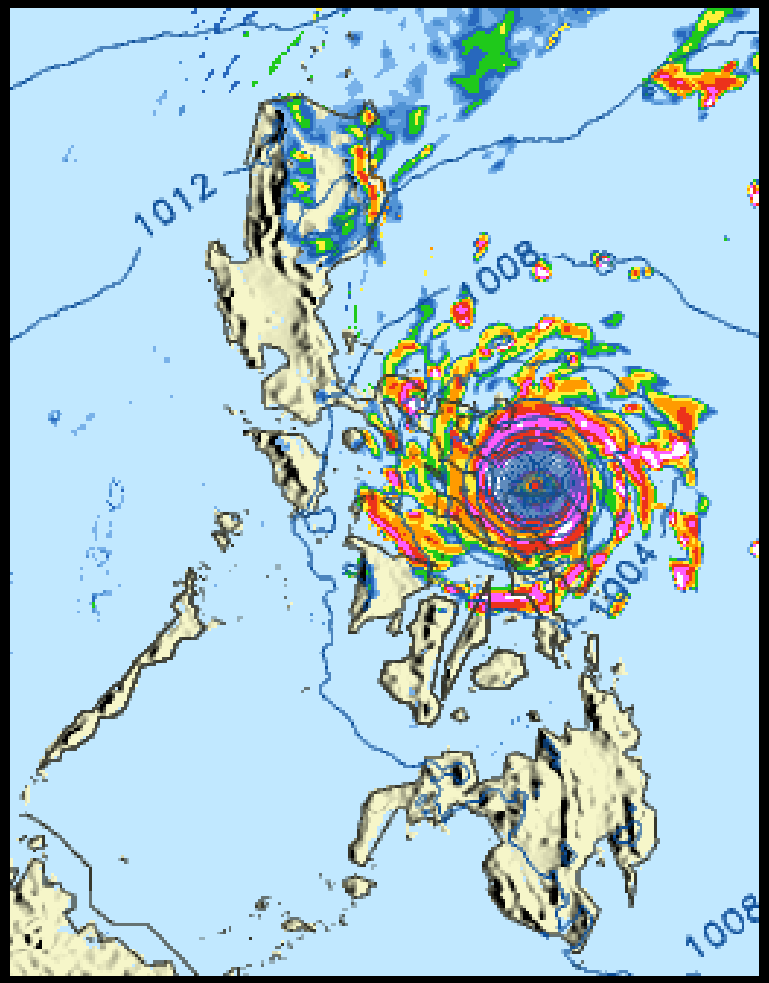
The 4.4 km

4.4 domain

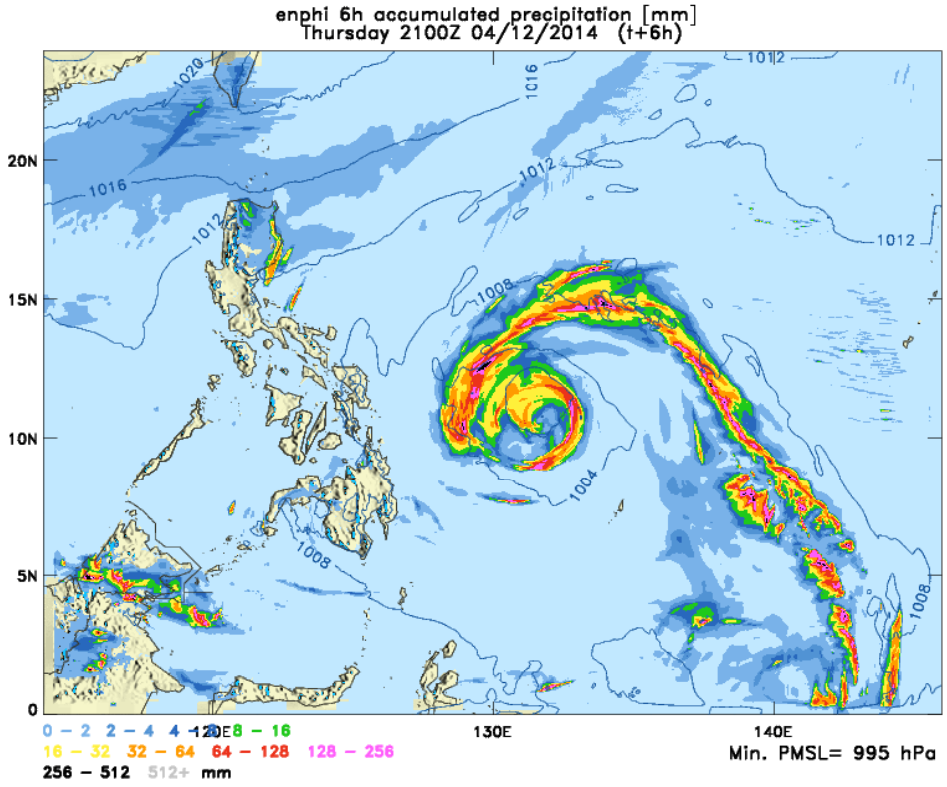


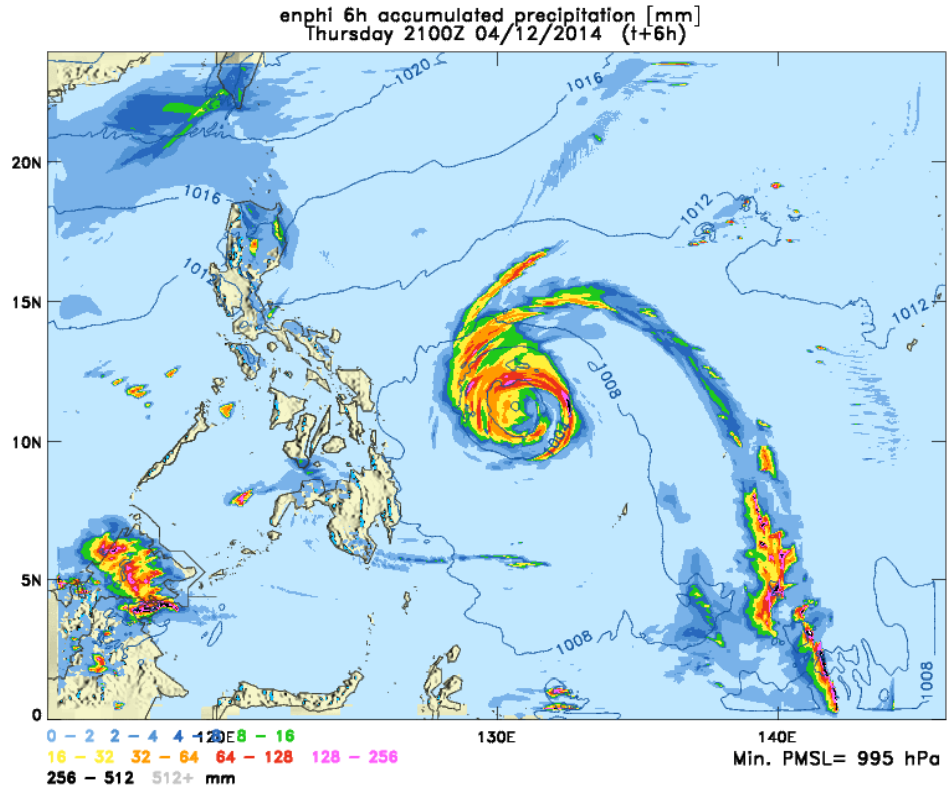


Global (deterministic)



4.4 km





TWO scenarios

1. Stalling northerly – landfall not until Tuesday or later. Main hazards: Heavy rainfall, severe inland flooding and landslides. Probability 70%

2. Fast westerly – landfall later Saturday or early Sunday. Main Hazards: wind and storm surge. Probability 30%.

What was the difference?

- Similar magnitude events but...
- Typhoon Haiyan caused over 6000 deaths
- Typhoon Hagupit caused less than 100 deaths

Forecast impacts, not just hazards.

Explain the warnings in terms that the emergency services and public understand.

Criteria for issuing a warning

Which is more important?

