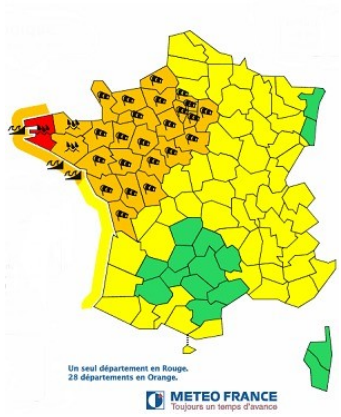


The meteorological “Vigilance”,

the french Impact based Forecast Early Warning System.

Anne CHARLAT, Regional Forecaster (Lyon-Bron, France)

IBF Workshop – Seoul, November 2018

Presentation outlines

Communicate about risks generated by meteorological events, and not only about meteorological forecast : Why ? How ?

- Meteo France organization
- Genesis of « La Vigilance », the french Multi-hazard Early Warning System (one of the firsts Impact based forecast systems?)
- Presentation of the System
  - Main principles (colours, hazards)
  - The vigilance map
  - Typical bulletin
  - Vigilance broadcast
- How is decided the vigilance colour (chain of decision's organization, thresholds for each hazard)
- Overseas, european vigilance, awarness from 2 to 7 days.
- IBF/Vigilance assessment/evaluation

METEO FRANCE

France : various climates and meteorological risks







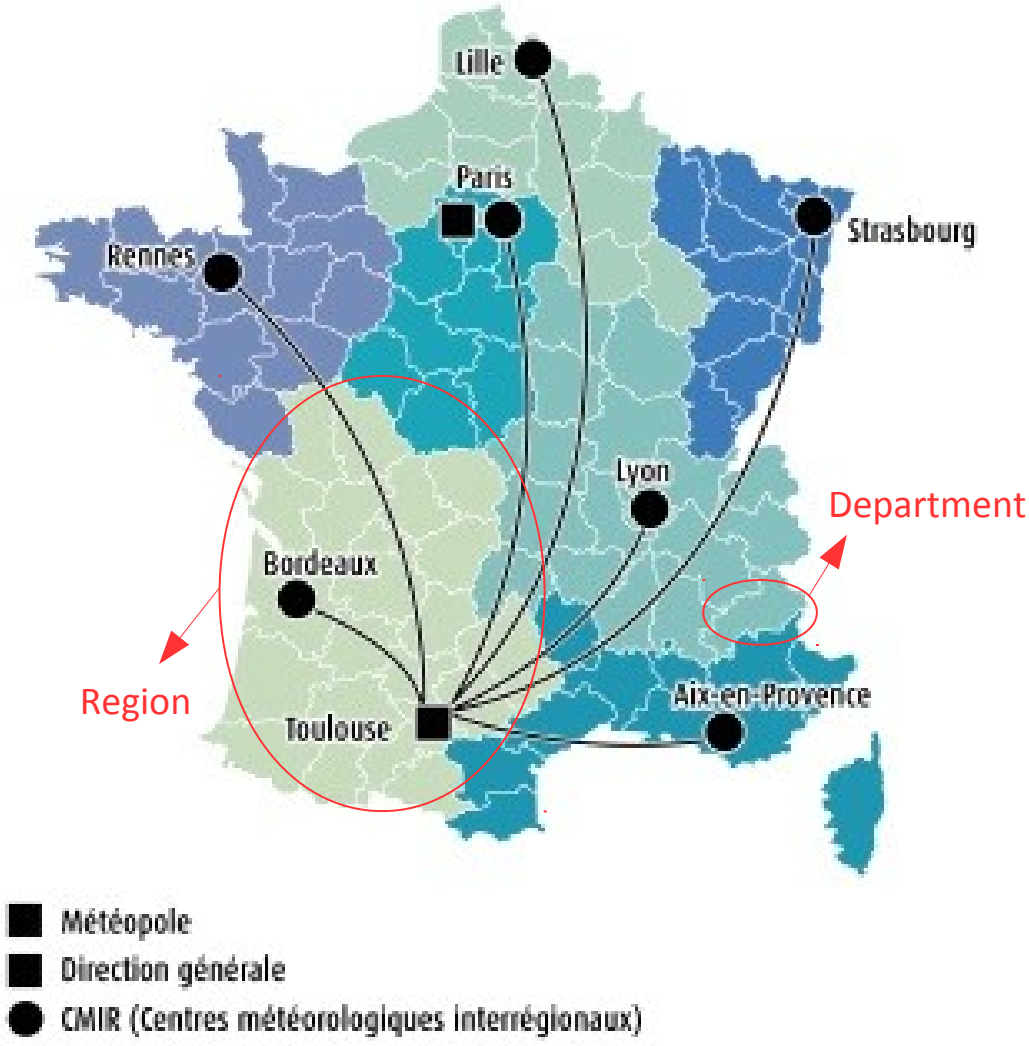




Meteo France is the operator of the French Governement as regards the meteorological safety of people and goods

METEO FRANCE

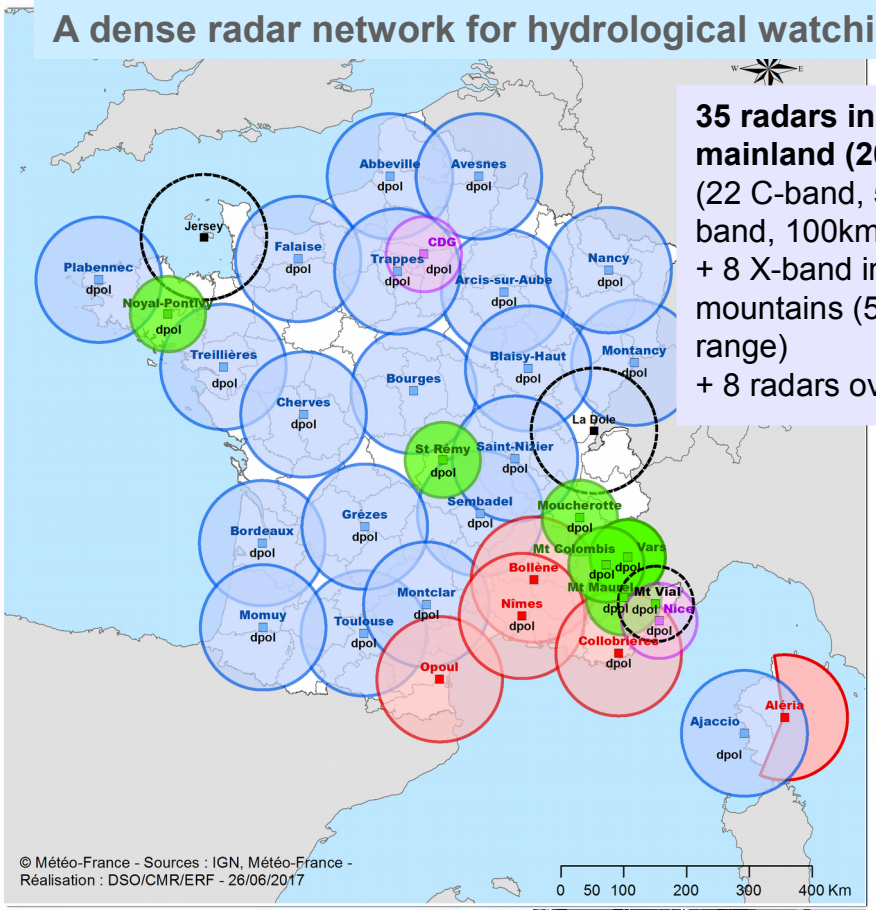
Meteo France organization
(and administrative organization of France)



- 3 levels :
  - National (550 000 km2)
  - Regional (10 to 20 departments)
  - departmental/local (75 km x 75 km)
- Around 3000 persons . Very approximatly :
  - 1000 in Toulouse (with researchers, school of meteorology, technical supports), 300 in Paris
  - 100/region (7 CMIR) including few departments
  - Overseas

Supporting technology: improved observation networks and NWP models

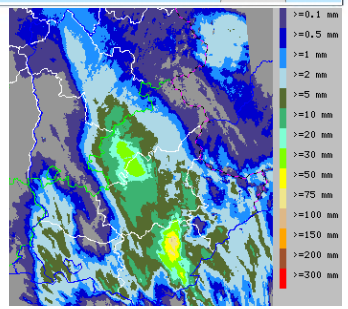
A dense radar network for hydrological watching



35 radars in mainland (2018)
(22 C-band, 5 S-band, 100km range)
+ 8 X-band in mountains (50km range)
+ 8 radars overseas

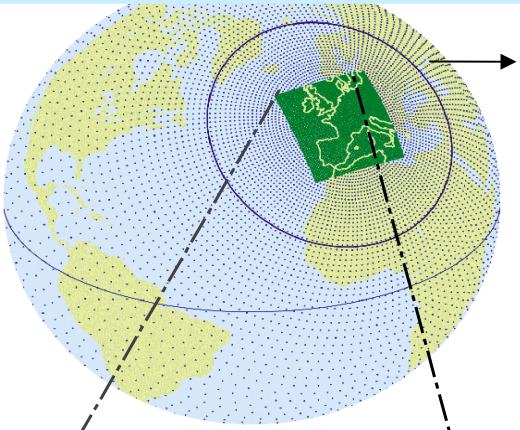
Légende
Type de radar :
- bande X
- bande S
- bande C
- bande X - LEOPARD
- radar partenaire
- non inclus dans mosaïque radar

dpol : double polarisation



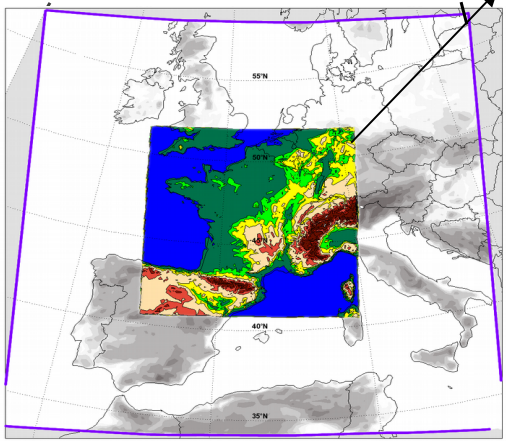
3D radar product
(cumulative precipitation estimation)

A constantly improving of NWP models



- Stretched Global Model **ARPEGE**, Forecasts to 5 days

Resolution 7.5 km
Europe,
Forecasts to 3 days



- Resolution 1,3 km
Mainland France fine mesh model **AROME**, Forecasts to 42 hours

(and several Arome for oversea territories)

\+ **Operational nowcasting-oriented AROME**
(run every 1H, up to 6 hours) (convective-scale)

\+ **Operational ensemble prediction AROME**

Genesis of the « Vigilance » system

Before 2001

- Meteorological Regional Warning Bulletin (BRAM) issued when necessary (no regular schedule, the only obligation is to issue the first and the last warning), as it exists in every countries.
- For Civil protection authorities
- According to meteorological thresholds (locally defined, according to local uses… for example one area uses *mean wind*, another *gusts*, or for rainfall : *total rainfalls*? *Instantaneous intensity*?)
- Description of the area impacted, the meteorological parameter, the duration of the event, the meteorological situation and events (values reached, etc.)

Either you are local authorities or population :

- ***If you don't know exactly what means « 100 mm of rainfall during 6 hours », « 3 centimetres of snow per hour », « 80 km/h mean wind, reaching 100 to 120 km/h in gusts », is this message sufficient ?***
- ***Is it really exceptionnal ? Dangerous ?***
- ***What will be the consequences ?***
- ***What do I have to do ?***

METEO FRANCE

Genesis of the « Vigilance » system

1999

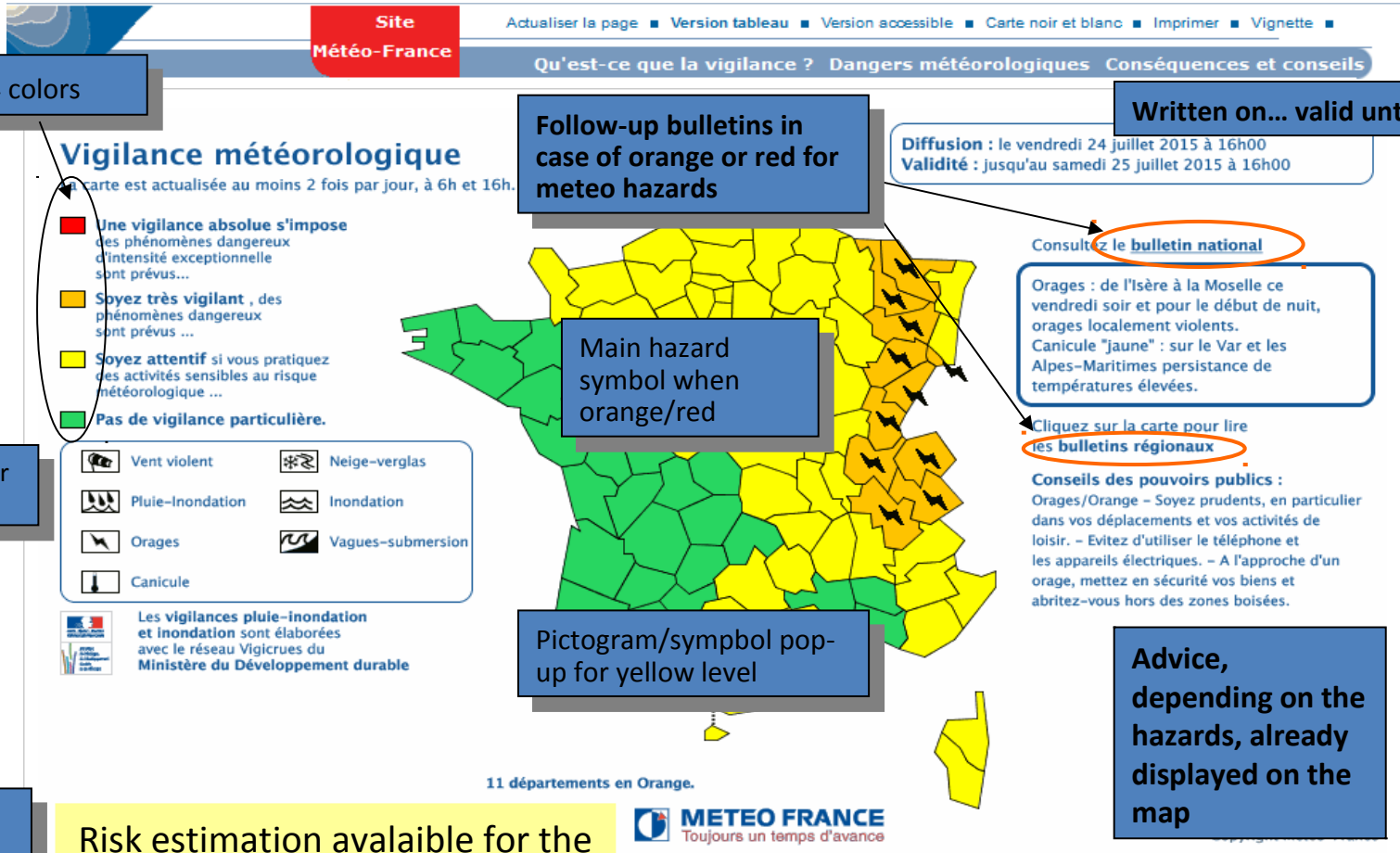
- 2 major storms in Dec.(between Christmas and NYE) : 92 p. killed (140 in Europe), huge damage in forests and infrastructure (15 bn €)

- <u>Good/correct forecast but poor efficiency in warning process, poor understanding from the public and authorities</u>

- A strong political will : Prime Minister decides to update the Warning procedure and inform the **general public and Authorities simultaneously** on the basis of **simple and updated colour information** (colour depends on the intensity of the forecast event)*.

