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Rail infrastructure answer to extreme weather event : a first french study

1st WEATHER Workshop – Sept. 14/2010



Context : some very recent extreme weather events : january 24th, 2009 : hurricane Klaus reaches southwestern France

- Weeks of troubles on the transportation network
- A concern for the present : facing weather extreme episodes



Context : some very recent extreme weather events : february 28th, 2010 : hurricane Xynthia reaches Vendéen Coast

- One line totally stopped
- Many weeks of trouble



Facing weather extreme episodes

- **Ministry in charge of Ecology lauched a plan for climate change adaptation which includes infrastructure, even if nobody clearly knows the direction (according to last IPPC-gate enquiries)**

- **Closer to us, RFF has to face to the consequences of :**
 - more **rainfalls** and snowfalls resulting in damage on earthworks and structures
 - more and more serious **storms** resulting in troubles in electric and signalling systems
 - windstorms and tornados : tree falling and catenary injuries
 - **humidity** (tunnel and earthwork fragility) and flooding (risk on embankments, fundaments, seawalls and electric facilities)
 - **heatwaves** and more changes in temperature (rail dilatation, electric systems failures)
 - **dryness** : risk for structure fundaments on clay, risk of river drying (fundaments)
 - **coolwave** : rail contraction, catenaries, ice in electric systems

- **These issues have to be adressed now, and not only in a 50y time scale**

Preparing the infrastructure

- **Difficulties to forecast the climate and probability of extreme weather events**
 - increasing impacts and costs
 - towards a « risk management approach »

- **Existing infrastructure :**
 - design based on climate stability hypothesis (for example : the 100 years flooding)
 - and on short and non significant weather data

- **New lines :**
 - risk management approach : which level of risk is acceptable to manage both risk and cost
 - several methods : no-regret strategy, reversible or flexible options, systematic safety margins, slow adaptation strategies

What about resilience ?

Concept of resilience can have several aspects

■ Territory :

- social and economic approach
- “basic and crisis” transportation system :

■ Network :

- alternative route available
- Technical knowledge of the network

■ Economics :

- Repair costs VS improvement costs
- Times losses

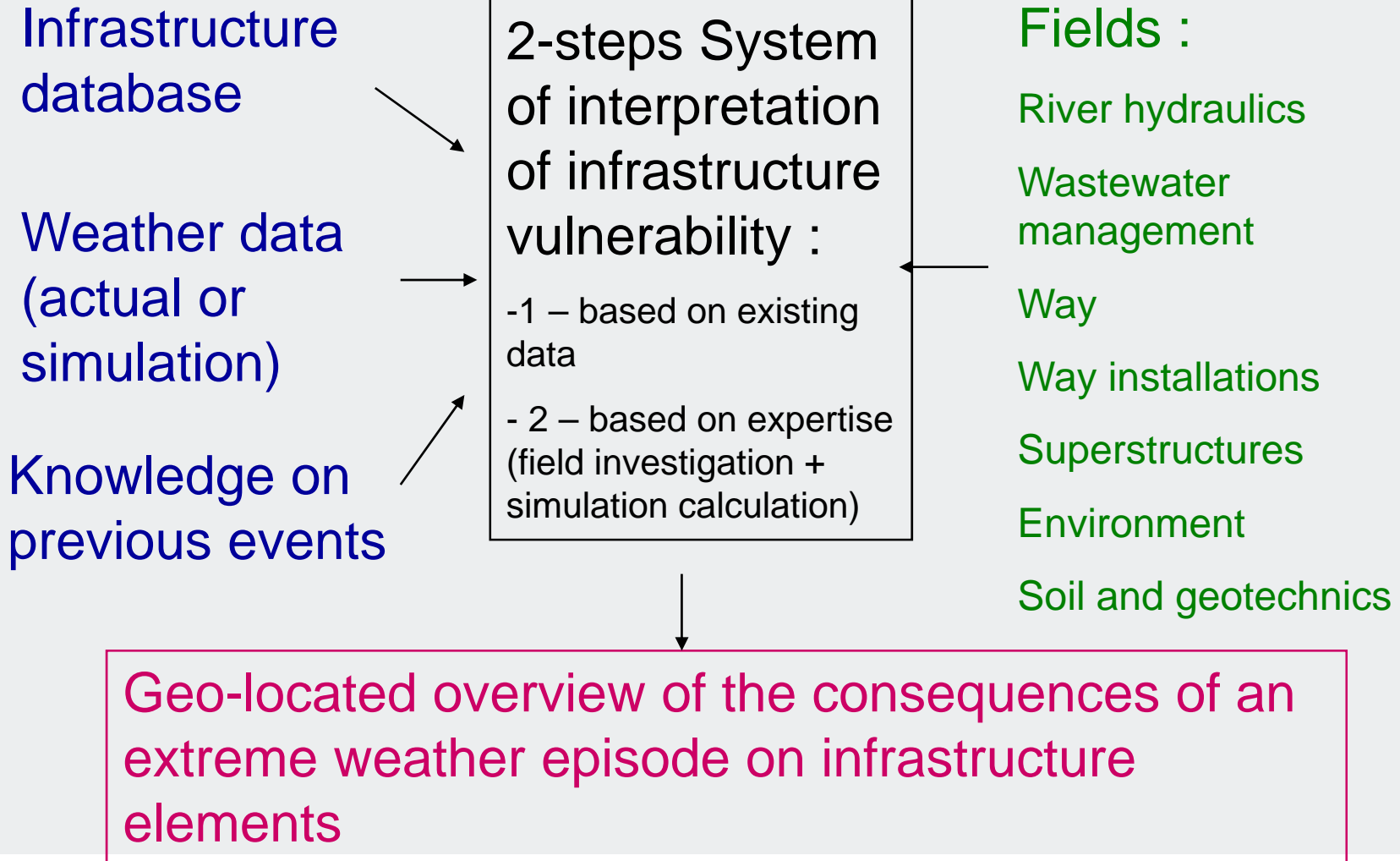
■ Politics :