- **Thresholds**
- 20mm/hr
- 30mm/hr
- 40mm/hr
- 10mm/24hr
- 50mm/24hr
- 50mph gusts
- 60 mph gusts
- 2m tidal surge

- **Impacts**
- Saturated ground/Large puddles
- Flooding of agricultural land from rainfall/ from river bursting banks/coastal
- Flooding of road networks from rainfall/ river bursting banks/coastal
- Flooding of towns/cities from rainfall/ river bursting banks/coastal
- Trees blown down/boats overturned/ power cables brought down

Primary hazard

Secondary hazard

WEATHER 6 APRIL 2016

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Impacts of heavy rain in Ethiopia: which are the impacts? (6)

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At least 20,000 families have been made homeless, according to the UN, while local officials say there are a number of people still missing.

Livestock are already weak because of the drought

Meteorologists have blamed this year's particularly powerful El Nino weather phenomenon for the country's high rainfall.

Aid organisations anticipate continued flooding could displace tens of thousands more.

"People can be affected in different ways. They can have damaged crops, they can lose their livestock, and in the more extreme cases, lose their entire households and go really quite destitute," Paul Handley, of the UN's Office for the Coordination of Humanitarian Affairs (OCHA) in Ethiopia, said.

The floods have also hampered distribution of vital aid to drought-affected areas.

The situation is exacerbated because more than 10 million people have been forced to rely on aid after the country suffered its worst drought in decades that lasted at least a year.

Handley said the six affected regions had already been in a dangerous situation relating to food security.

Impacts of heavy rain in Ethiopia

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What do we need to know?

- Establish
  - which types of weather need a warning and why
    - how much rain has to fall?
    - how strong does the wind need to be?
  - Is that the right question? Should it be
    - What impact will that rain have?
    - What impact will that wind have?

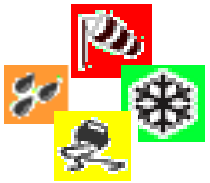
Exercise (10 mins)

- In groups of ~4 discuss
  - Select a country:
  - What source (weather) is important: e.g. typhoon
  - What are the hazards of that weather?: primary, secondary, tertiary
  - What are the impacts of that weather?
  - Which is more important
- Be prepared to feedback in 10 minutes

Developing an impact based warning service

What makes a weather warning effective to the public and emergency responders? (7)

What makes a weather warning effective



Easy to understand

Help Emergency Responders respond

Variety of access points

Essential Elements

Help Emergency Responders plan

Easy to access

Change behaviour

Effective

Major Weather and Climate related risks

- Drought
- High temperatures
- Flooding
- Typhoon (strong winds, heavy rain, flooding, storm surge etc.)
- Hail
- Lightning

Terms used in risk management

- Hazard
- Risk
- Impact
- Vulnerability
- Exposure

Terms used in risk management

- Hazard

  WMO definition:

  ‘Potentially damaging physical event that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.’

Terms used in risk management

- Risk

  WMO Definition:

  ‘Probable impacts, expressed in terms of expected loss of lives, people injured, property, livelihoods, economic activity disrupted or environmental damage.’

Terms used in risk management

- Impact

  Definition:

  ‘The effect of the hazard on humans, animals, environment or economy.’

Terms used in risk management

- Vulnerability

  WMO Definition:

  ‘Physical, social, economic, and environmental factors which increase the susceptibility to be impacted by hazards. Vulnerability engages resistance and resilience.’

Terms used in risk management

- Exposure

  WMO Definition:

  ‘Exposure is the total value of elements at-risk. It is expressed as the number of human lives, and value of the properties, that can potentially be affected by hazards. Exposure is a function of the geographic location of the elements.’

Assessing Risk: (impact x likelihood)

Assessing the Risk

Location

Rural

Urban

Coastal

Assessing the Risk

Current conditions

Plenty

Deficit

Assessing the Risk

Time of year

Assessing the Risk

Time of day / day of week

The National Severe Weather Warning Service and the Flood Forecasting Centre

How it was developed in the UK.....catalysts!

History of NSWWS

The National Severe Weather Warning Service was established in 1988 following the ‘Great Storm’ of October 1987 in which there were18 deaths, 15 million trees lost, hundreds of thousands of homes without power.

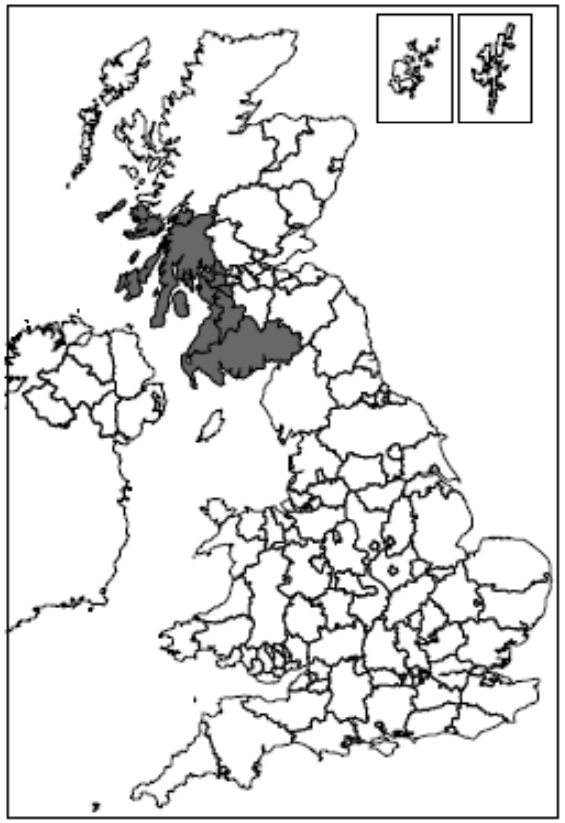
1988-2007

National Severe Weather Warning Service

FLASH WARNING

Set up as a threshold based warning system. Warnings were issued when the probability of thresholds being met was reached.

For example : 80% confidence of gusts reaching 70 mph or more.



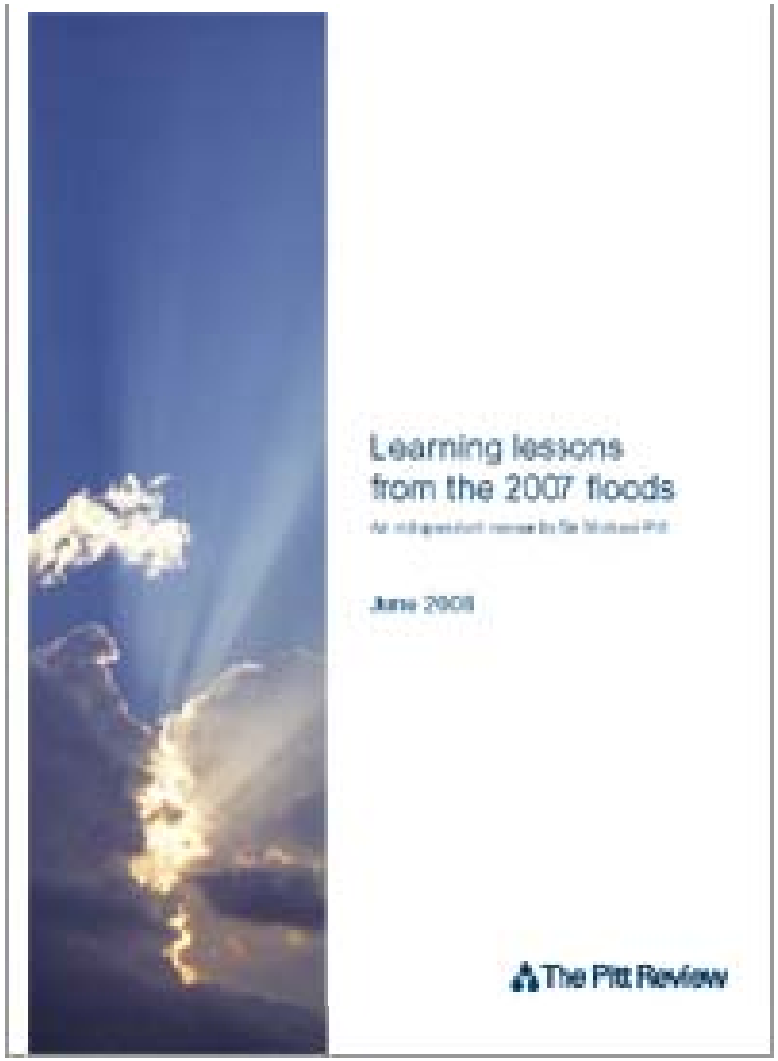
2007-2011

Met Office consulted responders across the UK, working alongside the Cabinet Office

Requirement for more lead time to prepare for possible events, even if there was only a low probability of the event occurring.