* based on proposals from Météo-France and the Civil Protection Authorities

Meteorological vigilance map



4 colors

Follow-up bulletins in case of orange or red for meteo hazards

Written on… valid until…

Summer hazards

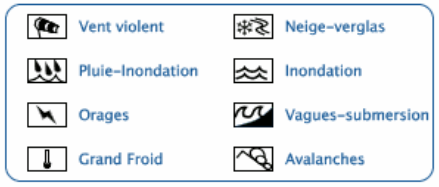
Main hazard symbol when orange/red

Pictogram/sympbol pop-up for yellow level

Advice, depending on the hazards, already displayed on the map

9 hazards including floods

Risk estimation avalaible for the **next 24 hours**



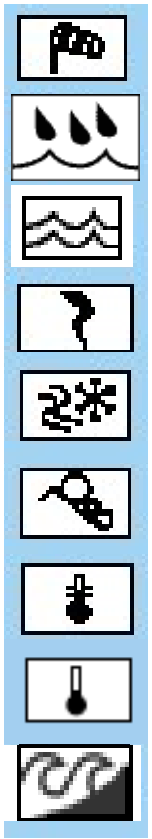
Winter hazards

- Broadcast/updated daily on internet, at least twice a day **at 6 am et 4 pm**
- Updated if necessary (when orange or red or...)

La Vigilance mé

Natural Hazards described by Vigilance – levels of risk

9 weather hazards



- Strong winds
- Heavy rain/Floods
- Floods only
- Thunderstorms
- Snow/Ice
- Avalanches (1nov - 5 jun)
- Heat wave (1 jun - 31 aug)
- Cold spell (1 nov - 31 mar)
- Coastal waves and flooding

4 colours/levels of risk :

***Red* : absolute awarness**.
Exceptionally intense meteorological phenomena have been forecasted. Follow orders and any advice given by your authorities under all circumstances, be prepared for extraordinary measures.

***Orange* : Be very vigilant !**
The weather is dangerous. Unusual meteorological phenomena have been forecasted.

***Yellow* : Be attentive** if you intend to practice activities exposed to meteorological risks.

***Green* : No particular awareness** of the weather is required.

New hazards have been added each time the system shown it was insufficient for good communication :

- **Heat waves and cold spell since 2004** (after 2003, estimation of 15 000 death)
- **« Heavy rainfalls/floods » since 5/12/07 (instead of « only » heavy rainfalls)**
- **« Floods only » and « coastal waves » since 3/10/11** (after Xynthia storm in 2010, 50 death due to storm surge)

METEO FRANCE

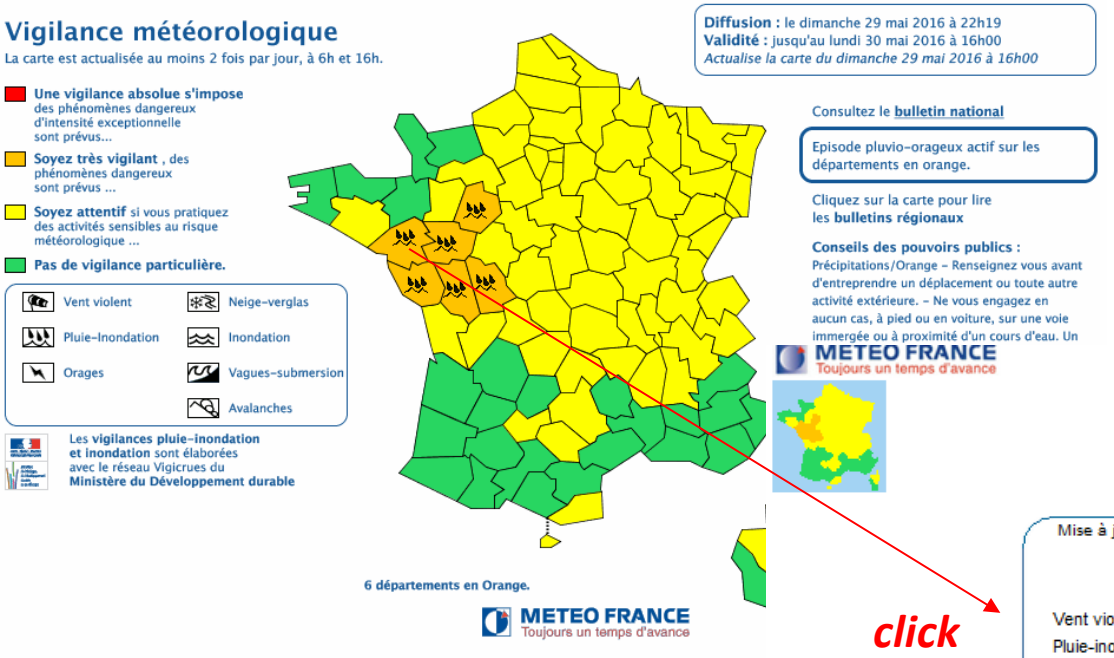
Levels of risk and Civil protection means

For population		Civil Protection means
Exceptionally intense meteorological phenomena. Dramatic consequences.		The capacity of rescue (Civil Protection) of the department is not adapted. **Reinforcement necessary** (other departments' help, national help, army)
Dangerous weather. Unusual meteorological phenomena. Important consequences.		Important number of interventions/rescue actions. **All the means of Civil Protection (of the department) can be useful**, but should be sufficient.
Be attentive if you intend to practice activities exposed to meteorological risks. Possible local consequences.		Isolated/scattered possible interventions of Civil Protection
No consequences due to weather conditions		No intervention due to weather conditions

Even if it's not an official definition, a link exists, in practice, between the level of risk and the capacity of Civil protection necessary to deal with the situation

METEO FRANCE

Chronological evolution at the district/department/county level



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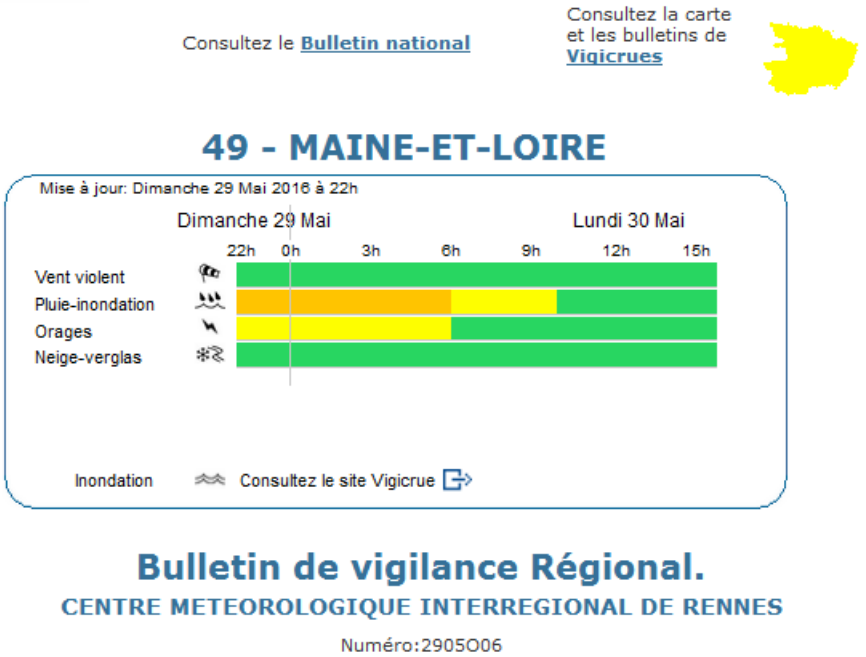


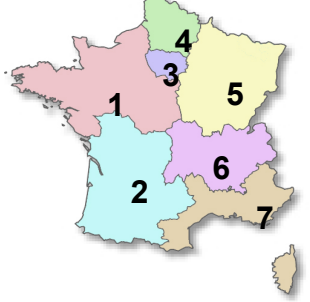
Bulletin de vigilance Régional.

CENTRE METEOROLOGIQUE INTERREGIONAL DE RENNES

Numéro:2905O06

Emis le : dimanche 29 mai 2016 à 22h00
par : Météo-France Rennes
Date et heure du prochain message : au plus tard le lundi 30 mai 2016 à 03h00

Follow-up reports / Typical bulletin



METEO FRANCE VIGILANCE

Bulletin de vigilance Régional

CENTRE METEOROLOGIQUE INTERREGIONAL DE LYON

Numéro : 2407CE02

Emis le : vendredi 24 juillet 2015 à 19h00 par : Météo-France Lyon

Bulletin issued by ... at ...

Date et heure du prochain message : au plus tard le vendredi 24 juillet 2015 à 22h00

Next bulletin will be issued at least at ...

Phénomène(s) : Orages.

Phénomène en cours.

Type of danger/hazard and schedule *(expected event's begining and end time)*

Fin de phénomène prévue le samedi 25 juillet 2015 à 00h00

Localisation :

Début de suivi pour :
Aucun département

Impacted areas = list of departments in Orange or Red vigilance

Maintien de suivi pour :
Ain (01), Haute-Savoie (74), Savoie (73) et Isère (38).

Fin de suivi pour :
Aucun département

Description :

Qualification du phénomène : Rapid event qualification
Episode de courtes durée, mais susceptible d'engendrer des phénomènes orageux de forte intensité.

Faits nouveaux :
Orages sur tous les départements de la région Rhône-Alpes.

Situation actuelle : Observed data, what happens at the time of redaction
De nombreux orages éclatent actuellement sur tous les départements de la région Rhône-Alpes. Des rafales de vent, pour l'instant modérées (70 km/h), et des chutes de grêle ont été observées.

Evolution prévue : Forecast, what should happen after
En soirée, les orages attendus sur l'Ain, la Haute-Savoie, la Savoie et l'Isère seront localement forts. Ils s'accompagneront de puissantes rafales de vent, le plus souvent voisines de 80 km/h et ponctuellement supérieures à cette valeur, de fortes et brutales averses de pluie, d'une activité électrique marquée et de grêle. Les derniers orages de cette séquence prendront fin vers minuit.

In case of orange or red vigilance only :

- **Regional bulletin :**
  - Issued approximately every 3 hours
  - Produced by the regional center (7 regions)
- **National bullletin** :
  - Compilation/resume of the regional reports

Possible consequences (automaticaly included, depends on the colour + hazard)

Advice of action/behavior (automaticaly included, depends on the colour + hazard)

Conséquences possibles :

Orages/Orange
* Violents orages susceptibles de provoquer localement des dégâts importants.
* Des dégâts importants sont localement à craindre sur l'habitat léger et les installations provisoires.
* Des inondations de caves et points bas peuvent se produire très rapidement.
* Quelques départs de feux peuvent être enregistrés en forêt suite à des impacts de foudre non accompagnés de précipitations.

Conseils de comportement :

Orages/Orange
* A l'approche d'un orage, prenez les précautions d'usage pour mettre à l'abri les objets sensibles au vent.
* Ne vous abritez pas sous les arbres.
* Evitez les promenades en forêts [et les sorties en montagne].
* Evitez d'utiliser le téléphone et les appareils électriques.
* Signalez sans attendre les départs de feux dont vous pourriez être témoins.

FRANCE

Rapid event qualification

- That “short” description must be almost sufficient to warn people *who don’t read carefully a detailed forecast/bulletin*.
- Comments/ comparisons with « famous » other events in the collective memory / frequency of that type of event.
- **Input help** for redaction is available for the forecaster (examples that can be used, among a large choice).

Example of « event qualifications » :

- *« Event not exceptional, that occurs in automn 2 or 3 times a year, but worrying due to last days rainfalls and rivers states »*
- *« Very strong storm that looks like the 1999’s one »*
- *« Light snowfall, but which will rapidly stick on roads, due to very cold temperatures, and lead to bad traffic circulations during those holidays departures »*

Description of potential impacts
Possible consequences

- In addition to the forecast itself, for orange or red level warnings, potential impacts are systematically described in warning texts/bulletins.

- It's a generic information. Forecaster don't write them, they're automatically included in the bulletin, according to which hazard and severity (colour) is announced.

- The wordings were **co-elaborated** with Civil Protection, Ministry of Ecology and Sustainable Development, Ministry of Health, Transports, Hydrology, Seas, etc.

Example of described impacts :

« Power and phone distribution networks may be disrupted for relatively long periods. »
« Vehicles can be deported. »
« Lightweight habitat and temporary facilities may be in real danger. »

Example of possible consequences

In case of Thunderstorms (orange level) 

- Severe thunderstorms may cause significant local damage, on houses, parks, crops and plantations.

- Significant damage is locally to be feared on light habitat and temporary facilities.

- Cave and low spots floods can occur very quickly, as well as torrential floods near creeks and small rivers.

- Some fire starts can be recorded in forest following lightning strikes not accompanied by precipitation.

Remarks : heavy gusts, tornadoes, hail are not automatically mentioned because it depends on the characteristic of the thunderstorm/meteorological environment.
Those hazards are described by the forecaster.

Advice (of action/behaviour)

Based on potential impacts, behavior advice for people is systematically provided :

- with a summary on the national map itself
- with full information for orange/red text warnings

Co-elaborated with our partners (Civil Protection, Ministries, etc.), it appears as "**Advice from public authorities**"

Also automatically included, and not written by the forecaster.

Ongoing assessment may lead to updates those sets of advice.

Example of advice :

« Prepare emergency lighting means and have a supply of drinking water.»
« Do not, in any case, walk or drive on a submerged road. »

METEO FRANCE

Example of advice of behavior

In case of Thunderstorms (orange level)

- When approaching a thunderstorm, take the usual precautions to shelter wind-sensitive objects. Shelter outside the wooded areas.

- Be cautious, especially in your travels and leisure activities. Avoid forest walks and mountain walks.

- Avoid using electrical devices.

- Report without delay the fire starts that you may witness.

- Do not engage in any way, on foot or by car, on a submerged track or near a watercourse. A vehicle even a 4x4, can be carried in 30 centimeters of water.

- In case of heavy rain, do not go down in basements.

Remarks : all the possible consequences and advice for each hazard are available on Meteo France website
http://vigilance.meteofrance.com/guide/consequence_conseil.html

Sorry, it's only in french, but it's easy to translate in the language you wish with any on-line translator… It can be used as a basis for establishing your own Advice/Consequences

METEO FRANCE

Few remarks

- The main job of forecaster remains to elaborate meteorological forecast. The potential consequences and advice are automaticaly defined (included in the bulletin by the IBF software) according to the hazard and risk level.

- He/she decides warning colors according to meteorological thresholds (wich are « help for decision » and can be adapted / modulated in specific situations. Note that thresholds depends on the area, and can be modified from a year to another.

→ Meteorological thresholds are « confidential » and don't need to be comunicated to media/populations (but of course, forecast values are mentionned in the bulletin).

- The decision is taken at a regional scale, by an independant H24 forecaster, familiar to his territory. But not too small (to avoid heterogeneity). Discussions with national and very local colleagues are necessary at least twice a day (conference calls, team work). The national consitency is warranted by the national senior forecaster.

  For « missed » events (late warning still possible), the decision is sometimes rapid (without needing the «chief» autorization). Even if the responsability of decision is alocated to 1 person, the decision is the result of a team work.

- A gratifying and valluing challenge for NMHS.

  Color's decision is an important responsability. The IBF expert (forecaster) has to be abble to speak with the highest local authorities, answer to media, explain the forecast/what should happen with simple terms and make it accessible to meteorological neophytes.

