



Vulnerability of Road Networks to Climate change :

→ 4 years Experience Assessment

→ GERICI Tool methodology

Vulnérabilité des réseaux routiers au changement climatique :

→ Bilan de 4 années d'expérience

→ Méthodologie et outil GERICI

Michel RAY – Directeur Technique et de l'Innovation – EGIS

Hervé GUERARD – Chef de Projet – Egis Structure et Environnement





Gerici : an Applied Research Project leading to a practical and innovative methodology and tool

Gerici : un projet de recherche appliqué débouchant sur une méthodologie et un outil concrets et innovants

- In response to a 2003 national call for proposals
- En réponse à l'appel à projets 2003 du RGCU
- Presented by a Consortium of 7 partners :

* EGIS	}	Project leader ; Expertise + integrator
* SANEF		2 large Motorway concessionary companies
* ASF		
* EGIS eau		Hydraulic expertise
* METEO-FRANCE		Meteorological data and expertise
* LCPC		National Laboratory
* ESRI		Advice on GIS

GERICI objectives

1. Design of a **Climate Risk Analysis** and Management Approach for Infrastructures
 - A large-**Network** approach for General Directorates
 - A **section**-by-section, object-oriented, approach
2. Design of a Risk Management and **Simulation Tool**
 - Short-term action of alert and prevention for **operation managers** facing unusual events
 - Medium term action to **adapt** infrastructures to climate evolution
3. Propose **Palliative Measures to Mitigate** the Risks
4. **Understand new challenges** to anticipate and suggest **policy changes** and **cooperation strategies** between concerned stakeholders



Key-Unwanted Events targeted :

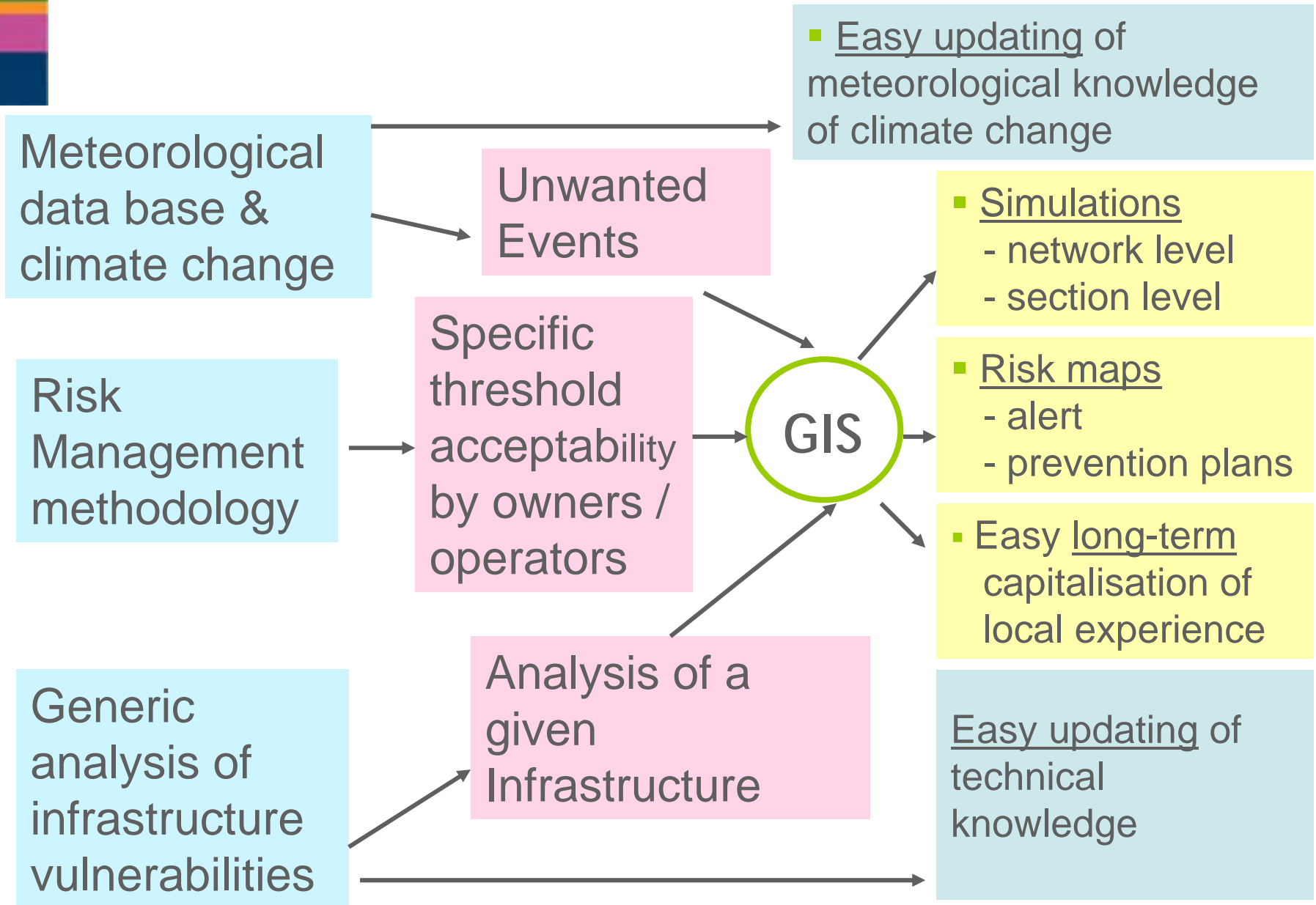
Rain, snow, floods, heat waves, cold / frost, wind