Flood Forecasting Centre established.

Longer range warnings were issued (up to 5 days).



The Current Service

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Stakeholder engagement in the UK

- The public
- First responders
  - Fire service
  - Ambulance
  - Police
  - Military
- Government departments
- Health professionals
- Media outlets
- Local government
- Transport
- Utility companies
- Communications companies
- Environment Agency
- etc

March 2011 to present day

Consultation with responders and the public in summer 2009, the outcomes of which were:

- Warnings should be impact based
- Communication needs to be improved.

'Weather warnings should only be issued if severe weather is expected to have an impact'

'Warning categories are too complex. Needs to be simplified'

The new Impact based Warning Service was launched in March 2011.

In Ethiopia?

- In groups of 4 discuss and note down
- Who would need to be involved in stakeholder engagement?
  - By questionnaire?
  - At workshops?
  - Any other ideas?

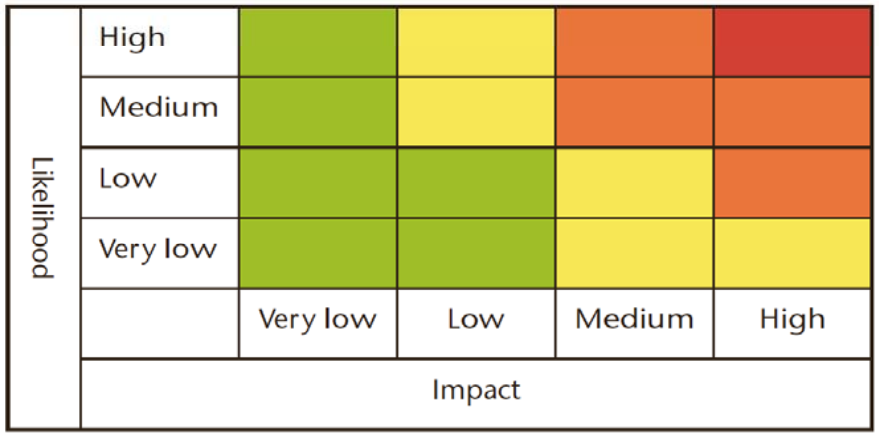
- At a national level
- At local (Woreda?) level

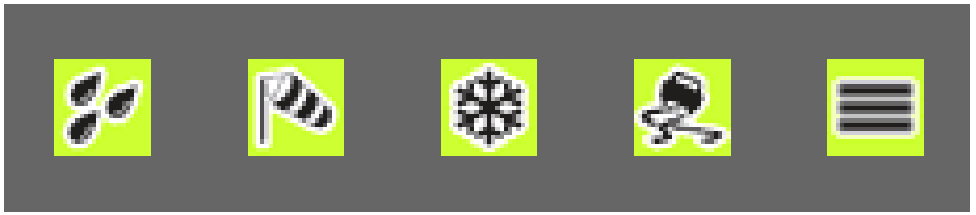
- Please feed back in 20 minutes

Following the consultations in the UK

Main changes

The new Impact based Warning Service was launched in March 2011. The main changes made were





Rain Wind Snow Ice Fog

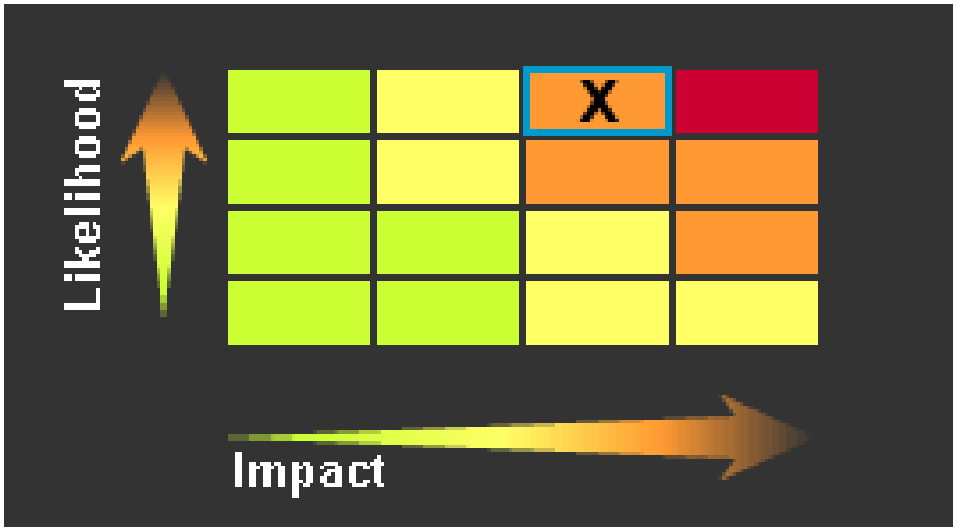
	Very Low	Low	Medium	High
Impact and advice applying to ALL SEVERE WEATHER	On the whole, day to day activities not affected but some localised, small scale impacts occur A few transport routes affected.	Some short lived disruption to day to day routines in affected areas Incidents dealt with under' business as usual' response by emergency services Some transport routes and travel services affected. Some journeys require longer travel times. .	Injuries with danger to life Disruption to day to day routines and activities. Short-term strain on emergency responder organisations. Transport routes and travel services affected. Longer journey times expected. Some vehicles and passengers stranded. Disruption to some utilities and services. Damage to buildings and property.	Danger to life Prolonged disruption to day to day routines and activities Prolonged strain on emergency responders organisations. Transport routes and travel services affected for a prolonged period. Long travel delays. Vehicles and passengers stranded for long periods. Disruption to utilities and services for a prolonged period. Extensive damage to buildings and property.

Warnings

NSWWS since 2011

- We worked with partner agencies to develop a risk matrix

Likelihood of impacts occurring



Level of impacts Expected

- The alert/warning will provide a combination of
  - The potential impact the weather will have
  - The likelihood of the weather happening

Public Messaging Slogans

Introduced in 2007

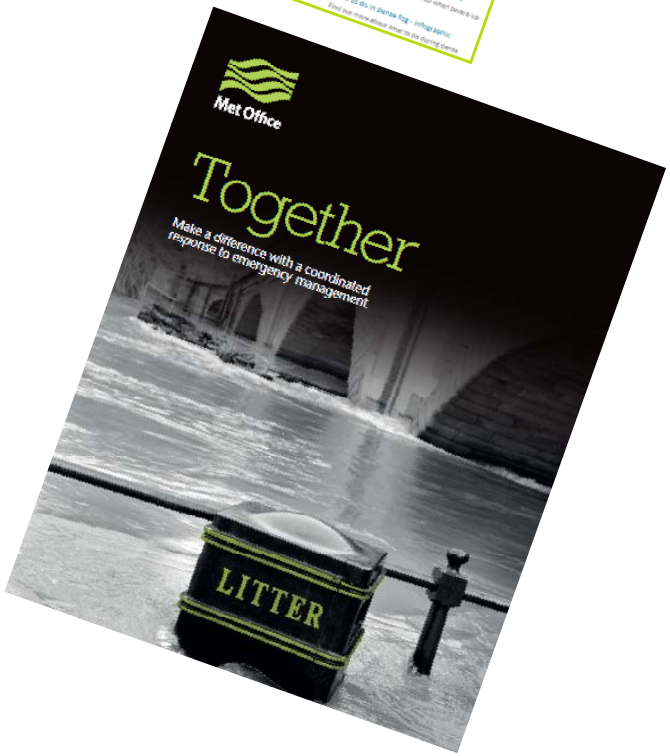
GREEN	**NO SEVERE WEATHER EXPECTED**
YELLOW	**BE AWARE**. There is a moderate risk of severe or a low risk of extreme weather occurring. *Remain alert and ensure you access the latest weather forecast.*
AMBER	**BE PREPARED.** There is a high risk of severe or a moderate risk of extreme weather occurring. *Remain vigilant and ensure you access the latest weather forecast. Take precautions where possible.*
RED	**TAKE ACTION**. There is a high risk of an extreme weather event occurring. *Remain extra vigilant and ensure you access the latest weather forecast. Follow orders and any advice given by authorities under all circumstances and be prepared for extraordinary measures.*