METEO FRANCE

Institutional framework (cooperation partners/stakeholders)

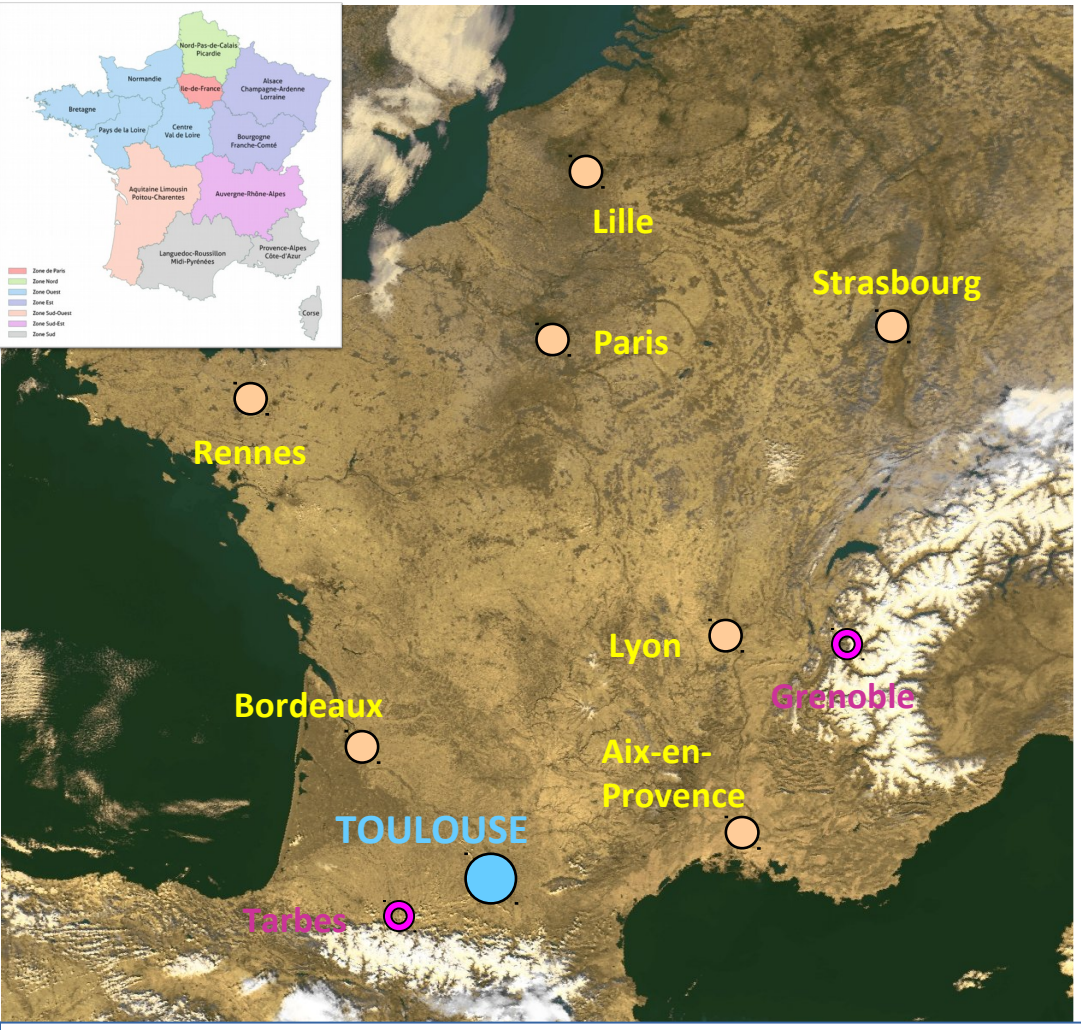
Inter-ministerial circular defines the Vigilance system with differents partnerships

- Civil Security/Interior national protection Ministry/risk managment
- Environment, energy and Sea Ministry
- Roads Security
- Health Ministry (Heat and Cold waves)
- French Navy's Hydrographic and Oceanographic Department (SHOM)

+ Central Service for Hydrometeorologocal and flood warning support (SCHAPI)

The first step, and maybe one of the most important before creating an IBF Warning system : **define the good partners !** ❤

Organisation for Vigilance production in Meteo France



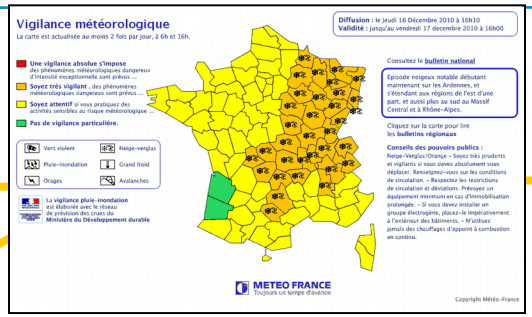
- **National Forecast Centre**
  - National/Synoptic forecast pattern
  - National consistency of the vigilance map and broadcast
  - National follow-up reports
  - Input for waves/storm surge
  - Contact with Cogic/Schapi
- **7 Regional Centres**
  - Regional adjustment of the forecast
  - **Proposal of the vigilance colours**
  - Regional follow-up reports
  - Contact with 7 COZ/DIRoads/prefects
- **2 focal points for avalanches**
  - Avalanches watching
  - Proposal of the vigilance colours for avalanches only
  - Avalanches follow-up reports.

+ MF managment on call 7d/24h Red validation

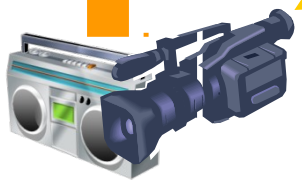
Crisis managment or exceptional dangerous phenomenom.

A multi-expert process

General public



Updates twice a day at 6 am & 4 pm (for green/yellow) + more (orange and red)



Media

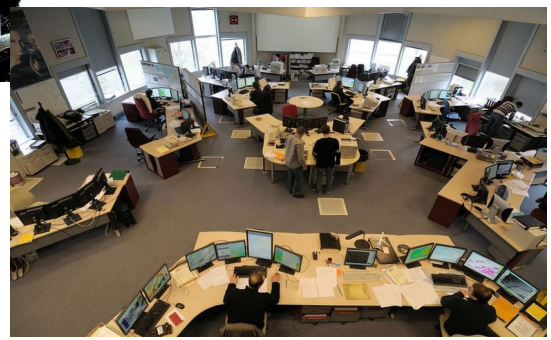
Contacts with national civil security service

Manager NFC on call for out of routine situations, (red level event, crisis management)

2 conference calls at 9 am and 9 pm

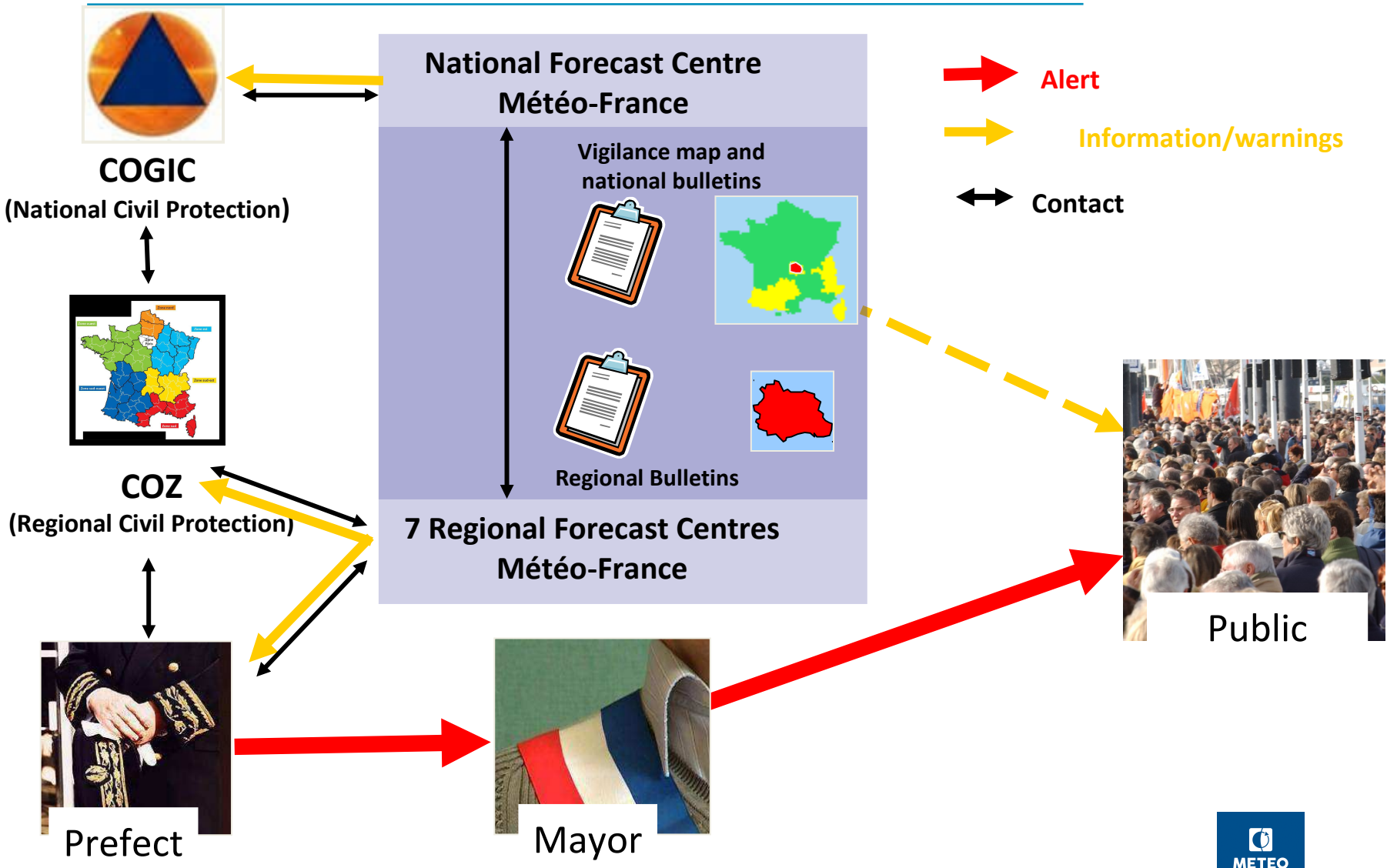
client/server tool

Senior forecaster H24/7D in National Forecast Centre (NFC) Color validation

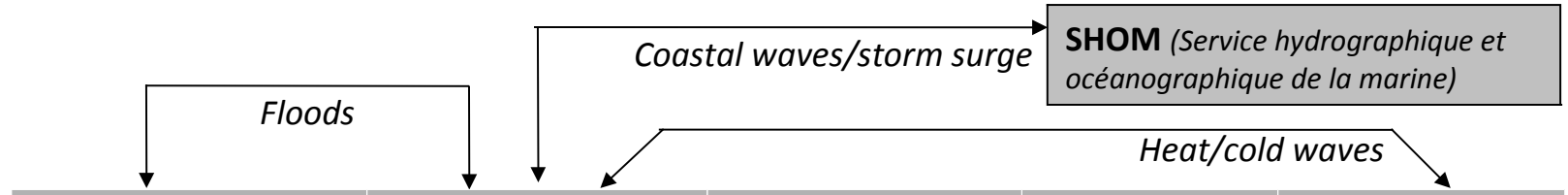


7 forecasters in Regional Meteorological Centres (color choice) H24/7D

From the meteorological Warning to the Civil Protection alert



A similar/close organisation at every levels for all partners



	Hydrology	Meteo France	Civil Protection	Roads	Heath
General managment	**DGPR** **General Direction for Risk Prevention**	**D2IMI** **Institutional Missions**	**DGSCG** **Main Risk Bureau**	**DSCR** **Secirity and Roads circulation**	**DGS** **General Direction for Health**
Operational National level	**SCHAPI** **Service central hydrometeorologie et appui à la prévision des innondations** *(Nat floods forecast)*	**CNP** **Centre National de Prévision** *National Forecast Centre (Toulouse)*	**COGIC** **Centre Opérationl de Gestion Interministériel de Crises**	**DIT Direction des Infrastructures de Transports**	**Santé Publique France** *National Agency for Public Health*
Operational regional level	**SPC (Service de Prévision des Crues)** *Focal floods forecast*	**CMIR** **(Inter-regional Meteo Centre)** *Regional forecast centres*	**COZ** **(Centre Opérationnel de Zone)**	**DIRRoute de Zone (Interdepartmt direction for roads)**	**CIRE** (Cellules Interrégionales d'épidémiologie) **ARS** (Agence régionale de Santé)
Operational local/county department		**CM (Meteo Centre)** *Local/county forecast centre*	**Préfecture, SIDPC,SDIS, CODIS** *Security, firemen, local rescue*	**DD Direction départemental des territoires**	**DDCS (Direction départemental de la cohésion sociale)**

Vigilance map and bulletins broadcast

Institutional partners

Civil Protection

Email, fax, sms

Environment Energy Ministry

DGSCGC, COGIC (nat)

COZ (regional)

Prefects (regional)

SIDPC, SDIS (local, dept)

Town level

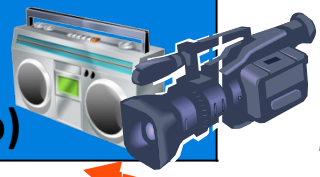
Mayors

Internet website :
http://www.meteofrance.com

Twitter Vigilance:
@VigiMeteoFrance

Mobile:
Appli Vigilance
Phone
05 67 22 95 00

Médias
(TV, radio)



Seas
SHOM

Roads Security

DIT (national)

DIR Roads (reg)

Hydrology (Floods forecast)

SCHAPI (national)

SPC (regional)

Health Ministry

Santé Publique France, DGS

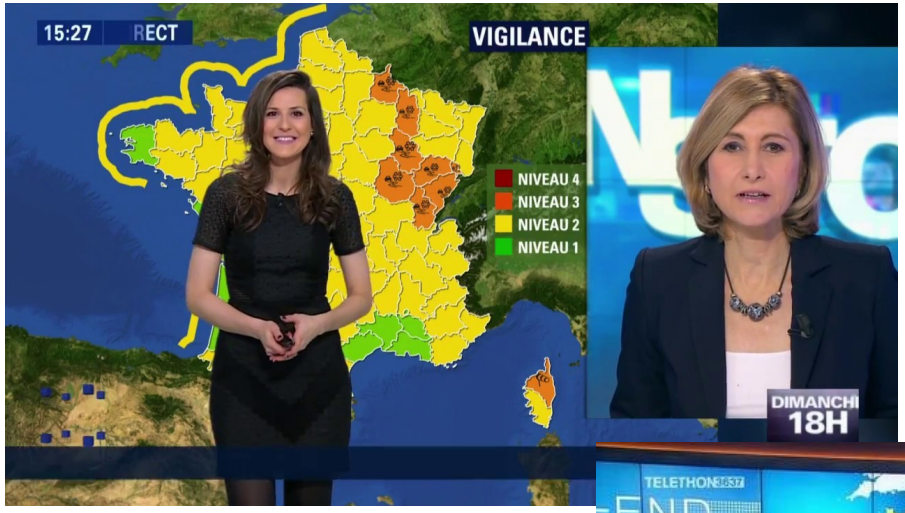
CIRE (Regional)

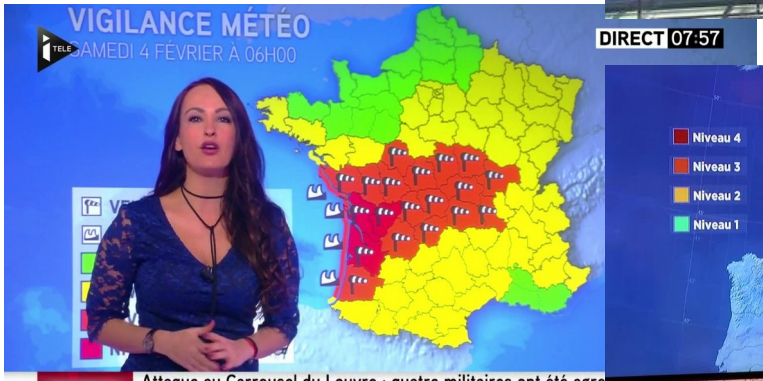
ARS (Regional agencies)

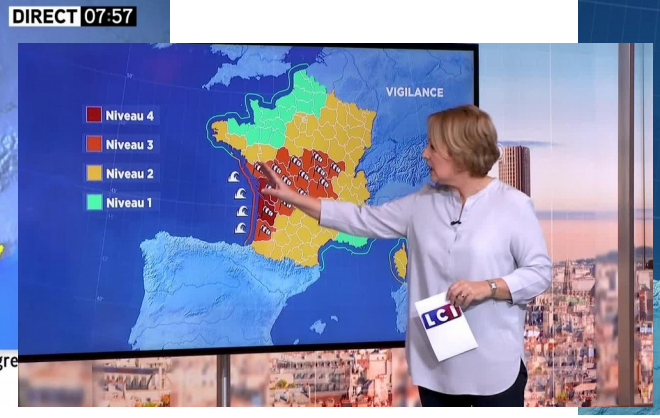
In case of Orange/red vigilance, broadcast on main national chanels, and radio, often at the opening of TV news.