Seven domains of expertise :

Pavements, geotechnics, structures, environment (trees,...) motorway operation equipment, small hydraulics and drainage, river hydraulics.



Structure of GERICI Approach & Results



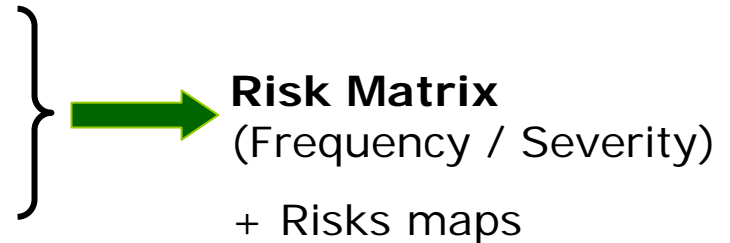
Risk Maps

Risk maps are analysed in light of foreseeable consequences on :

- Costs
- Infrastructure durability
- Continuity of service to users
- Users' safety
- Prejudicial effects to environment

This leads to the identification of critical sections and scenarios:

- Route disruption
- Disruption of access to sensitive areas
- People injuries



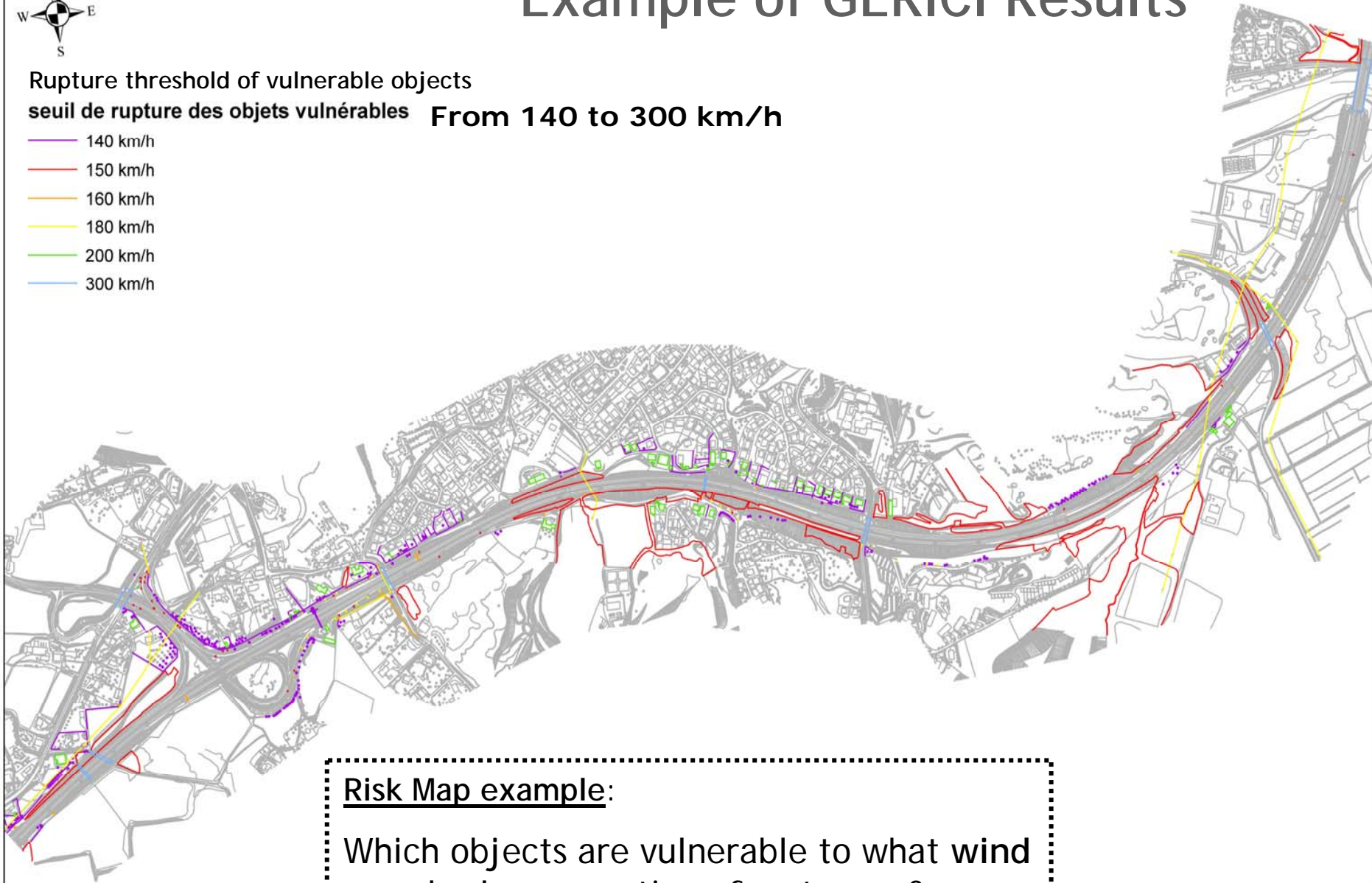
Example of GERICI Results



Rupture threshold of vulnerable objects

seuil de rupture des objets vulnérables From 140 to 300 km/h

- 140 km/h
- 150 km/h
- 160 km/h
- 180 km/h
- 200 km/h
- 300 km/h

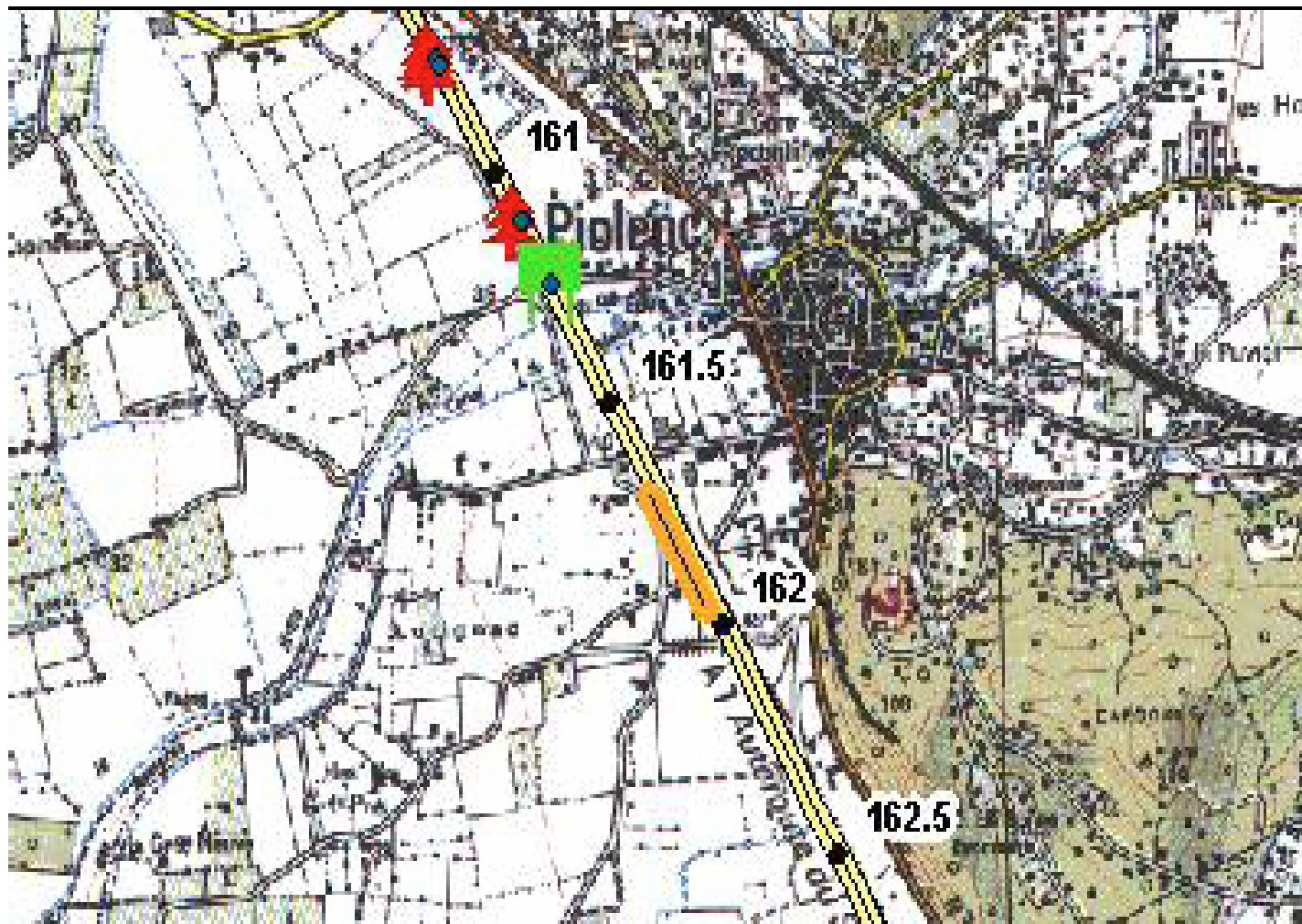


Risk Map example:

Which objects are vulnerable to what wind speeds along a section of motorway?

0 250 500 Mètres