Impact tables

There are impact tables for All Severe Weather and each of the five weather elements warned for.

http://www.metoffice.gov.uk/guide/weather/severe-weather-advice

More detailed Impact Tables in the ‘Together’ Brochure, via: http://www.metoffice.gov.uk/publicsector/emergencies



Impacts

http://www.metoffice.gov.uk/weather/uk/advice/

	Very Low	Low	Medium	High
Impact and advice associated with SNOW	Small amounts of snow lying on roads and pavements so some slippery road surfaces possible. Traffic may move generally slower than normal. Take extra care when walking, cycling or driving in affected areas.	More widespread snow lying on roads and pavements but road networks generally open. Care needed with only localised travel disruption. Problems mostly confined to usual prone areas. Take extra care when walking, cycling or driving in affected areas. Journeys through affected areas may take longer than usual.	Widespread snow with a number of road closures, others passable only with care. **BE PREPARED** for some disruption to road, rail and air transport with difficult driving conditions likely and longer journey times.	Widespread deep snow with many roads closed or impassable. Roads likely to become impassable with high risk of drivers becoming stranded. Significant disruption to road, rail and air transport. Risk to personal safety. Expect significant disruption to normal day to day life as a result of transport issues, school closures etc. Avoid making unnecessary journeys.

Other impacts specific to rain, wind, ice and fog also listed.

Flood Impacts Table			
Minimal Impacts	**Minor Impacts**	**Significant Impacts**	**Severe Impacts**
• Generally no impact, however there may still be • Isolated and minor flooding of low-lying land and roads • Isolated instances of spray/wave overtopping on coastal promenades • Little or no disruption to travel although wet road surfaces could lead to difficult driving conditions	• Localised flooding of land and roads – risk of aquaplaning • Localised flooding could affect individual properties • Individual properties in coastal locations affected by spray and/or wave overtopping • Localised disruption to key sites identified in flood plans (e.g. railways, utilities) • Local disruption to travel – longer journey times	• Flooding affecting properties and parts of communities • Damage to buildings/structures is possible • Possible danger to life due to fast flowing/deep water/ wave overtopping/ wave inundation • Disruption to key sites identified in flood plans (e.g. railways, utilities, hospitals) • Disruption to travel is expected. A number of roads are likely to be closed	• Widespread flooding affecting significant numbers of properties and whole communities • Collapse of buildings/structures is possible • Danger to life due to fast flowing/ deep water/ wave overtopping/ wave inundation • Widespread disruption or loss of infrastructure identified in flood plans (e.g. railways, utilities, hospitals) • Large scale evacuation of properties may be required • Severe disruption to travel. Risk of motorists becoming stranded

Flood impacts matrix

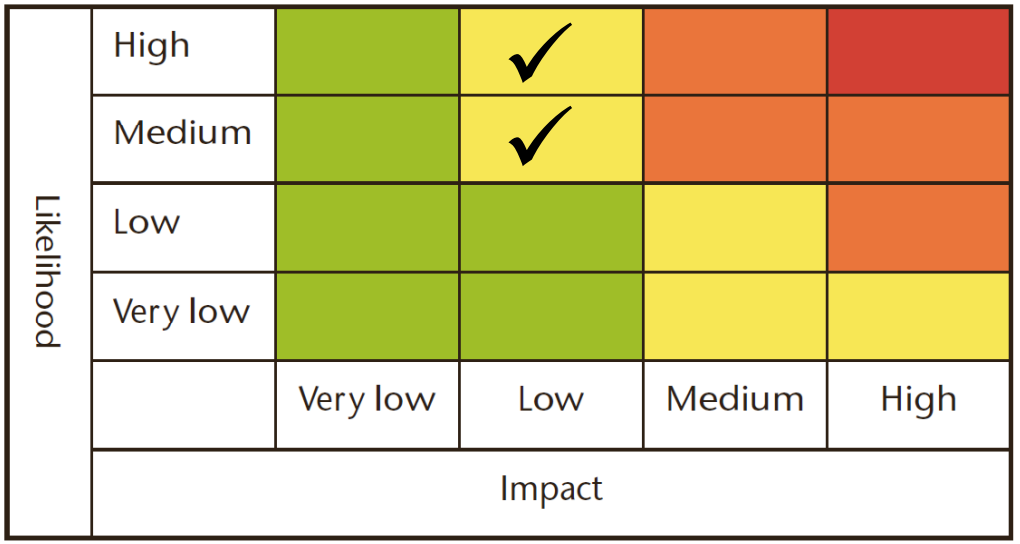
Understanding Weather Warnings

Low Impact Warning

Some short lived disruption to day to day routines

‘Business as usual' response by emergency services

Some transport routes and travel services affected. Some journeys require longer travel times.



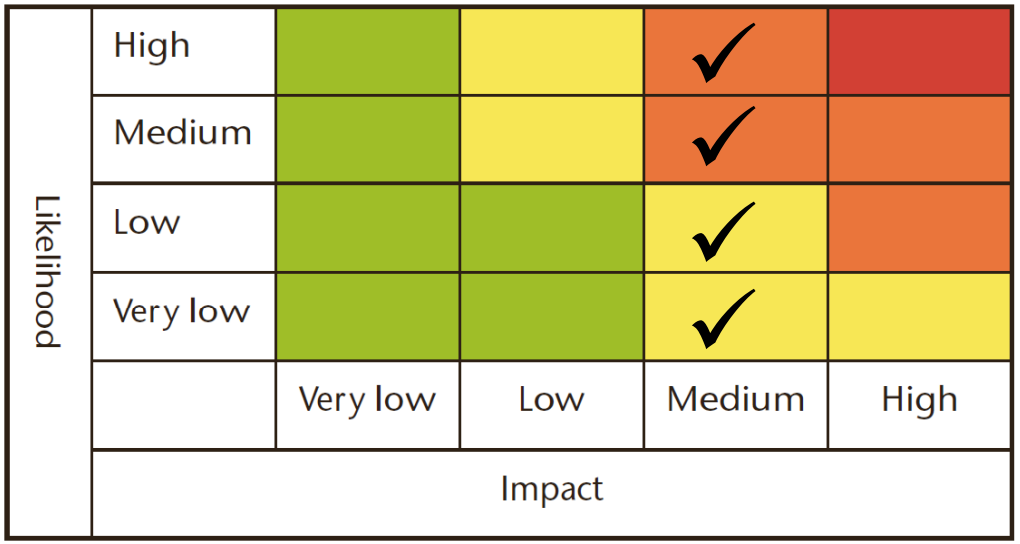
Understanding Weather Warnings

Medium Impact Warning

Injuries with danger to life

Disruption to day to day routines and activities.

Short-term strain on emergency responder Organisations – multi-agency



Transport routes and travel services affected. Longer journey times expected. Some vehicles and passengers stranded.

Disruption to some utilities and services.

Damage to buildings and property.