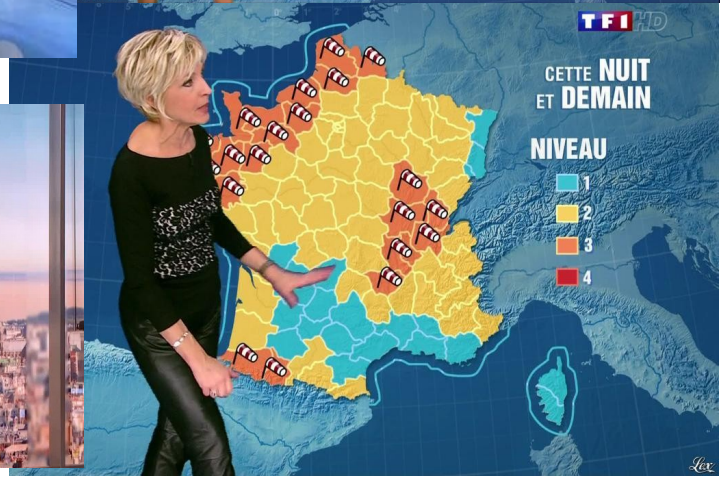
Expert from Meteo France can be invited.

TV News broadcast



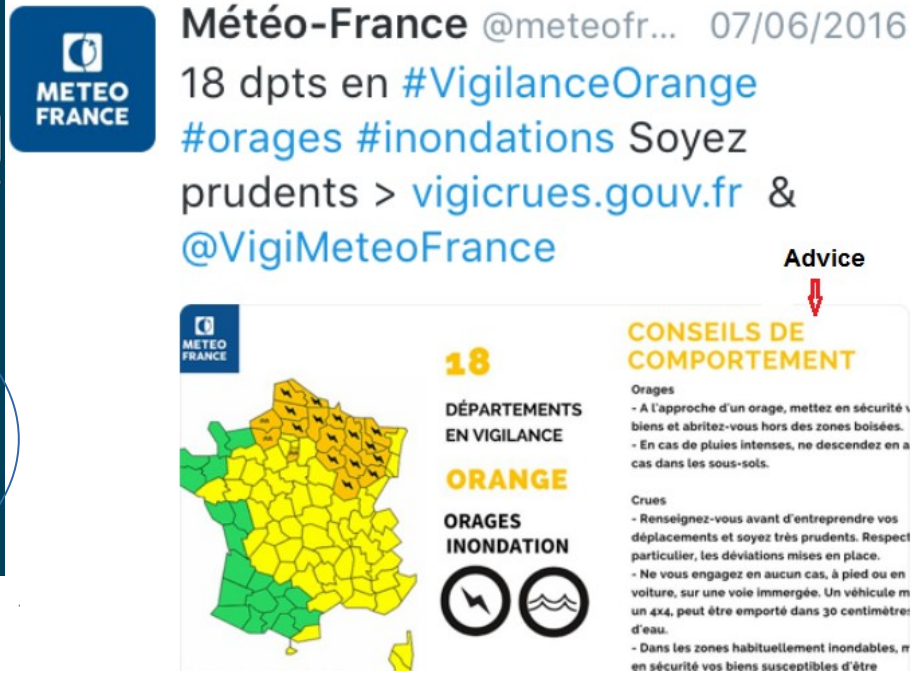






Differents media : smartphone, twitter…

Advice



Few words about the importance of broadcast/updated time

- The vigilance's map is avalaible for the next 24 hours and updated/broadcast at least twice daily at :
  - **6 h am**

    (to be ready for morning News, before people go to work, …)
  - **16 h pm**

    (to be avalaible before people/authoriries leave their job, before evenning News, …)

- This **regularity** (of the hours of diffusion) is important to retain, accustom and simplify uses (for people/authorities/media).

- Of course, for **Orange/Red** level of vigilance (= danger possible within the next 24 hours), the map of vigilance can be **updated at every moment**.

  But it's always necessary to think about the most appropriate broadcast / announcement time for the alert to be effective.
  - Examples :
    - For wind storm, snow event, whith good predictibiliy and wide area impacted, you can announce Orange as soon as possible
    - For thunderstorms, difficult to forecast in intensity and impacted areas, you can wait few hours before, until you are almost sure (to avoid too many false alarms, wich leads to a loss of credibility).

METEO FRANCE

Help for colour decision : thresholds (but not only)

(*) *over a significant part of the department/county or over an « important » area (city, turristic area, ...)*

Weather hazard	Thresholds/criteria for yellow	Thresholds/criteria for orange	Thresholds/criteria for red
Strong winds (gusts, storms) Depending on the climatology of the area	**Gusts in plains (and inlands) (*) ~70 to 100 km/h**	**Gusts in plains (and inlands) (*) ~100 to 130 km/h**	**Gusts in plains (and inlands) (*) > 130 km/h On a case-by-case basis**
Heavy rainfalls Depending in the climatology of the area	**(*) W : 20 to 40mm/24h SE : 40 to 120mm/24h**	**(*) W : 60 to 100mm/24h SE : 120 to 300mm/24h or >80mm in 6h or less**	**Depends on the regional climatology On a case-by-case basis**
Thunderstorms	**Scattered, local thunderstorms**	**Widespread organized thunderstorms/cells**	**On a case-by-case basis, no standards criteria**
Avalanches	**Risk 3 (European scale)**	**Risk 4 or 5 (European scale)**	**On a case-by-case basis Risk 5 widespread**
Snow/Ice Differencies between used and non used areas	**In plains, snow on the ground**	**Snow on the ground in plains (*) of : - few cm in Paris - more than 10 cm in NE. Freezing rain** (or over frozen ground)	**Snow on the ground in plains ≥ 30 cm (*) or loc 50 cm. In mid-mountains, 40 to 80 cm . Intense freezing rains (*)**

Other meteorological criteria : forecast reliabily, event's duration, simultaneity of several hazards, localisation, …

Help for colour decision : other elements can modify consequences/impact

Situational modulations may lead to lower/modify thresholds on decision of the forecaster (and after discussion)

- Day or time/schedule of the event (week-end, holidays, dense traffic hours …)
- not used population
- hazard occurs in a used district or not
- Urbanized/cities area
- altitude of highways
- hydrological background, snowmelt
- earliness (or lateness) of an event
- knowledge of "historical" events records
- leaves on the trees
- anticipated impacts

Meteorologists alone do not know enough about vulnerability and risk assessment.

Overseas (Hurricane alert system)
European awareness
Forecast for 2 to 7 days

A. Charlat – Nov 2018

Day 2 to Day 7 : maps issued for stakeholders only

Risk/probability of having an orange/red warning level by regions/hazards

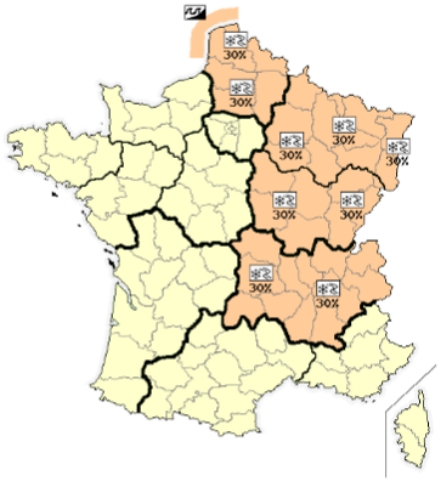
Prévision des phénomènes remarquables

Production quotidienne du Centre National de Prévision (Météo-France, Toulouse)

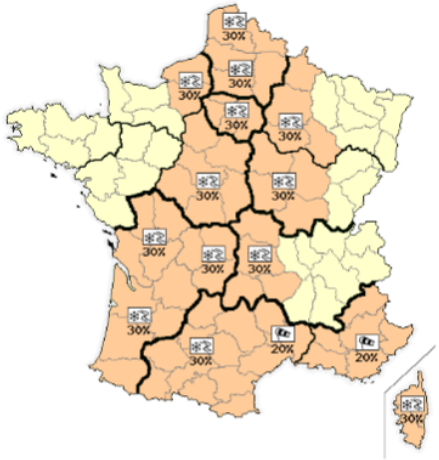
Diffusion : **le jeudi 12/01/2017 à 13 h 44**

METEO FRANCE

Validité : Samedi 14/01/2017 de 00h à 24h



Dimanche 15/01/2017 de 00h à 24h



Risque de ' Grand froid '
➤ pour la période J+4/J+7 uniquement

Commentaires à J+2 et J+3 :

On surveillera la conjonction de forts coefficients de marée et de fortes vagues sur le sud de la Mer du Nord dans la nuit de vendredi à samedi.

Samedi, des averses de neige sont attendues sur le nord et l'est du pays, souvent jusqu'en plaine, mais les quantités devraient rester faibles.

Dimanche, un épisode de neige en plaine est possible, sur un axe allant de la Belgique aux Pyrénées.
Des chutes de neige significatives sont aussi attendues en Corse jusqu'à basse altitude.

Le Mistral et la Tramontane vont par ailleurs se renforcer significativement au cours de la journée de dimanche.

Lundi 16/01/2017

Mardi 17/01/2017

Mercredi 18/01/2017 et Jeudi 19/01/2017

Commentaires de J+4 à J+7 :

Lundi une perturbation neigeuse devrait affecter les régions allant du Nord à l'ouest du Massif-Central puis du Sud-Ouest aux Pyrénées. En Corse les averses de neige pourraient s'abaisser jusqu'en plaine mardi.
Le froid va s'accentuer et les gelées seront assez marquées à partir de mardi notamment du Massif-Central au Nord-Est et aux Alpes.

Issued only for Civil Protection, Health Ministry, etc.

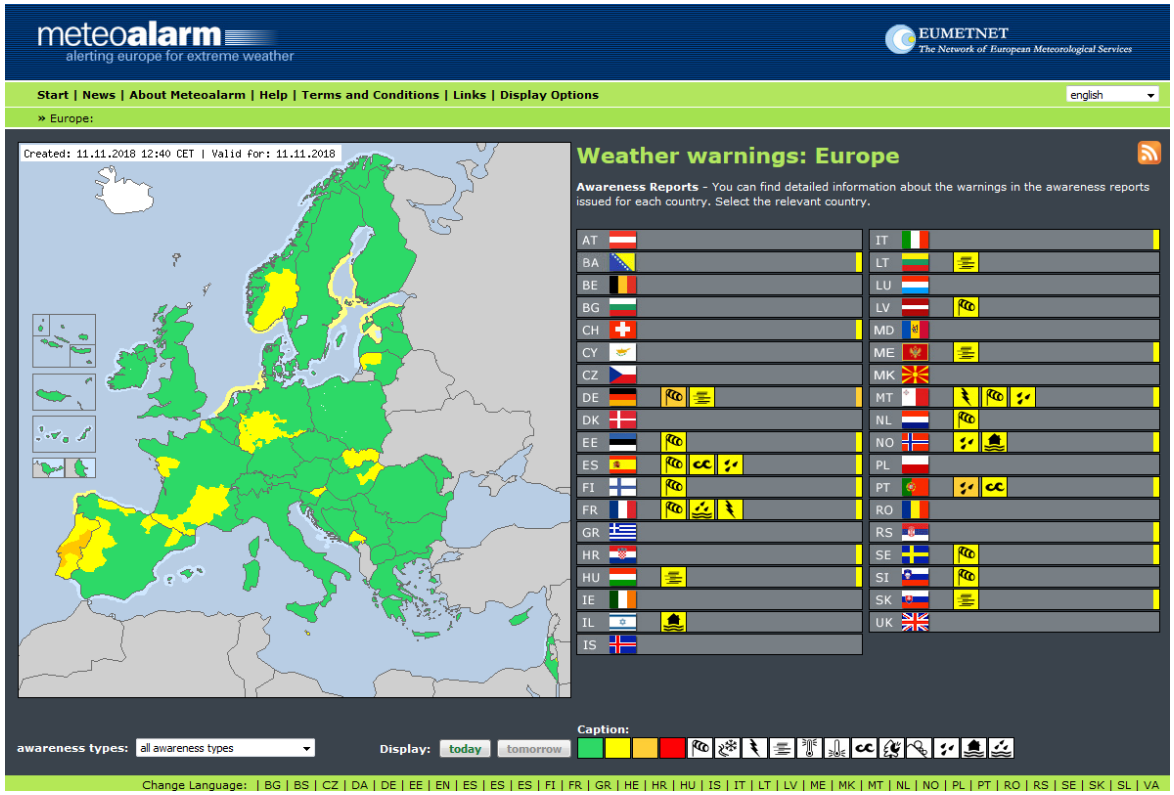
METEO FRANCE

The European awareness system : Meteoalarm

A public Website operational since Spring 2007

(Eumetnet project EMMA *European Multi Services Meteorological* Awareness) :

- European visualisation
- National visualisation
- Multilingual static information



Link with existing national systems websites

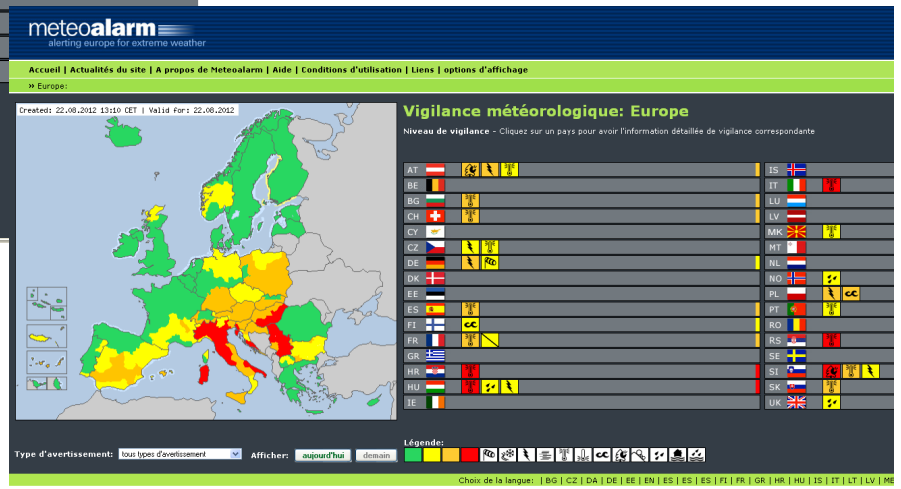
Public Website :http://www.meteoalarm.eu/

The 2nd level in Meteoalarm

Zoom on geographical areas

Difficulties & possible misunderstandings :

- List of parameters different from one country to another
- Not exactly the same signification of the colours between the countries : every country keeps its own criteria



French overseas : example of Reunion Island hurricane warning system

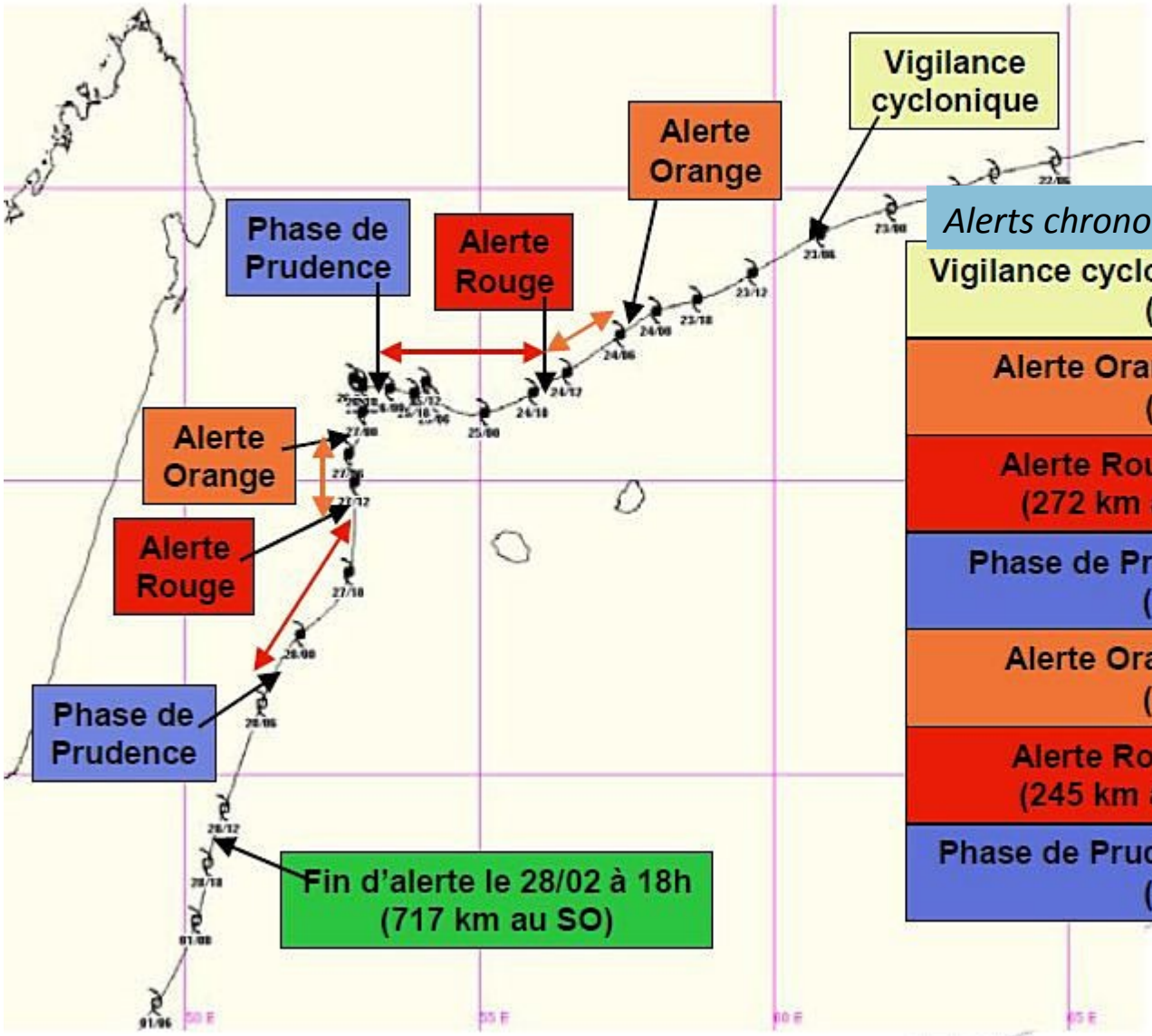
- Do not depends on the intensity (the threshold is hurricane conditions, or not). Color indicates the chronology of the danger.