- Who pay for that ? – according the public subvention to the railway infrastructure –
- How many times do you accept to pay ?

Basic questions (examples)

- **If the line has to be maintained (heavy maintenance) or improved, is it pertinent to include adaptation works on the basis of an expected failure term ?**
- **Can we imagine to close a route during X days when an extreme weather event occurs or to make it work under its nominal performance (without being fired) ?**
- **What are the weakest parts of our infrastructure ?**

- To answer to previous questions and have a good overview, RFF passed a contract with EGIS Engineering
- Previously, the method has been developed for road purposes
- **RISK = threat * vulnerability * consequences**
 - climate risk : you can't mitigate causes
 - act on vulnerability and consequences
- Tools to be implemented on new RFF projects + most vulnerable pieces of the existing network



Risk management on infrastructure : expected outcome

Simulation

Autoroute: A7 PK de départ: 157.00 PK d'arrivée: 177.00

Type d'évènement climatique: Vent
Intensité maximale de l'évènement: Vent (Km/h)

Pluie	mm/h
Crue	m3/s
Neige	cm
Gel	°C
Canicule	°C

Cumul de pluie en 24-h (mm): [] Température (°C): []
Nom du cours d'eau: [] Vitesse du vent (m/s): []

Ouvrages d'art Grande hydraulique
 Equipement Petite hydraulique
 Environnement
 Géotechnique

Exécuter la simu

Code couleur des seuils

- Seuil de rupture (Red)
- Seuil critique (Yellow)
- Seuil d'alarme (Green)

Objets traités

- Arbre
- Ouvrage d'art
- Ouvrage hydraulique
- Haut-mur
- Portique
- Palanque

Simulation

Traverse linéaire ASP

- GeoCrestPondus
- PR 10m
- PR 50m
- GeoCrestLinéaire
- ArbreCrestPondus
- Zone Inondable
- Scan 2D

Code couleur des seuils

- Afficher la légende
- Formuler de l'arrêt pour l'expertise
- Estimer l'expertise
- Sauvegarder la simulation



- **A study is now in progress in the Aquitaine area – Bordeaux -**
- **We are assessing the 3 main lines of this region**
- **Five extreme events are tested (rainfall, heatwave, coolwave, hurricane and flooding)**
- **Results are expected for the 2nd quarter of 2011**
 - where are the weakest points ? → bridges
 - what are the main risks ? → probably rainfall and flooding
 - how many does it cost to improve / to fix ? → for one line, first ideas say at least 100 M€
- **Similar studies should be conducted for all coastal regions – depend of first results and budget allocation -**

Thank you for your attention !

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