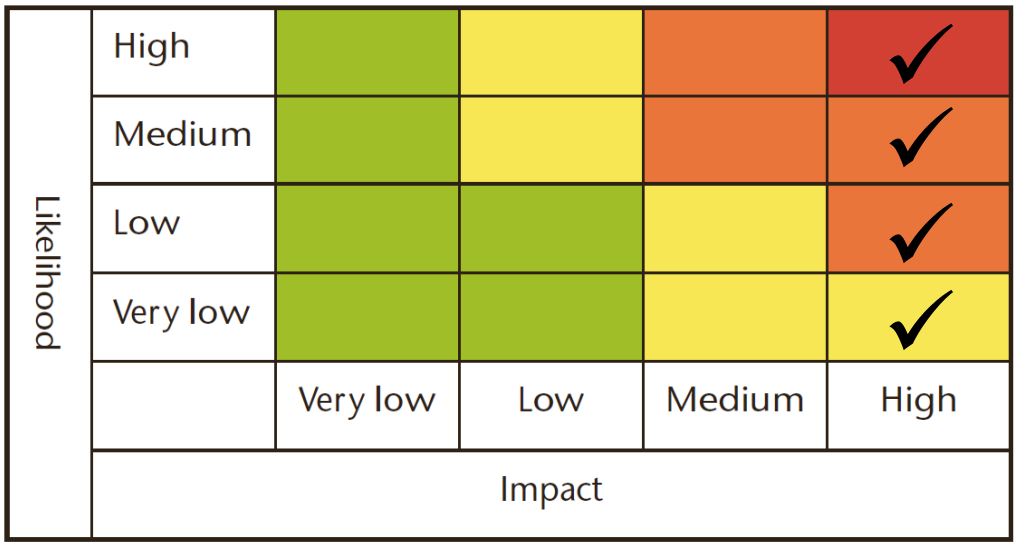
Understanding Weather Warnings

High Impact Warning

Danger to life

Prolonged disruption to day to day routines and activities

Prolonged strain on emergency responders organisations.



Transport routes and travel services affected for a prolonged period. Long travel delays. Vehicles and passengers stranded for long periods.

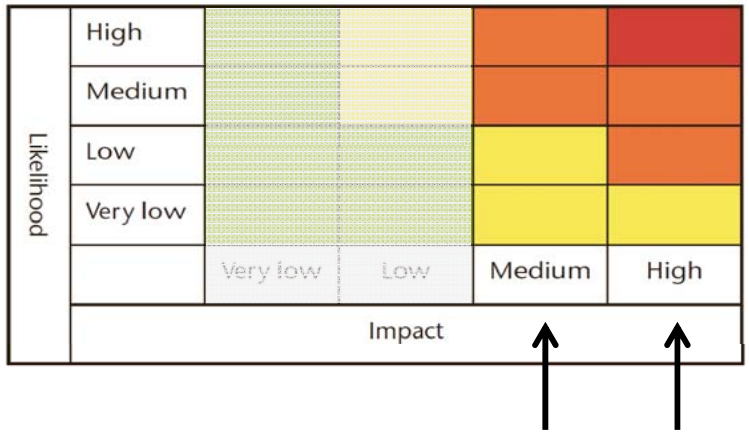
Disruption to utilities and services for a prolonged period.

Extensive damage to buildings and property.

Extra information

- Warnings are issued out to five days ahead

- Warnings where the tick on the matrix is in the Medium or High column are sent to registered users.



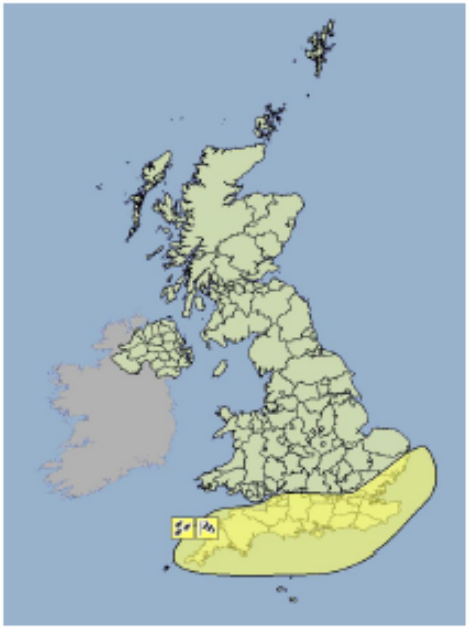
- Forecasters are encouraged to issue warnings during normal working hours.

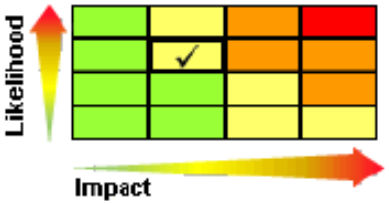
Met Office

Example Warning

Met Office

National Severe Weather Warning Service





Chief Forecasters Assessment
A vigorous area of low pressure, now named Storm Angus, will move northeast across southern and southeast England during Sunday morning. This will be accompanied by a period of heavy rain, starting in the west of the area during Saturday evening, and very strong winds. 20-30 mm and locally 40 mm of rain is expected within a 6-9 hour period. Conditions are expected to improve from the west during the morning and early afternoon.

The warning area has been further extended further west across all of southwest England, with the start time brought forward to mid evening on Saturday.

The Met Office have issued a **Yellow Warning** of **Rain and Wind**

Valid from **21:00 on Sat, 19th Nov 2016** until **14:00 on Sun, 20th Nov 2016**

A spell of heavy rain and some very strong winds are expected to sweep across southern and southeastern parts of England during Saturday night and Sunday morning. Gusts of 45-55 mph are likely inland and 60-65 mph near English Channel coasts, but we expect the strongest winds to affect coastal counties from the Isle of Wight eastwards, where 70-80 mph gusts are possible (see separate Amber warning).

Please be aware of the risk of difficult driving conditions due to localised surface water flooding and possible debris from trees.

For more details please go to:
http://www.metoffice.gov.uk/public/weather/warnings

Issued by the Met Office at 10:37 on Fri, 18th Nov 2016

Updated by the Met Office at 17:42 on Sat, 19th Nov 2016

Verification of Warnings

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Verification of Warnings

As NSWWS (and Flood Risk) is an impact based warning system it is necessary to monitor the impacts that were seen during severe weather. Sources of impact information:

- Broadcast Media
- Social Media (incl Twitter & Facebook)
- Websites
- Emergency Responders (Resilience Group meetings & minutes/Local impact recording/Survey)
- Met Office Weather Observation Website (WOW)

Verification of Warnings

Warnings are checked against:

- Impacts seen as expected
- The impacts were in the area expected
- The impacts were in the time period expected

Overall Marking Assessment		
0-2	Very Poor	Warning was missed or gave very poor guidance to customer, perhaps being classed as a "False Alarm"
3-5	Poor Guidance	Although a warning was issued it gave poor guidance to the customer
6-7	Good Guidance	A warning was issued which gave generally good guidance to the customer
8-9	Excellent Guidance	The warning issued gave excellent guidance to the customer

Target:

- 70% good or excellent guidance
- If poor guidance reaches 20% an improvement plan must be instigated