- System anterior to the Vigilance system.

Hurricane alert level	Chronology (of hurricane conditions)	Main advice or consequencies	Prefectural/authorities rules
Yellow (pre-hurricane alert)	Potential danger in coming days	Keep informed	Nothing
Orange alert	Danger **within 24 hours**	Schools and nurseries close but economic activity continue	**Schools and nurseries close**
Red alert	Danger **within next 3 hours**	**All activities stop**, From the announcement, everyone has 3 hours to go home or take shelter	**Prohibition to circulate**
Safeguard phase	Hurricane has moved away, but there are still dangers	Keep informed. Schools and nurseries remain close	Variable (possible prohibition to circulate in some areas, according to prefectural instructions)

- Coexistence of vigilance (as in mainland France) and this specific hurricane warning system
- The vigilance (map and bulletin) is suspended when a Hurricane Alert occurs

Track of GAMEDE hurricane and associated alerts



Alerts chronology – 23 to 28th feb. 2007.

Vigilance cyclonique : vendredi 23/02 à 11h (768 km au NE)
Alerte Orange : samedi 24/02 à 08h (435 km au NE)
Alerte Rouge : samedi 24/02 à 21h (272 km au NNE) préavis de 3h
Phase de Prudence : lundi 26/02 à 06h (350 km au NO)
Alerte Orange : mardi 27/02 à 07h (305 km au NO)
Alerte Rouge : mardi 27/02 à 18h (245 km à l'ONO) préavis de 3h
Phase de Prudence : mercredi 28/02 à 08h (455 km au SO)

METEO FRANCE
Toujours un temps d'avance

Meteorological Vigilance : Detailed presentation for each hazard

A. Charlat – Sept 2018

Heavy rainfalls - floods

- **Heavy rainfalls are due to :**
  - **violent thunderstorms (stationnary,or several successive cells)**
  - **Cold front stationnary or undulating of an oceanic perturbation associated to wide rain bands.**
- **Posibilities of floods (rapid floods, run-off).**
- **Critical thresholds depending on the areas :**

Examples	Yellow	Orange	Red
West region	**Over a significant part of the department or an « important » area (city, turistic area...)** **20 to 40 mm/24h**	**Over a significant part of the department or an « important » area** **40 to 80 mm/24h**	**on a case-by-case basis Over a significant part of the department or an « important » area** **> 80 mm/24h**
South-East region	**...** **40 to 120 mm/24h**	**> 80 mm in 6 h even locally 120 to 300 mm/24h over a significant part of the department**	**on a case-by-case basis** **(> 200 mm in 6h or > 300 mm in 24h)**

- **Floods can be due to slow raise of rivers.**

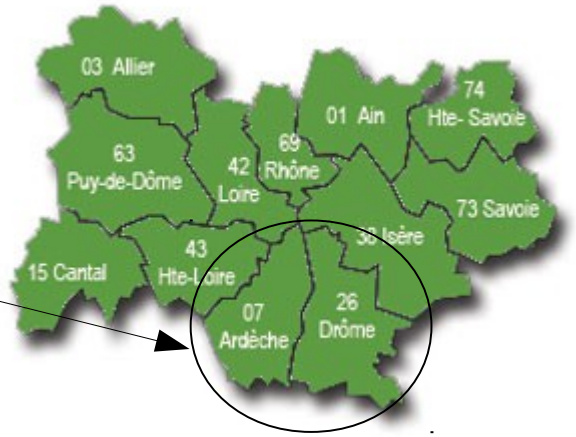
Floods watching and forecast are not a responsability of Météo-France, but are done by the SCHAPI-SPC network (MEEM)

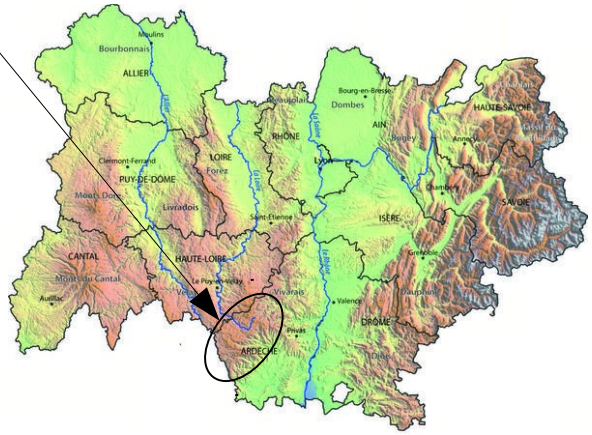
Heavy rainfalls / floods
Exact thresholds in Centre-East Region

Thresholds for Rainfall in Centre-East Region (Auvergne-Rhône-Alpes)

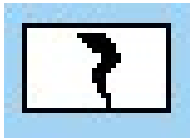
Accumulation over a significant portion or area of interest of the department	Accumulation over a significant portion or area of interest of the department	Accumulation over a significant portion or area of interest of the department
Auvergne Rhône-Alpes (except Drôme Ardèche) 30 to 90 mm in 24 h **Drôme Ardèche (07/26)** 40 to 120 mm in 24 h **Cévenne ardéchoise** 100 to 200 mm in 24 h	**Auvergne Rhône-Alpes** (except Drôme Ardèche) 70 mm in 12 h 90 mm in 24 h 120 mm in 48 h **Drôme Ardèche** 80 mm in 6h (even locally) 120 mm in 24 h 200 mm in 48 h **Cévenne ardéchoise** 120 mm in 6 h 200 mm in 24 h 300 mm in 48 h	**Auvergne Rhône-Alpes** (except Drôme Ardèche) 100 mm in 12 h 140 mm in 24 h 200 mm in 48 h **Drôme Ardèche** 150 mm in 6h 200 mm in 24 h 250 mm in 48 h **Cévenne ardéchoise** 200 mm in 6 h 350 mm in 24 h 500 mm in 48 h
Possible lowering of thresholds :	in case of instability (Cb embedded in the mass)	
	according to the hydrological context : - rainfall in previous days - melting of the snowpack	
	in case of special circumstances (examples: December 31st, summer migrations, etc.) or to take into account the uncertainty of the positioning	

Auvergne Rhône-Alpes





« Thunderstorm »



Thunder storms	Yellow	Orange	Red
Criteria	Isolated thunderstorms	Organized and widespread	Exceptional – No standard criteria

- When their is a risk of violent thunderstorm in yellow, we can write a specific warning bulletin for authorities (Civil Protection, prefect), and contact them.

- False alarm rate for thunderstorms is higher than for other hazards : over 2008-2015, it reached 20%, while it is only at 10% for snow-ice (14% for pour les quatre phénomènes vent violent, fortes précipitations, orages et neige-verglas) .

- In order to reduce false alarms, anticipation is lower than for other hazards.

Vigilance Snow / Ice

- Danger generated by snow is linked to
  - quantity
  - impacted area : *difference between used areas (or not used people, such as urbans people in mountains) and non used areas, importance of the urban/cities issue, and risk of consequences for collective life (electric disconnections, bad traffic conditions, hollydays …).*
  - State of the ground
  - Intensity of the snowfall
- Not an easy forecast, everything depends on little details *(an error in forecast temperature of 1°C is enough to have rain instead of snow)*
- Many cases need lowering of thresholds

Thresholds criteria Snow/Ice - Help for decision

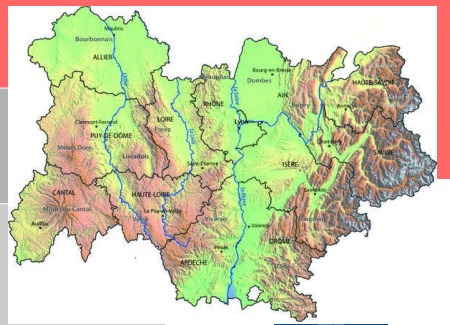
AI that can be locally slipery.	**Depending on the area :**	**Snow in plain : ≥ 30cm on large surfaces or loc 50cm**
Snow on the ground locally in plains	**Snow :** **- Few cm on the ground in plains** **- More than 10 cm over NE and CE regions.**	**Medium mountain snow ≥ 40cm or 80 cm loc.**
Freezing rains or rains over frozen ground can occure locally	**Freezing rains or rain over very frozen ground over a significant area**	**Freezing precipitation, intense (~1cm ice), durable and without thaw over a significant area**
Frost after rain	**For the next 24h after snowfalls, remaining layer of snow at least of orange level or risk of widspread frozen.**	

Snow / Ice
Exact thresholds in Centre-East Region

Thresholds for Snow/Ice in Auvergne-Rhône-Alpes

In plain or at low altitude (about 500m): **Snow holding locally and temporarily on the ground**. In intermediate zone (from 500 to 1000 m approx) : layer of 5 to 10 cm In mountain area : more than 10 cm Or Freezing precipitation or possible freezing conditions Or Significant frost after of a rainy disturbance Or Situation with significant risk of deposition of frost on the ground (example: fog by negative temperature)	Snow Acclimated departments (15, 43, 01, 73, 74, 38) Plain : - layer reaching at least 10 cm on large areas, or 20 cm locally In middle mountains (around 500m above sea level): - layer reaching at least 20 cm over large areas, or 40 cm locally Departements little/not acclimated (all other) Plain: - layer reaching at least **5 cm on large areas, or 10 cm locally** In the middle mountains (around 500m above sea level): - layer reaching at least 10 cm on large areas, or 20 cm locally Or Ice: Freezing precipitation or strongly frozen ground over a significant portion or area of interest of the Department Or for the 24-hour period following the end of an episode of snow or freezing precipitation: maintenance of a layer of snow on the ground from a height exceeding the orange level criteria and / or risk of general refreezing in case of partial or total melting.	Departments little/not acclimated (03, 63, 42, 69, 26, 07) : - Plain, layer reaching at least 30 cm on large areas, or 50 cm loc., - In mid-mountains (around 500 m altitude), layer reaching at least 40 cm on large areas, or 80 cm loc. Departments acclimated (15, 43, 01, 73, 74, 38) : - Plain, layer reaching at leasts 40 cm on large areas, or 80 cm loc. - In mid-mountains (around 500 m altitude), layer reaching at least 60 cm on large areas, or 120 cm loc. Or Intense freezing precipitation (in the order of 1 cm of ice or more), durable and thaw free over a significant portion or important area to the department

Weather modulations	Lowering of thresholds possible in case of: - important refreeze - wind favoring snowdrifts - established risk of heavy or sticky snow
Situational modulations	Lower thresholds based on the following aggravating factors: - presence of a large agglomeration and concomitance of snowfall with hours of heavy traffic - calendar indicating a difficult trafic - **beginning or end of winter season**
	Special circumstances (December 31st, **Holidays**,…), uncertainty of the positioning
Remarks	For the release orange, if the end of the event takes place after 4 pm and before 6am and the risk of freezing is expected to be maintained during the night, the lifting of the orange will be postponed to the early at 10h



METEO FRANCE

Vigilance « strong winds »

Strong winds	yellow	Orange	Red
Depending on climatology of the area	For ex. Gusts *(*)* ~70 to 100 km/h inlands, in plains	For ex. Gusts *(*)* ~100 to 130 km/h inlands, in plains	For ex. Gusts *(*)* >130 km/h inlands, in plains

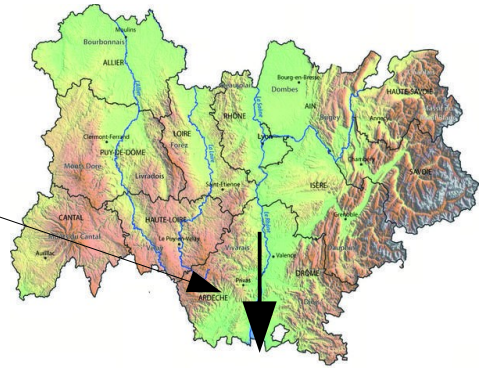
(*) ***over a significant part of the department/county or over an « important » area (city, turristic area, ...)***

Modulations depending on areas :

- In the SE, differencies of intensity thresholds according to direction (northerly mistral or not)
- A 100 km/h wind in Paris is more dangerous than elsewhere

Strong winds
Exact thresholds in Centre-East Region

Thresholds for Wind in Centre-East Region (Auvergne-Rhône-Alpes)		
Plain : Gusts over a significant portion or an important area of the department from 70 to 100 km/h Mistral (northerly wind) : 90 to 110 km/h Medium mountain: above 90 km/h	Plains : Gusts over a significant portion or an important area of the department from 100 to 130 km/h. Mistral (northerly wind) : 110 to 130 km/h Medium mountain: case-by-case decision based on wind over 110 km/h in populated area	Plains : Gusts over a significant portion or an important area of the department > 130 km/h



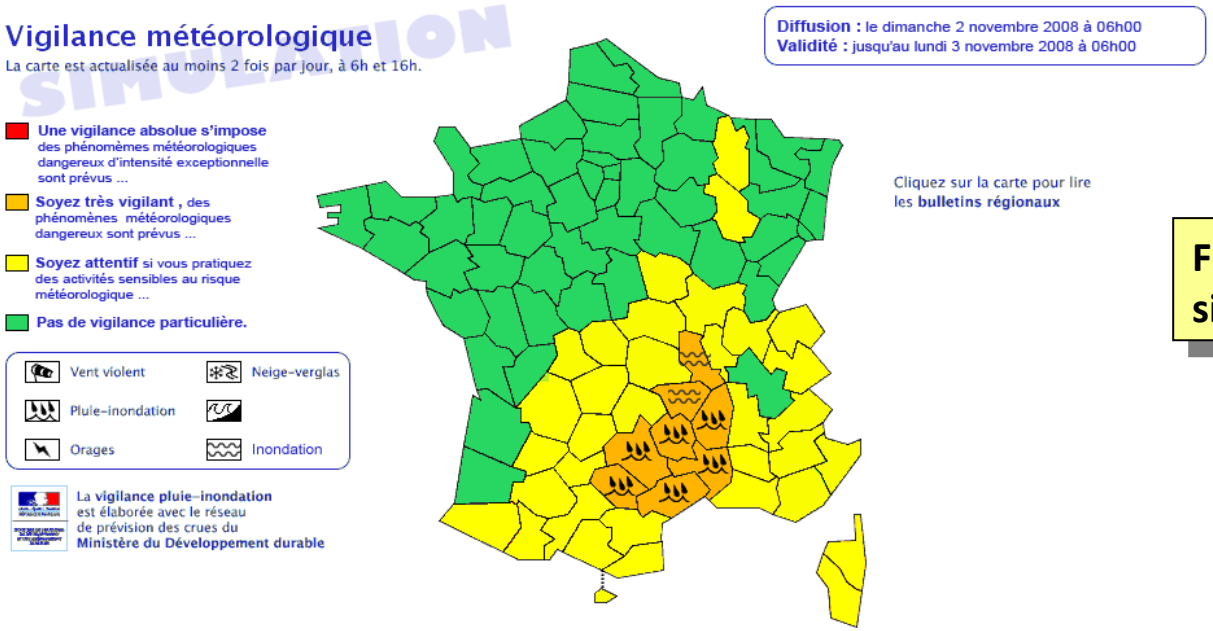
Possible lowering of thresholds in case of leaves on the trees, special circumstances (examples: December 31st, summer migrations, etc.) or to take into account the uncertainty of the positioning, or rapid low-pressure crossing.