Example of GERICI Results : 160 km/h wind simulation





As a Result of GERICI four-years Experience :

1. **Owners** can request an analysis of the **vulnerabilities** of their **networks**, and the identification of the most critical sections :

2. **Operators** can request the implementation of the tool on infrastructure **sections** or routes:
 - . to **simulate** risks and,
 - . develop the most appropriate
 - » program of intervention
 - » **preventive investments**



3. Experience has been carefully capitalised :

- Data base of actual climate events and observed infrastructure vulnerabilities (national and international)
- Analytical-knowledge base : which infrastructure object is sensitive to which climatic-event threshold, with what kind of damage ?
- Detailed tests on two large and heavy-traffic motorways (A1 ; A7)
- International network of motivated stakeholders

4. This knowledge is now being translated into day-to-day engineering by EGIS :

- To design new « climate-change-proof » infrastructures
- To rehabilitate old heavy-traffic motorways into « climate change-proof » ones
- To advice stakeholders to accelerate necessary strategy/policy improvements

5. GERICI Tool/Approach can also **Facilitate a Quality Dialogue** between Stakeholders :

- **Local** level (concessionary company, State representative, mayors,...) – ex. : flood scenario and action plans
- At **company/network** level – ex. : which preventive investment priorities ?
- At **national** level : who should capitalise on what ? What technical regulations should take climate change challenges first and how ?

6. **International Cooperation Effectiveness and Reactivity** is key to prevent Major Future Problems :

- The concept of « 100 years return Flood » is now **dangerous**
- **Organising** pertinent **capitalisation** and sharing good and less-good experiences is now urgent
- Road Vulnerability to climate change needs to be a significant **objective in PIARC 2008-2011 Strategic Plan.**



e-mail : michel.ray@egis.fr