Natural Hazards Partnership

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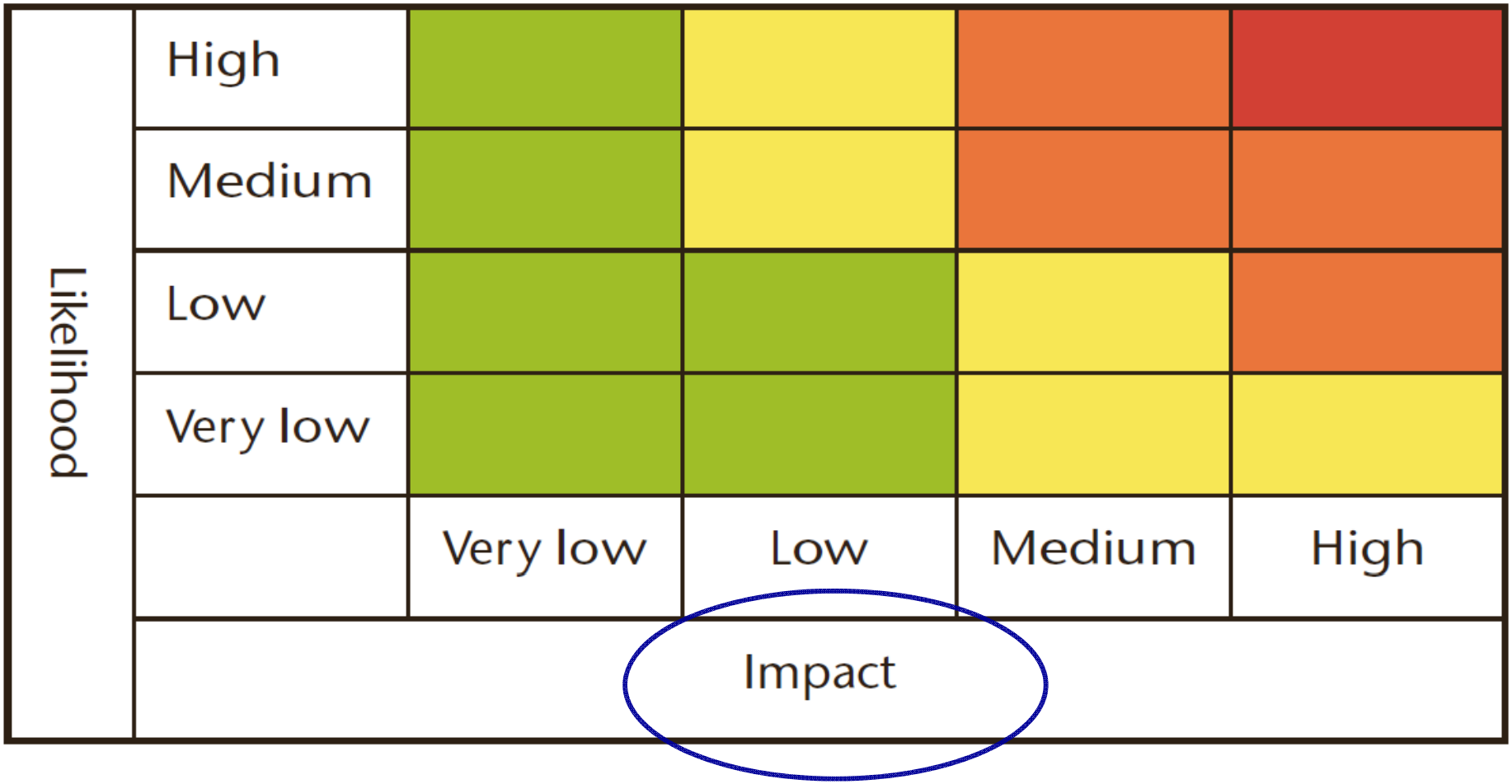
17 public bodies (mainly government departments and agencies which aims to build on partners' existing natural hazard science, expertise and services to deliver fully coordinated impact-based natural hazard advice provided for civil contingencies and responder communities and governments across the UK

Natural Hazards Partnership: overview, hazards, science notes

http://www.naturalhazardspartnership.org.uk/about-us/:

Developing an impact based warning

Concentrating on (case study weather type)



Impact

- Examples of impacts from the UK – heavy rain

Very Low	Low	Medium	High
Localised flooding of low-lying land and susceptible roads. A few transport routes affected. Road conditions affected with localised spray and some standing water.	Localised flooding of homes and businesses and susceptible roads Some transport routes and travel services affected. Some journeys require longer travel times. Road conditions affected by spray and standing water. Localised and short term disruption to utilities and services	Flooding of homes and businesses. Danger to life from fast flowing/deep water. Damage to buildings/ structures. Transport routes and travel services affected. Longer journey times expected. Some road closures. Difficult road conditions due to spray and standing water Interruption to utilities and services. Some communities temporarily inaccessible due to flooded access routes.	Widespread flooding of homes and businesses. Danger to life from fast flowing/deep water. Extensive damage to and/or collapse of buildings/ structures Transport routes and travel services disrupted for a prolonged period. Long travel delays. Widespread road closures. Dangerous driving conditions due to spray and standing water. Prolonged disruption to or loss of utilities and services Communities become cut off for a prolonged period, perhaps several days, due to flooded access routes.

Very Low	Low	Medium	High
Localised flooding of low-lying land and susceptible roads. A few transport routes affected. Road conditions affected with localised spray and some standing water.	Localised flooding of homes and businesses and susceptible roads Sc ro se S r Rc aff Loc ter… disruption to utilities and services	Flooding of homes and businesses. Danger to life from fast flowing/deep conditions due to spray and standing water Interruption to utilities and services. Some communities temporarily inaccessible due to flooded access routes.	Widespread flooding of homes and businesses. Danger to life from closures. Dangerous driving conditions due to spray and standing water. Prolonged disruption to or loss of utilities and services Communities become cut off for a prolonged period, perhaps several days, due to flooded access routes.

Something may happen but it can be dealt with easily and does not cause concern – wont necessitate a warning

Very Low	Low	Medium	High
Localised flooding of low-lying land and susceptible roads. A few transport routes affected. Road conditions affected with localised spray and some standing water.	Localised flooding of homes and businesses and susceptible roads Some transport routes and travel services affected. Some journeys require longer travel times. Road conditions affected by spray and standing water. Localised and short term disruption to utilities and services	Flooding of homes and businesses. Danger to life from fast flowing/deep water. Damage to buildings/ structures. Transport routes and travel services affected. Longer journey times expected. Some road closures. Difficult road Some communities temporarily inaccessible due to flooded access routes.	Widespread flooding of homes and businesses. Danger to life from fast flowing/deep water. Extensive damage to and/or collapse of buildings/ structures Transport routes and travel services disrupted for a prolonged period. Long travel delays. Widespread road Prolonged disruption to or loss of utilities and services Communities become cut off for a prolonged period, perhaps several days, due to flooded access routes.

Generally localised impacts

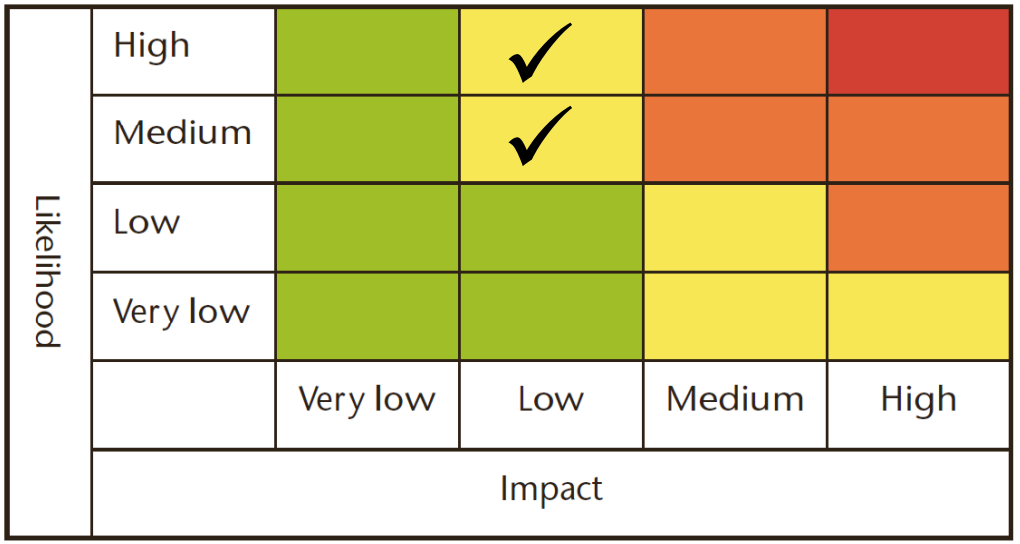
Understanding Weather Warnings

Low Impact Warning

Some short lived disruption to day to day routines

‘Business as usual' response by emergency services

Some transport routes and travel services affected. Some journeys require longer travel times.



Very Low	Low	Medium	High
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More widespread and severe impacts

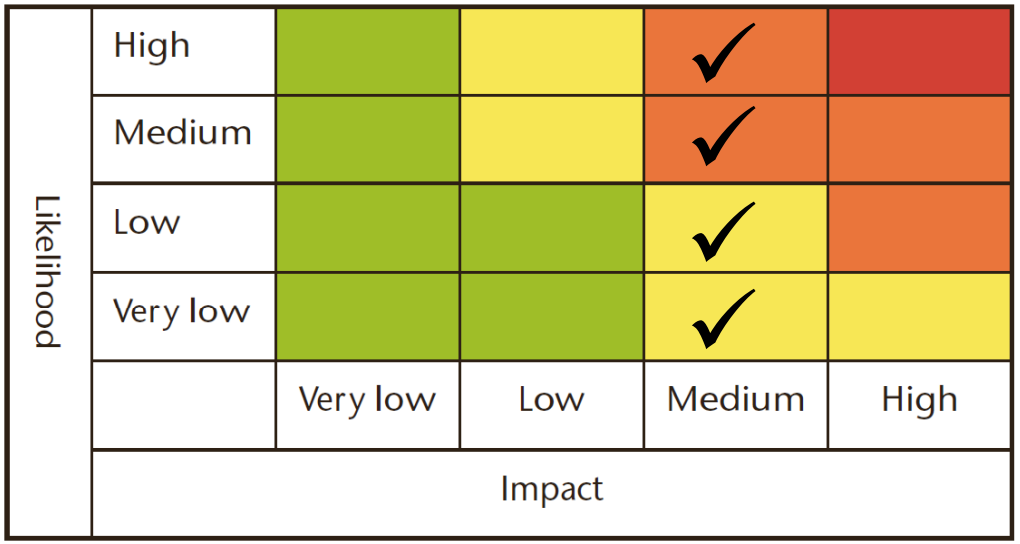
Understanding Weather Warnings

Medium Impact Warning

Injuries with danger to life

Disruption to day to day routines and activities.