METEO FRANCE

Vigilance « floods only »

Objective : separate « floods » that occure without heavy rainfalls

- " **Floods** " symbol  shows risk of floods without same level of heavy rainfall
- " **rainfall-floods** " Symbol  : risk of heavy rainfall, associated or not to floods.
- *In case of floods only and other meteorolocigal hazards (wind, thunderstorms, snow-ice), a choce of the main displayed symbol is done by Meteo France and Schapi together.*



Floods only Vigilance exists since 3 oct 2011

Flood risk management –

A close cooperation between hydrologists and meteorologists

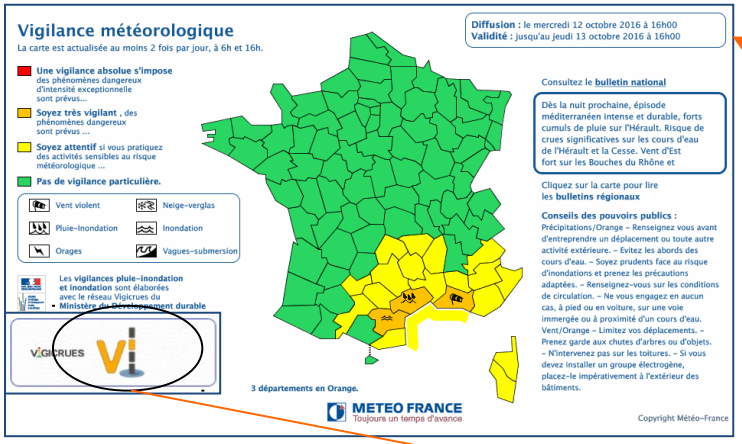
1.Warning Risk of rapid submersion due to heavy rainfall forecast :

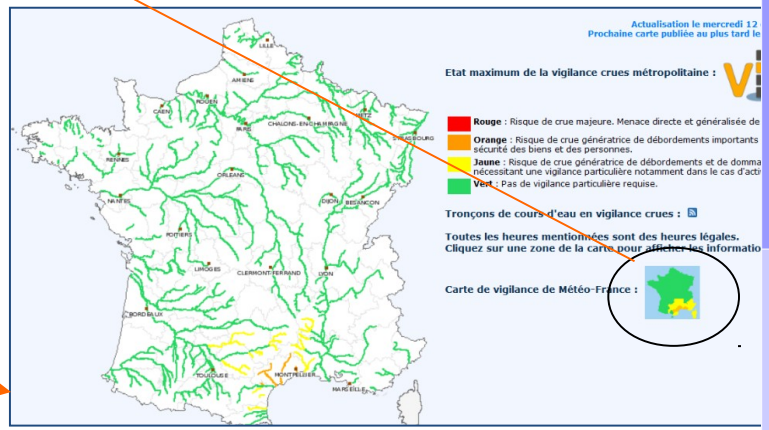
- Meteorological Vigilance EWS – pictogram

2. **Warning floods due to floods occuring in the main rivers** under State surveillance

- River floods EWS of the hydrometeorological and flood forecasting services (local and national office)

Partnership with the governement risk prevention office (DGPR)





On the met. vigilance map :

Integration of the flood risk

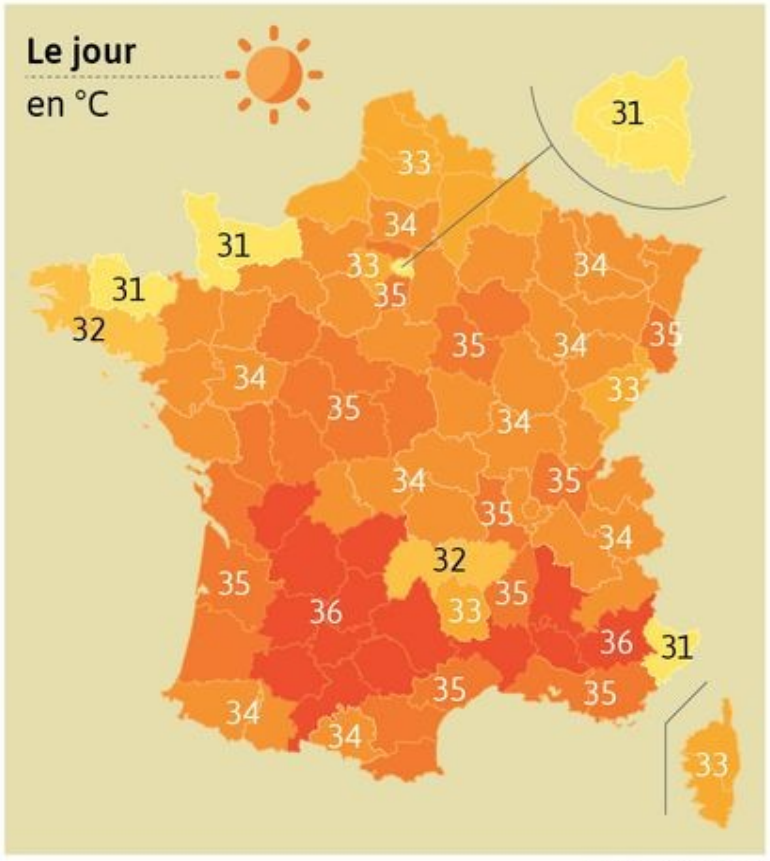
	Risk of River floods without heavy rains
	Heavy rains with or without river floods

Thresholds of orange vigilance for heatwave

Heatwave orange vigilance is activated for a department when the temperatures ...

...for **at least 3 nights do not go below** a specific threshold and...

...for **at least 3 days exceed** a specific threshold.



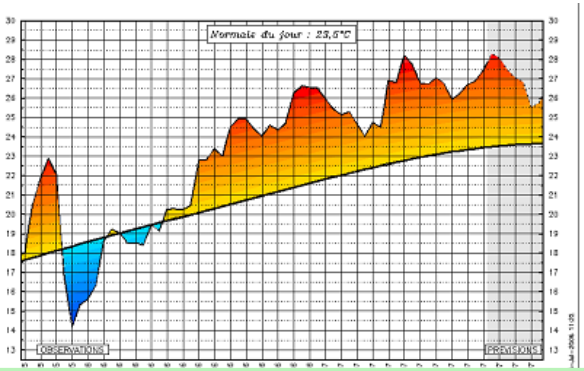
Min and Max temperatures in significant/specific points (1 representative city per department)

Thresholds estimated/established by correlation with passed observed over-mortality due to heat (strong partnership with national health agency)

METEO FRANCE

Heat-wave Disaster Risk Management

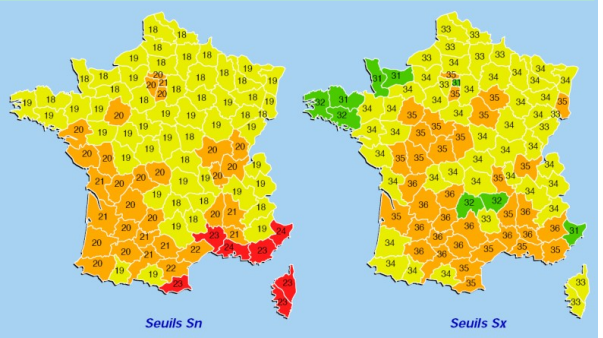
A close cooperation between health services and meteorologists



Observed and forecast **T° values**

+

Thresholds* for min and max biometeorological* indices



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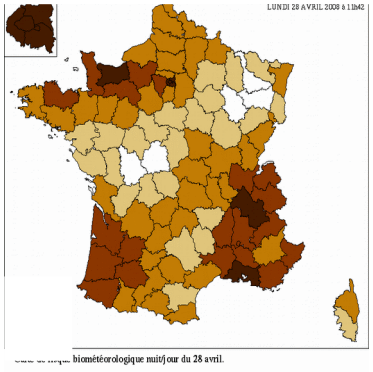
Statistical analysis of past **model errors**

- *Biomet. index = average T° for 3 consecutive days*
- *Thresholds also based on overmortality indices*

Risk for the Biometeorological indices to be over the thresholds



Other meteorological criteria (duration, pollution, …)

Healty impacts

Health Authorities

16h map

Prefect (district)

Alert

National Heatwave Plan

Mayors, population

Biometeorological Index Min (IBMn) : mean of minimal temperatures
Max (IBMx) : mean of maximal temperatures measured and/or forecasted on three following days

« Cold » spell

National Index for cold spell :« Wind-chilled temperature » TR, IRE (apparent temperature, felt temperature) showing the feeling of coldness that depends on wind.

Air temperature (°C)

Mean Wind at 10m (km/h)	5	4	3	2	1	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	-16	-17	-18	-19	-20
5	4	3	2	1	0	-2	-3	-4	-5	-6	-7	-8	-10	-11	-12	-13	-14	-15	-16	-17	-19	-20	-21	-22	-23	-24
10	3	1	0	-1	-2	-3	-5	-6	-7	-8	-9	-10	-12	-13	-14	-15	-16	-18	-19	-20	-21	-22	-24	-25	-26	-27
15	2	1	-1	-2	-3	-4	-6	-7	-8	-9	-11	-12	-13	-14	-16	-17	-18	-19	-20	-22	-23	-24	-25	-27	-28	-29
20	1	0	-1	-3	-4	-5	-7	-8	-9	-10	-12	-13	-14	-15	-17	-18	-19	-20	-22	-23	-24	-25	-27	-28	-29	-30
25	1	-1	-2	-3	-5	-6	-7	-8	-10	-11	-12	-14	-15	-16	-17	-19	-20	-21	-23	-24	-25	-26	-28	-29	-30	-32
30	0	-1	-3	-4	-5	-6	-8	-9	-10	-12	-13	-14	-16	-17	-18	-20	-21	-22	-23	-25	-26	-27	-29	-30	-31	-33
35	0	-2	-3	-4	-6	-7	-8	-10	-11	-12	-14	-15	-16	-18	-19	-20	-22	-23	-24	-25	-27	-28	-29	-31	-32	-33
40	-1	-2	-3	-5	-6	-7	-9	-10	-11	-13	-14	-15	-17	-18	-19	-21	-22	-23	-25	-26	-27	-29	-30	-31	-33	-34
45	-1	-2	-4	-5	-6	-8	-9	-10	-12	-13	-15	-16	-17	-19	-20	-21	-23	-24	-25	-27	-28	-29	-31	-32	-33	-35
50	-1	-3	-4	-5	-7	-8	-10	-11	-12	-14	-15	-16	-18	-19	-20	-22	-23	-24	-26	-27	-29	-30	-31	-33	-34	-35
55	-2	-3	-4	-6	-7	-8	-10	-11	-13	-14	-15	-17	-18	-19	-21	-22	-24	-25	-26	-28	-29	-30	-32	-33	-35	-36
60	-2	-3	-5	-6	-7	-9	-10	-12	-13	-14	-16	-17	-18	-20	-21	-23	-24	-25	-27	-28	-30	-31	-32	-34	-35	-36
65	-2	-3	-5	-6	-8	-9	-10	-12	-13	-15	-16	-17	-19	-20	-22	-23	-24	-26	-27	-29	-30	-31	-33	-34	-36	-37
70	-2	-4	-5	-7	-8	-9	-11	-12	-14	-15	-16	-18	-19	-21	-22	-23	-25	-26	-28	-29	-30	-32	-33	-35	-36	-37
75	-3	-4	-5	-7	-8	-10	-11	-12	-14	-15	-17	-18	-19	-21	-22	-24	-25	-27	-28	-29	-31	-32	-34	-35	-36	-38
80	-3	-4	-6	-7	-8	-10	-11	-13	-14	-15	-17	-18	-20	-21	-23	-24	-25	-27	-28	-30	-31	-33	-34	-35	-37	-38
85	-3	-4	-6	-7	-9	-10	-11	-13	-14	-16	-17	-19	-20	-21	-23	-24	-26	-27	-29	-30	-31	-33	-34	-36	-37	-39
90	-3	-4	-6	-7	-9	-10	-12	-13	-15	-16	-17	-19	-20	-22	-23	-25	-26	-27	-29	-30	-32	-33	-35	-36	-38	-39

Thresholds :

Yellow Vigilance : TRmin <= –10 and TRmax < 0

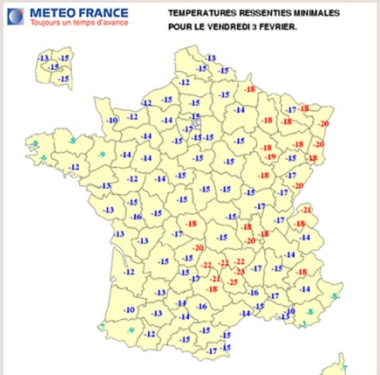
Orange Vigilance : TRmin <= -18 and TRmax < 0

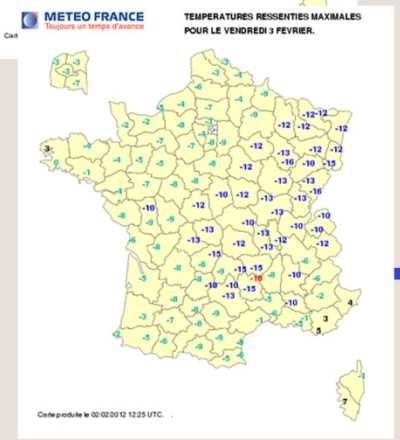
Red : TRmin <= –25 (+ situation) and TRmax < 0

TRmin = **Temp mini and Mean wind at 6h UTC**

TRmax = **Temp maxi and Mean wind 12h UTC**

Specific coopération for « Cold spell » vigilance





Cartes des températures mini et maxi ressenties

Tableaux des températures ressenties de J à J+3

CHAMPAGNE-ARDENNES

Villes		JEUDI 02		VENDREDI 03		SAMEDI 04		DIMANCHE 05	
		Matin	Ap_Mi	Matin	Ap_Mi	Matin	Ap_Mi	Matin	Ap_Mi
CHARLEVILLE-MEZIERES	T (°C)	-10	-3	-10	-4	-9	-4	-8	-4
	FF (km/h)	< 5	20	20	20	10	10	10	10
	TR (°C)	-10	-9	-18	-10	-14	-8	-13	-8
TROYES	T (°C)	-8	-3	-9	-3	-8	-4	-7	-4
	FF (km/h)	17	30	20	20	20	20	5	10
	TR (°C)	-15	-10	-17	-9	-15	-10	-10	-8

Si Température ressentie-TR comprise entre -5 et -10°C et TR maximum négative ou nulle
Si Température ressentie-TR comprise entre -11 et -17°C et TR maximum négative ou nulle
Si Température ressentie-TR inférieure à -18°C et TR maximum négative ou nulle