Short-term strain on emergency responder organisations.



Transport routes and travel services affected. Longer journey times expected. Some vehicles and passengers stranded.

Disruption to some utilities and services.

Damage to buildings and property.

Very Low	Low	Medium	High
Localised flooding of low-lying land and susceptible roads. A few transport routes affected. Road conditions affected with localised spray and some standing water.	Localised flooding of homes and businesses and susceptible roads Some transport routes and travel services affected. Some journeys require longer travel times. Road conditions affected by spray and standing water. Localised and short term disruption to utilities and services	Flooding of homes and businesses. Danger to life from fast flowing/deep water. Damage to buildings/ structures. Transport routes and travel services affected. Longer journey times expected. Some road closures. Difficult road conditions due to spray and standing water Interruption to utilities and services. Some communities	Widespread flooding of homes and businesses. Danger to life from fast flowing/deep water. Extensive damage to and/or collapse of buildings/ structures Transport routes and travel services disrupted for a prolonged period. Long travel delays. Widespread road closures. Dangerous driving conditions due to spray and standing water. Prolonged disruption to or loss of utilities and services Communities become cut off for a prolonged period, perhaps several days, due to flooded access routes.

More extensive damage and strain

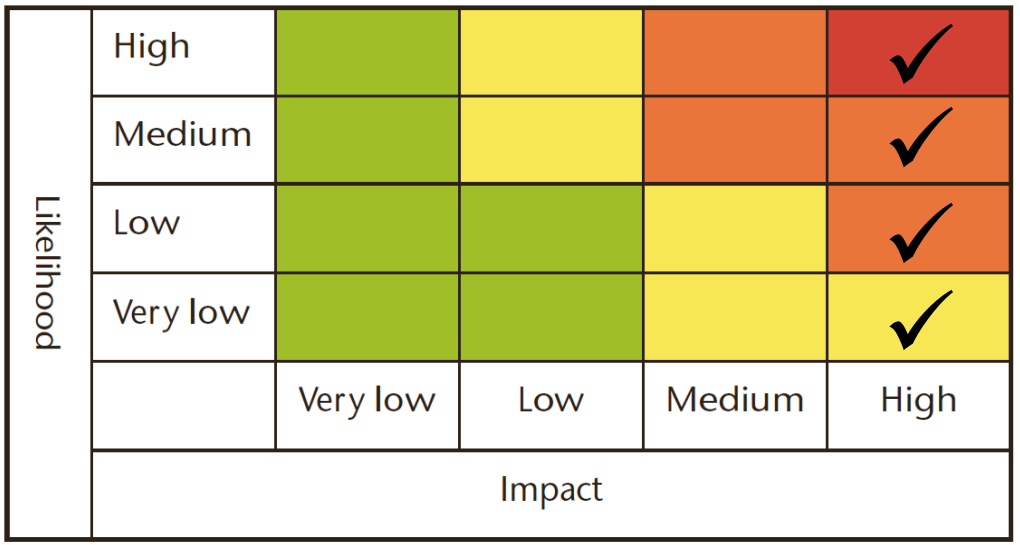
Understanding Weather Warnings

High Impact Warning

Danger to life

Prolonged disruption to day to day routines and activities

Prolonged strain on emergency responders organisations.



Transport routes and travel services affected for a prolonged period. Long travel delays. Vehicles and passengers stranded for long periods.

Disruption to utilities and services for a prolonged period.

Extensive damage to buildings and property.

Impacts in Asia

- Post it notes

- For this weather type….

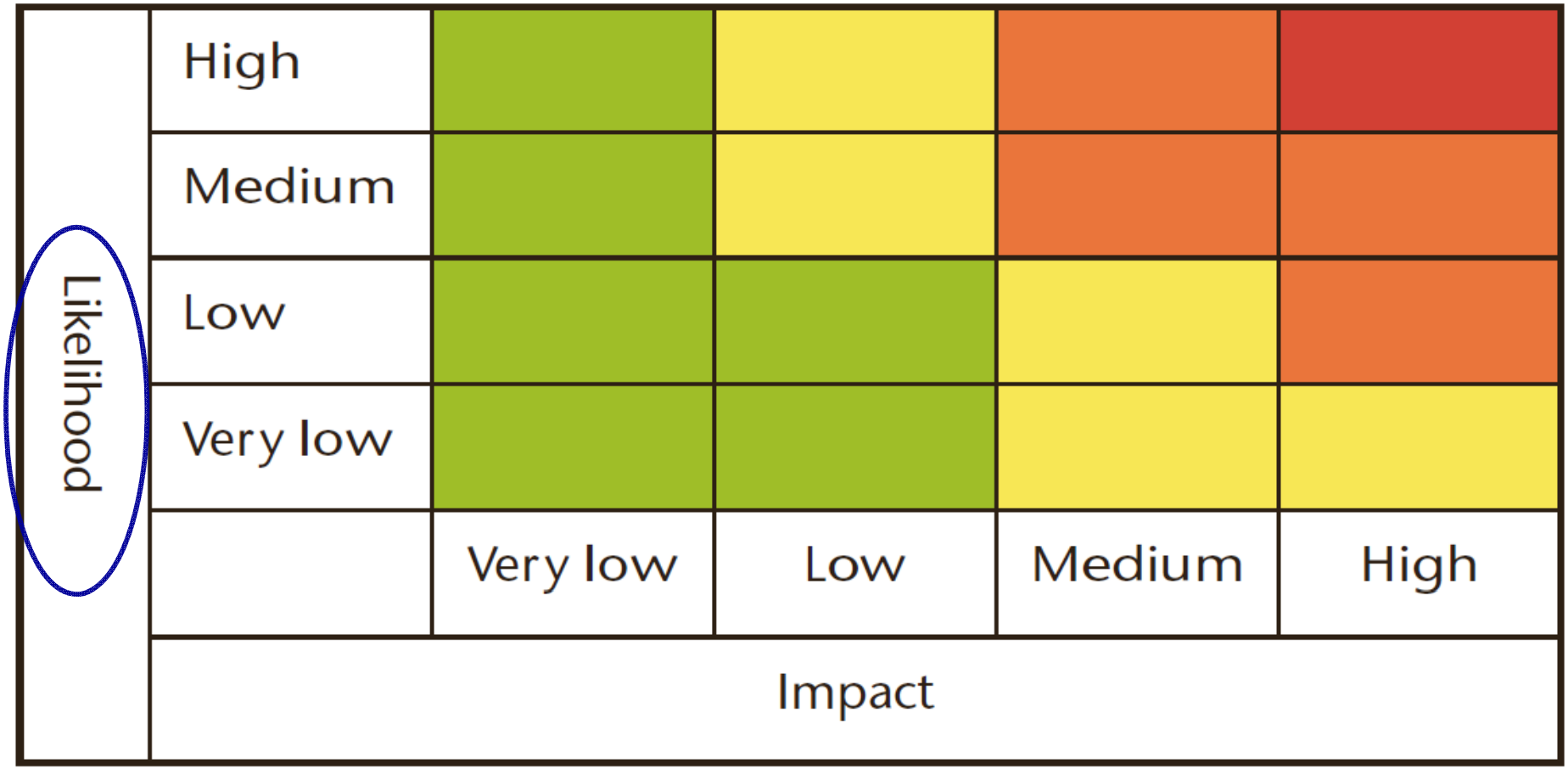
- Very low impacts
- Low impacts
- Medium impacts
- High impacts