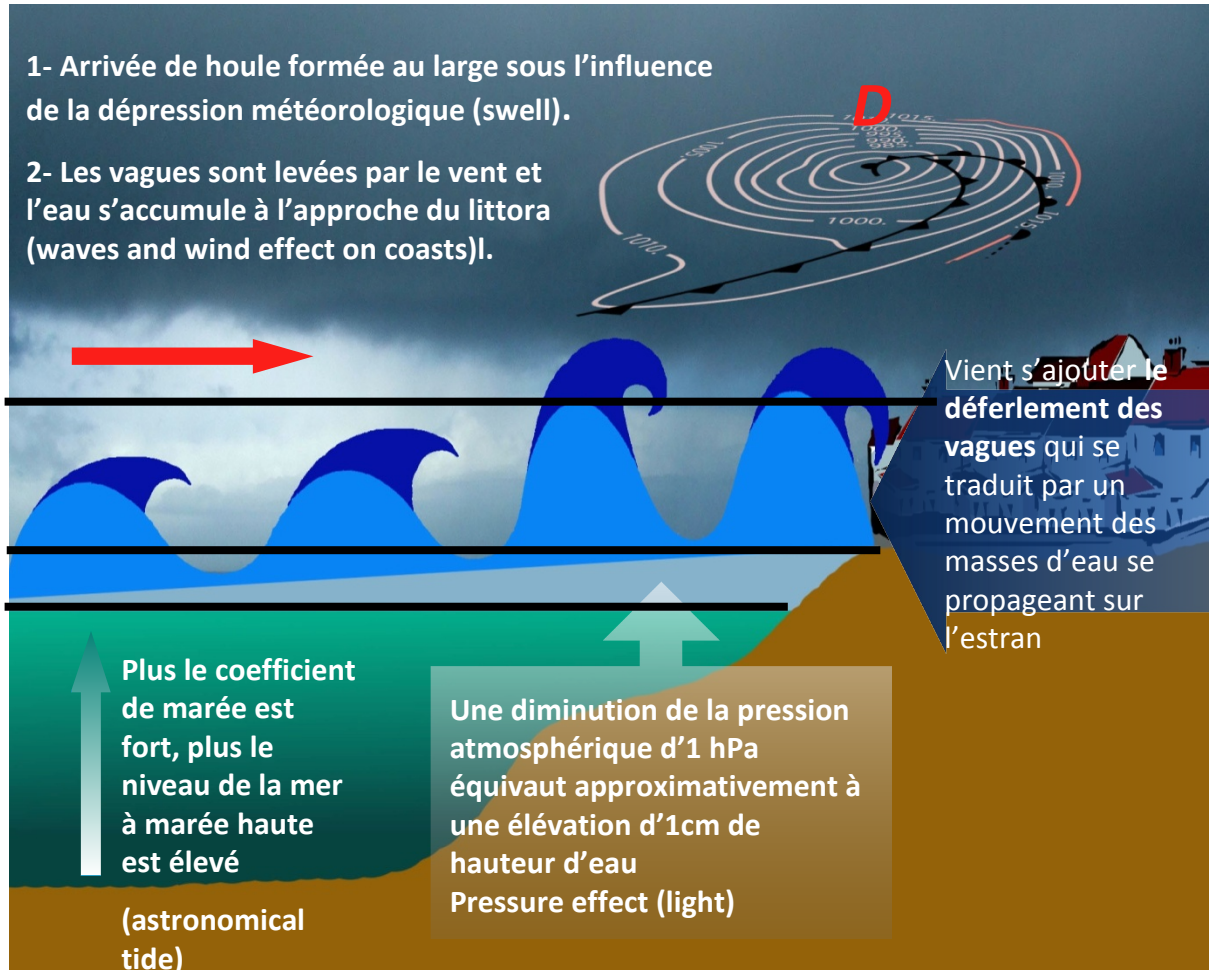
Carte de vigilance de 16 heures

ACTION

ARS, DGCS, DRHIL
Prefects

Mayors

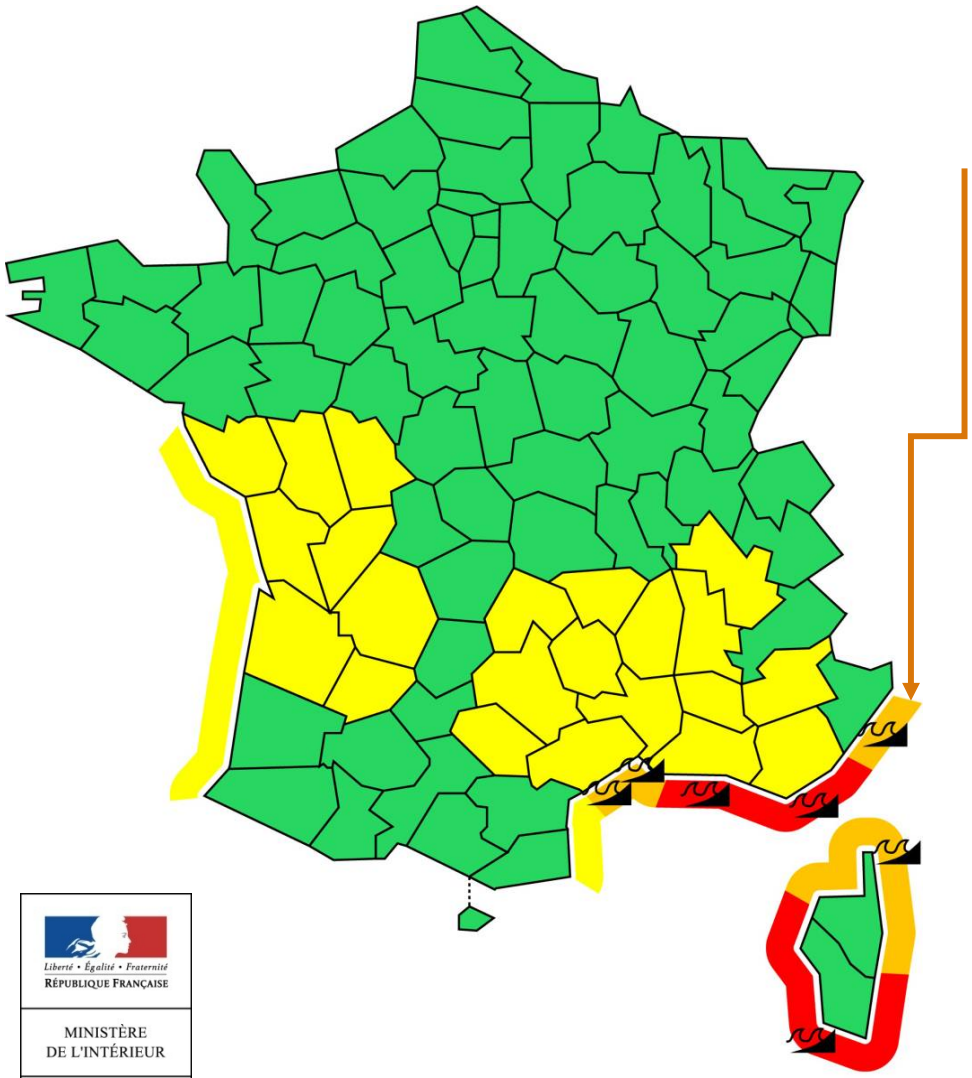
« Coastal waves- storm surge »



Forecast not easy due to :

- Astronomical tide (SHOM) + storm surge and waves generated by météorological conditions
- Importance of time/spatial correlations (*Xynthia*)
- This forecast depends a lot on the « deterministic » choosen forecast, with its associated uncertainty/doubt

Coastal waves specificities



- **When yellow level at least, a coastal band** is displayed on the department shore.
- **The symbol** is only displayed for **orange/red level**.
- **The shore/coastal band** of the department is « **clickable** ».

VVS (Coastal waves) exists since 3 oct 2011, after Xynthia storm in 2010

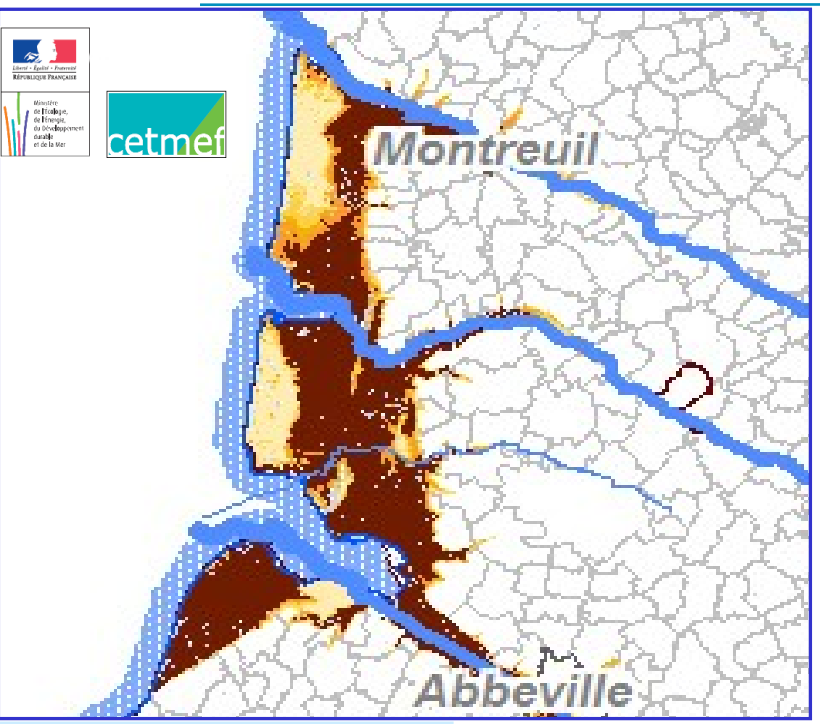
Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE
MINISTÈRE DE L'INTÉRIEUR
MINISTÈRE DE L'ÉCOLOGIE, DU DÉVELOPPEMENT DURABLE ET DE L'ÉNERGIE

SHOM

METEO FRANCE
Toujours un temps d'avance

METEO FRANCE

Thresholds/tables for each department



Maps of « low lands »

Guide for drafting color choices from tables :
- Total water level forecast at the model point closest to a reference point
- Forecast of significant wave height at closest model points

Then, definitive choice after exercise of forecasters' expertise (summary of criteria and elements specific to the situation and the coastline). Complex phenomenon.

46 differents tables in 46 representative point (for 46 departments with coasts)

Charente-Maritime

La Rochelle - La Pallice								
h 1/3 PM	[0 m, 1,5 m[	[1,5 m; 2 m[	[2 m; 2,5 m[	[2,5 m; 4 m[	[4 m; 6 m[	[6 m; 8 m[	[+8 m, 10 m[	[+10 m[
h eau PM + surcote								
>7.5								
7 – 7.5								
6.5 – 7								
6 –6.5								
inf à 6 m								
PHMA :	6,86 m							

Significative height

high tide+storm surge

Local rules to trigger the warnings (guess)

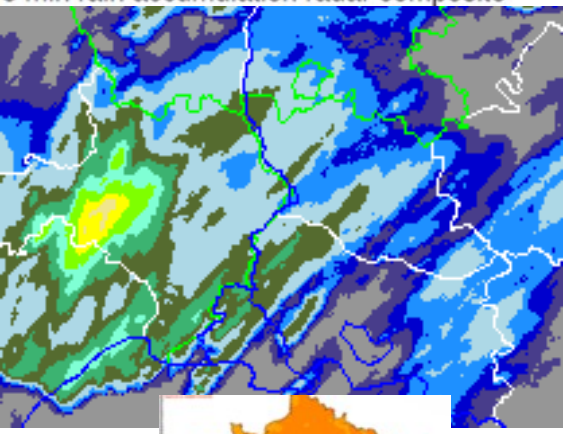
APIC : a complementary product to the EWS for heavy precipitation risk management (2011)

Meteorological radar network

based on **rainfall Observation only** (radar),

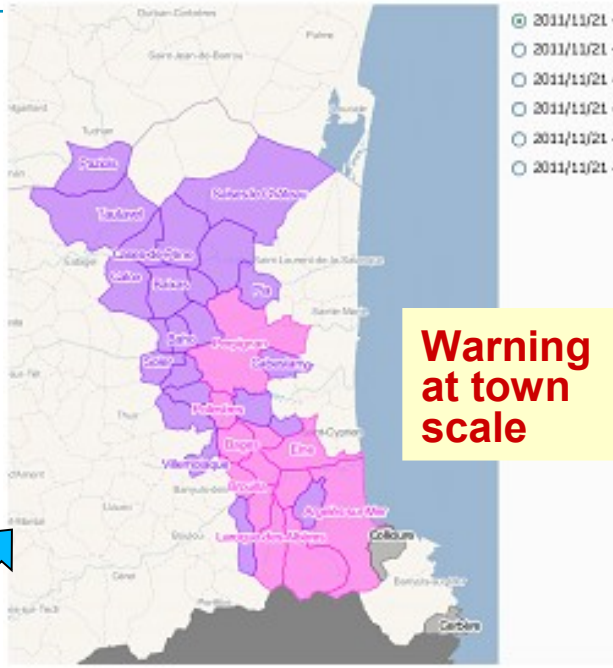
qualified into 2 classes (intense, very intense according to 10, 50 years return period)

accumulated rainfall estimation for the last 1h, 2h, 3h, 4h, 6h, 12h and 24h periods, with 5 min rain accumulation radar composite



Statistic on return period

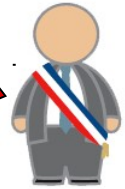
Extreme precipitation risk indicator (return period)



Warning at town scale

APIC warnings

Sms, vocal messages, email,



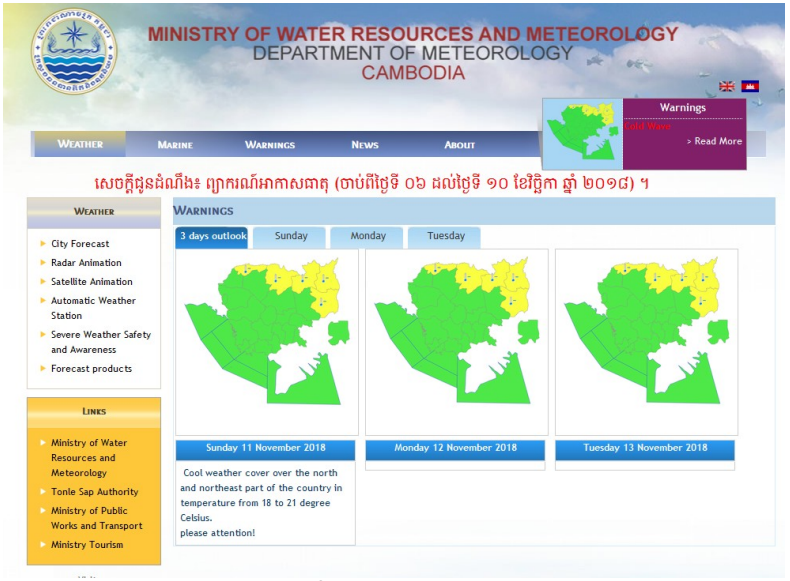
Mayor

METEO FRANCE

MeteoFactory® *PWS/EWS*

- MeteoFactory® is a software, a unique system that allows national weather services putting end-users at the center of their preoccupations. Being able to deliver customized warnings and forecasts at the right moment and in the right form according to the type of end-user targeted, this is the promise made by MeteoFactory®-

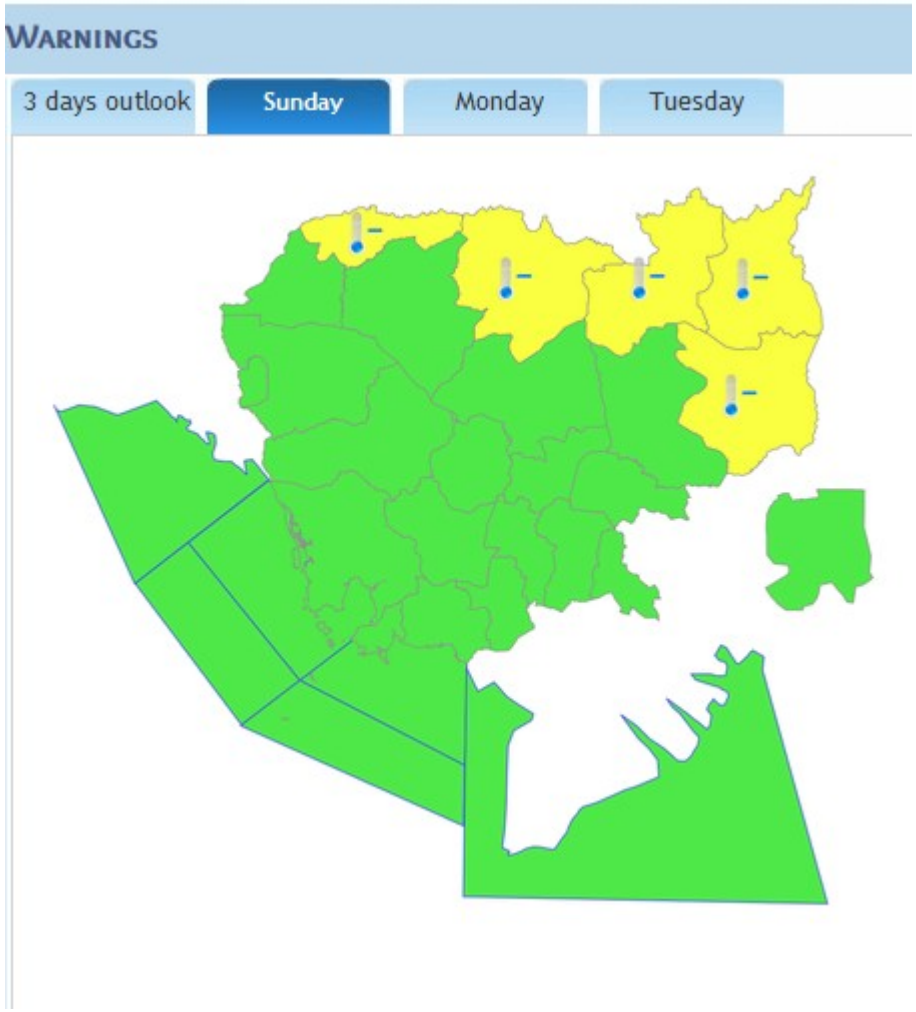
- An integrated Early Warning Solution for the generation and the dissemination of weather alerts and warnings maps, fully compliant with WMO recommendations for meteorological and hydrological alerts (MHEWS). MeteoFactory® also includes a cyclone module.

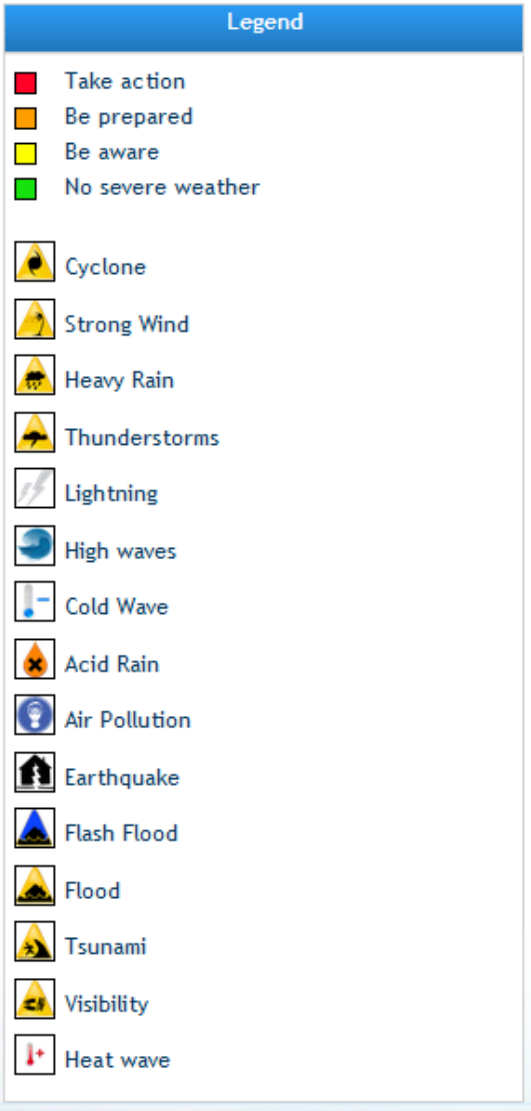


Example of Cambodia Website

For further information about MeteoFactory, please contact David BOUSIGUE at MFI
bousigued@mfi.fr
Or see MFI website http://www.mfi.fr/en/

MeteoFactory® *PWS/EWS*





Example of Cambodia EWS

IBF Assessment / Vigilance Evaluation

A. Charlat – Sept 2018

Evaluation of the IBF Vigilance system

1 . Performance assessment.

- At local level, each event of orange/red (or missed event) is evaluated by the NMHS according to recorded meteorological values.

+ all possible collected informations (number of emergency actions by civil protection, newspaper articles, every media, social networks such as Twitter, Facebook, …) : the Orange/Red warning was it justified or not (according to the NMHS viewpoint)?

- Three meetings each year (january, june, october) of the vigilance steering group (Meteo France and partners : Civil Protection, Health, Floods) = examine all the events (missed or justified), according to our partners viewpoints.

- All those evaluations are nationally collected and analyzed in annual assessment reports.

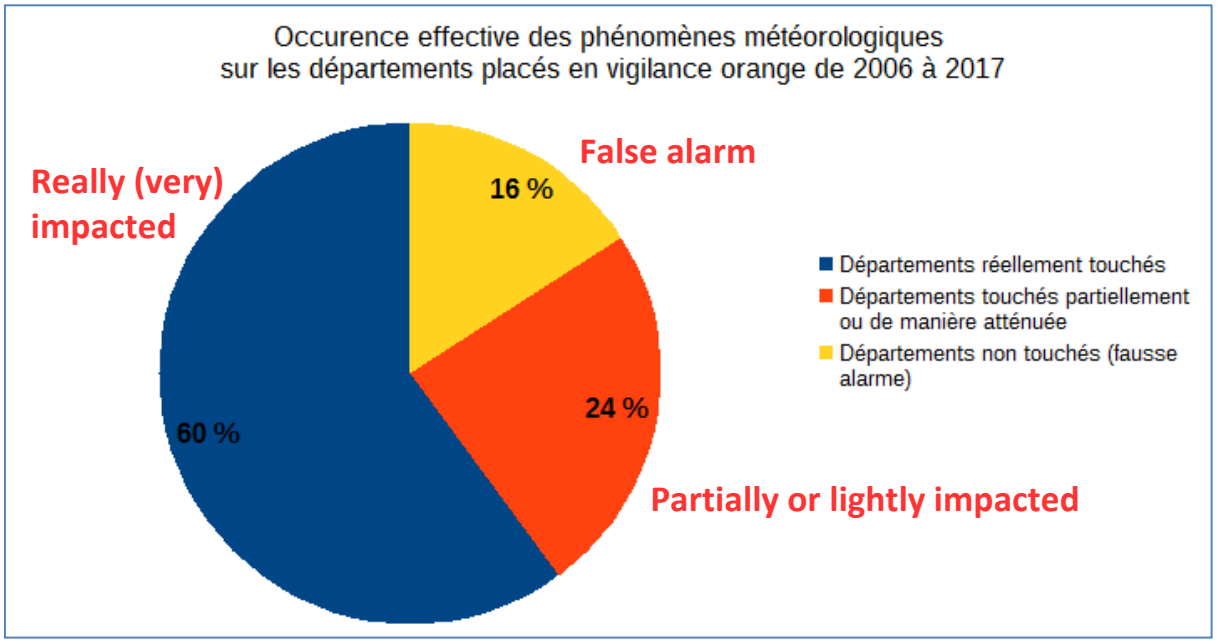
2 . General Public notoriety

- Evaluated each year by an independent “official statistics studies of consumers” (CREDOC) : knowledge of the Vigilance system by french population (map and bulletin), confidence in meteorological forecast.

Annual assessment : last results

Really meteorological event's occurance over departments in Orange/Red alert.

Statistics (average) over période 2006-2017



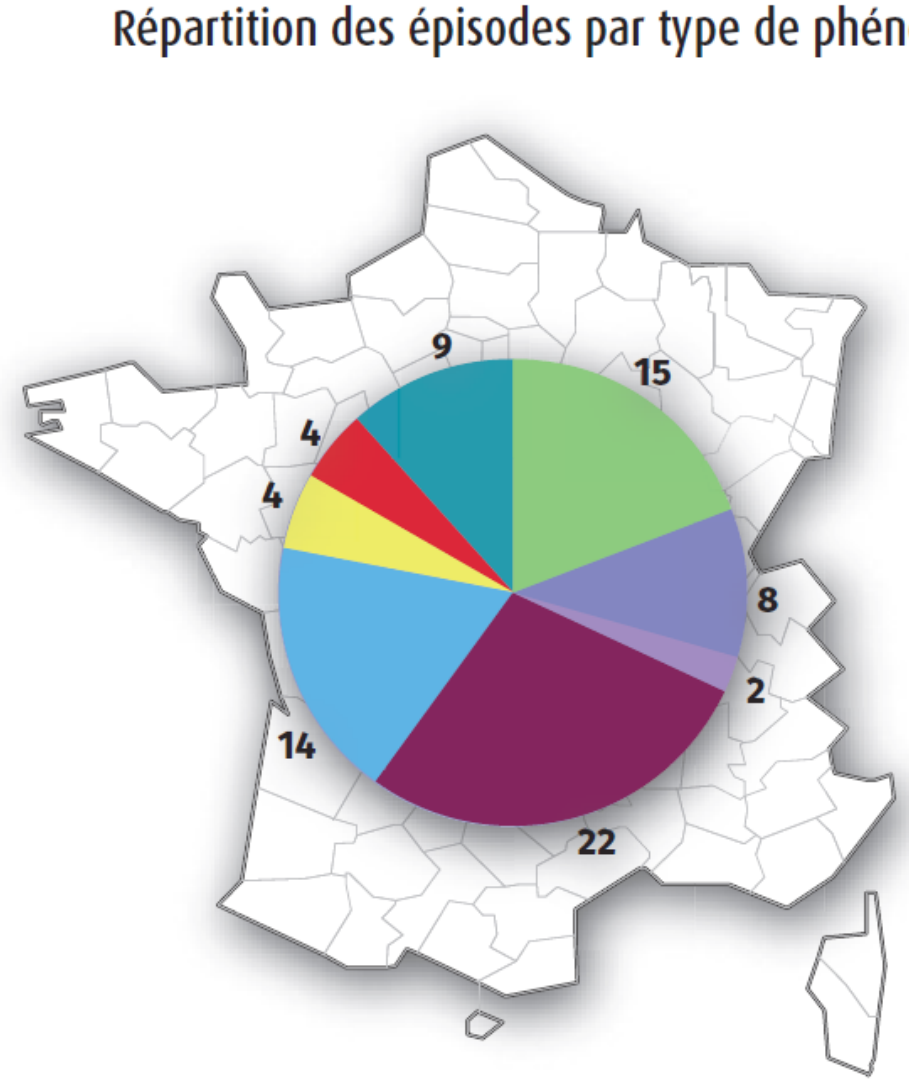
False alarm rate at district (departmental) scale : 16 %

Non-detection / missed events rate (departmental scale) : 3 %

Anticipation ≥ 1h (departmental scale) : 93 %

Anticipation ≥ 3h (departmental scale) : 86%

2017 overview/number of events by hazard



- Over 2006-2017 period, false alarm rate is 16 % for the 4 hazards (strong winds/heavy rainfall/thuderstorms and snow-ice)
- 20 % for thunderstoms
- only 11 % for snow-ice

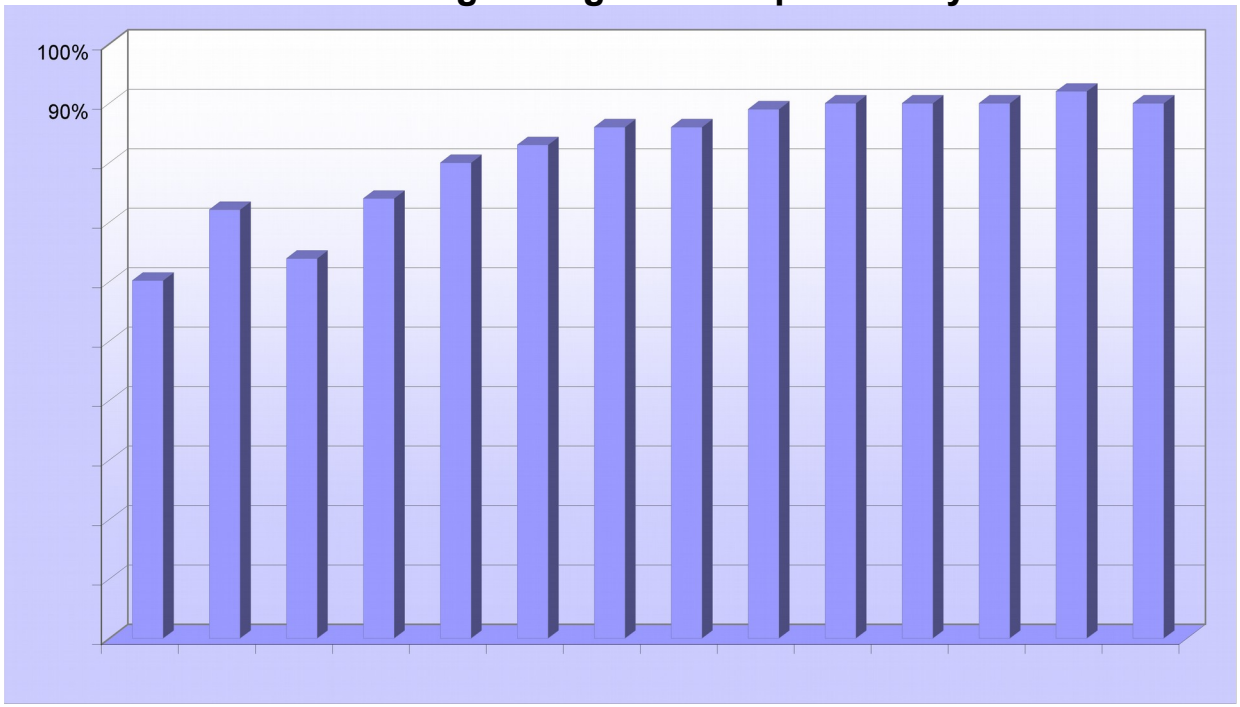
- Strong winds
- Rainfalls/floods
- Only floods
- Thunderstorms
- Snow-Ice
- Cold hell
- Avalanches
- Heat wave
- Coastal waves and flooding

- Due to difficulties of forecast (localization and intensity), thunderstorms are the hazard involved in main false alarms.
- False alarms rate for thunderstorms can't easily be reduced if we want to keep enough detection and anticipation to be usefull.

General public survey/inquiry

Rate of « Yes » answers to the question :
« Do you know the meteorological vigilance map, which shows, with colours, the level of dangerous hazards that could occure within the next 24 h ? »

Meteorological vigilance Map notoriety



To assess/evaluate:

- understanding
- expectations
- Match/relevancy of the « vigilance » product ;

<u>Annual survey, since 2002</u>

- Evaluation of vigilance notoriety
- Specific vigilance inquiry 2002-2004 (CSA, then Harris)
- More general inquiry since 2005 (Credoc, consumer polling organization). Panel/group of 2000 representative persons.

90 % of french people know the Vigilance Map 😀

But only 30 % know the Warning associated bulletin 😐

Overall return of experience

After more than fifteen years of operations :

- Around 90 % of the population know the vigilance map,
- of which 88% say they know the behavior advice (more or less).

- Close cooperation with Civil Protection is essential to anticipate and manage crisis situations : preventive actions are taken to reduce impacts and facilitate return to normal situation.
- Service delivery is enhanced by the use of internet technologies, social media, in addition to traditional media broadcast.
- Pressure on the system / public and authorities expectations are stronger and stronger (the system is built to make people responsible for their own security, but people wait more and more perfect forecast ; it's difficult to explain that we forecast a risk and not a certainty).

- Further improvements : smaller scale when it's possible, others hazards (risk of fire, etc?), bulletins more simple, enhance inter-operabilty between partners.