Impacts in Asia

- Place your post its with the impacts on the correct column on the matrix

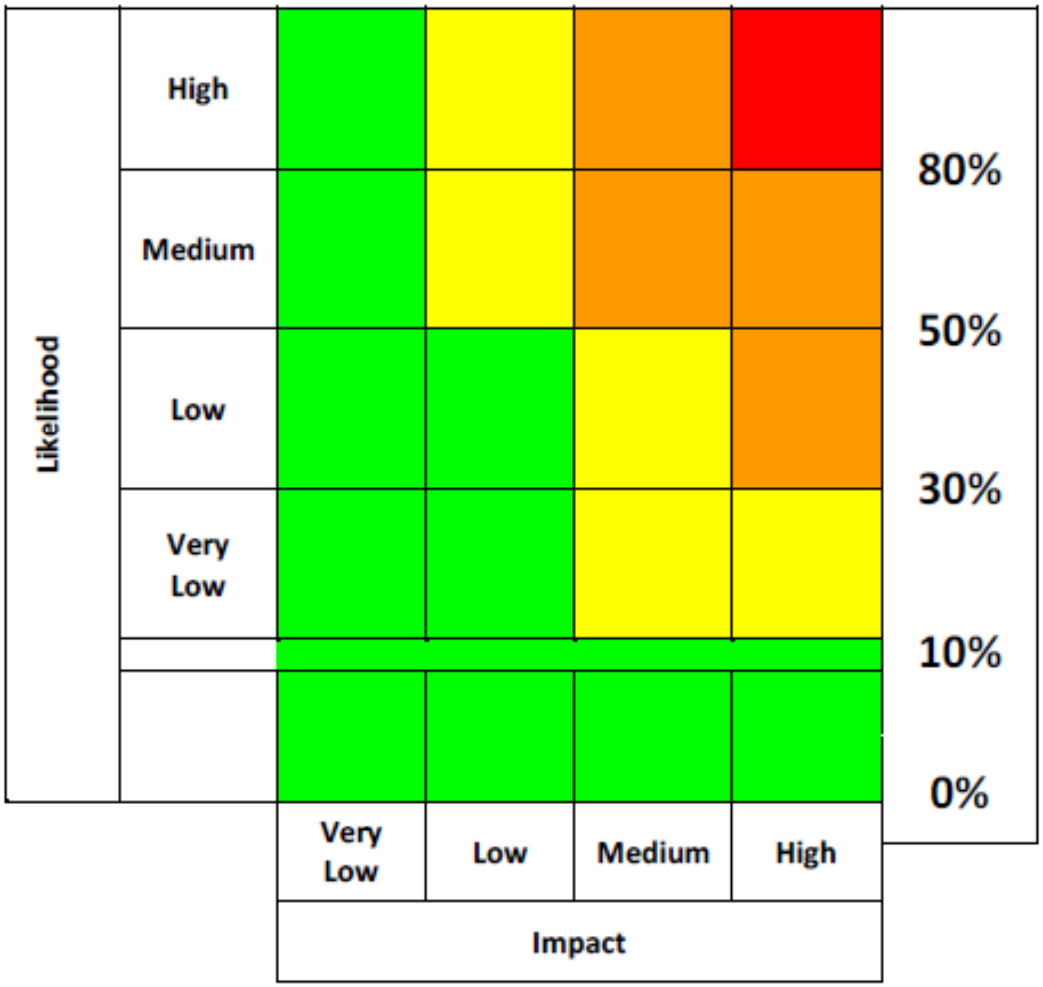
Likelihood

Concentrating on (case study weather type)



Likelihood

- Guidelines percentages
- Use ensembles etc
- However…it's the likelihood of the IMPACT happening not the WEATHER so need to consider time of day/year etc

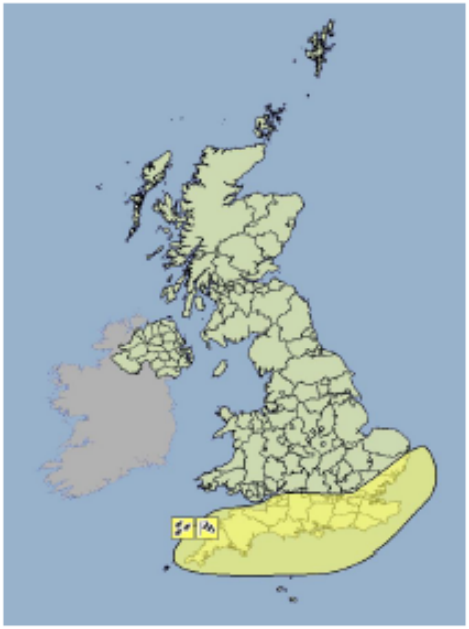


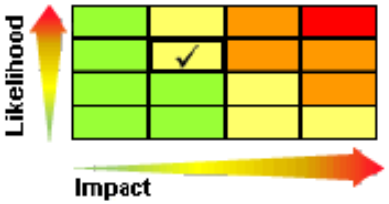
Met Office

Example Warning

Met Office

National Severe Weather Warning Service





Chief Forecasters Assessment
A vigorous area of low pressure, now named Storm Angus, will move northeast across southern and southeast England during Sunday morning. This will be accompanied by a period of heavy rain, starting in the west of the area during Saturday evening, and very strong winds. 20-30 mm and locally 40 mm of rain is expected within a 6-9 hour period. Conditions are expected to improve from the west during the morning and early afternoon.

The warning area has been further extended further west across all of southwest England, with the start time brought forward to mid evening on Saturday.

The Met Office have issued a **Yellow Warning** of **Rain and Wind**

Valid from **21:00 on Sat, 19th Nov 2016** until **14:00 on Sun, 20th Nov 2016**

A spell of heavy rain and some very strong winds are expected to sweep across southern and southeastern parts of England during Saturday night and Sunday morning. Gusts of 45-55 mph are likely inland and 60-65 mph near English Channel coasts, but we expect the strongest winds to affect coastal counties from the Isle of Wight eastwards, where 70-80 mph gusts are possible (see separate Amber warning).

Please be aware of the risk of difficult driving conditions due to localised surface water flooding and possible debris from trees.

For more details please go to:
http://www.metoffice.gov.uk/public/weather/warnings

Issued by the Met Office at 10:37 on Fri, 18th Nov 2016

Updated by the Met Office at 17:42 on Sat, 19th Nov 2016

Public Messaging Slogans

Introduced in 2007

GREEN	**NO SEVERE WEATHER EXPECTED**
YELLOW	**BE AWARE**. There is a moderate risk of severe or a low risk of extreme weather occurring. *Remain alert and ensure you access the latest weather forecast.*
AMBER	**BE PREPARED.** There is a high risk of severe or a moderate risk of extreme weather occurring. *Remain vigilant and ensure you access the latest weather forecast. Take precautions where possible.*
RED	**TAKE ACTION**. There is a high risk of an extreme weather event occurring. *Remain extra vigilant and ensure you access the latest weather forecast. Follow orders and any advice given by authorities under all circumstances and be prepared for extraordinary measures.*

Public Advice Key

Public advice key			
Very low	**Low**	**Medium**	**High**
No action required • Keep an eye on the weather and flood forecasts	**Flooding possible – BE AWARE** • Remain alert and ensure you access the latest weather forecast for up to date information • Be aware of conditions and drive accordingly • Check weather and flood warnings	**Flooding is expected** **BE PREPARED** • Remain vigilant • Consider re-scheduling your journey. Don't drive or walk through flood water • Think about preparing for flooding and take precautions where possible • Check flood warnings	**Significant risk to life** **TAKE ACTION** • Remain extra vigilant and ensure you access the latest weather and flood forecasts • Avoid all non-essential travel to postpone journeys if at all possible • Follow advice given by authorities under all circumstances, and be prepared for extraordinary measures

Write a warning

- Using this case study, and the impacts and likelihood/colour you have come up with write a brief weather warning

- Be prepared to feedback