Climate Change Impacts and Adaptation for Transport Networks and Nodes

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Martin Dagan, associate economic affairs officer, UNECE

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Context

- Role of transport networks and nodes in national and regional economies / disruptions on those assets impacts economies and human well-being.

- High potential of severe disruption by extreme events caused to the transport networks

- Increasing frequency and harshness of extreme events
Methodology

6 climate indices:

- **Heatwave**
  - **Warm spell duration index**
  - Annual count of days with at least 6 consecutive days when daily max. temp. > 90th percentile

- **Heat on rail and road**
  - **Number of very hot days**
  - Annual count of days when daily maximum temperature > 30°C

- **Permafrost thaw**
  - **Number of icing days**
  - Annual count of days when daily maximum temperature < 0°C

- **Downpours / flashfloods**
  - **R20mm**
  - Annual count of days when precipitation is > 20mm

- **Flooding**
  - **Rx5day**
  - Maximum 5-day consecutive precipitation amount

- **Low river flow**
  - **Maximum length of dry spell**
  - Maximum number of consecutive days when daily precipitation is < 1 mm

Data source
- Europe: data computed by the Climate Service Center Germany (GERICS) from the EURO-CORDEX project, spatial resolution of 12.5 km
- Canada: statistically downscaled multi-model ensembles, spatial resolution of 10 km

Other indices: riverine and coastal floods, provided by European Commission-Joint Research Centre (EC-JRC)
Two climate projection scenarios

- **RCP2.6 scenario**: stringent climate mitigation action (goals of the Paris Agreement)
- **RCP8.5 scenario**: “business-as-usual”

Baseline period: **1971-2000**
Projected period: **2051-2080**
Results – Examples: maps of climate change indices

Change in the number of very hot days under scenario RCP 8.5

Change in the maximum 5-day consecutive precipitation amount scenario RCP 8.5

Change in the number of icing days under RCP8.5

Change in the number of icing days under RCP8.5
Projected impacts on E80 and E712 in south-east of France, E45, E55 and E80 in Italy, E65 in the Western Balkans, E01, E80, E82 and E90 in Portugal, E05 and E15 in Spain, E55 in Greece, and E84 and E87 in Turkey.
Results example – Icing days and transportation

Change in number of icing days, RCP8.5, mean values
Results example – Precipitations above 20mm and transportation

E roads potentially impacted: E04, E06 and E18 in the north of Europe, E35, E45 and E55 crossing through the Alps; E65 in the Balkans; E50 and E58 crossing through the Carpathians; and E70 and E97 along the eastern and south-eastern coast of the Black Sea.
Results example – Flood hazards
Results example – Seal levels

Projections of extreme sea levels (in m) for the 100-year event (ESL100) at the end of the twenty-first century (RCP8.5 scenario)
Results – Case studies: approaches, practices, methodologies and tools for analysing climate change impacts on transport

Germany
• Adapting the German transport system to climate change
• Reviewing railway operation regulations and policies regarding potential climate change

Canada
• Methodology for assessing infrastructure vulnerability to climate change in Canada

France
• Measures concerning transport from the National plan for Adaptation to Climate Change

Poland
• Polish practice in carrying out sensitivity, vulnerability and risk analysis for the identification of hotspots on transport infrastructure due to climatic factors

Netherlands
• Development of a Climate Adaptation Strategy for the InnovA58 highway in the Netherlands

Romania
• Early Warning Intelligent System for Road Transportation Risks

UNCTAD
• Climate change impacts on coastal transport infrastructure in the Caribbean: Enhancing the adaptive capacity of Small Island Developing States (SIDS)
Results – Case studies: socioeconomic impacts and implications from climate change on transport infrastructure

Canada
• All-Season Roads in Northern Canada and Implications of Climate Change
• Winter Roads in Canada and the Implications of Climate Change

Finland
• New Guidelines for Winter Maintenance of Roads in Finland

Germany
• Low flow extremes of the Rhine river – Causes, impacts and adaptation of the most important inland waterway in Europe
• Impact of climate change on the water management of the Kiel Canal
• Influence of weather and climate extremes on supra-regional traffic flows – Stress test scenario Middle Rhine

Iceland
• Sea level changes, guidelines and adaptation
Lessons learned (1/3)

- Complex tasks

- Limited experience in countries (some countries as forerunners)

- Data limitations
  - on transport infrastructure (geo-coded) and on usage data (traffic volumes, freight processed)
  - no one climatic data set for UNECE region
Lessons learned (2/3)

- First step analysis as a good basis – exposure identified

- First step analysis insufficient / complementary analysis needed (natural and anthropogenic factors, characteristics of specific asset, downscaling of projections, impact modelling....)
Lessons learned (3/3)

- Sharing country experience key to identification and prioritization of transport adaptation needs

- Intermodal, cross-sectoral interactions and transboundary impacts key to avoid maladaptation
Recommendations (1/3)

- Create awareness and understanding of urgency (WP.5/sec)

- Disseminate approaches, tools and methodologies (MS/WP.5/sec)

- Improve availability of geo-coded networks and nodes data (call to WPs managing the infrastructure agreements) (MS/WPs)

- Geo-code networks and nodes data and present them in GIS (MS/sec)
Recommendations (2/3)

- Share data on use (census by WP.6) (MS/WP.6)

- Attempt to obtain consistent data projections for UNECE region (through CORDEX-Core project) (WP.5/sec)

- Expand the analysis on climate impacts (absolute/relative terms, additional indices) (WP.5/sec)

- Implement national projects (with assistance where necessary) to better understand vulnerability to climate change of transport systems (MS/WP.5/sec)
Recommendations (3/3)

- Establish a knowledge database with
  - features and conditions that make a section of a network or a node vulnerable to climate change (WP.5/sec)
  - adaptation measure and their cost-effectiveness (WP.5/sec)

- Elaborate guidance and /or mechanisms for better integration of climate change impacts and projections into planning and operational processes (WP.5/sec)
Next steps

- Consider the recommendations

- Design response to the existing demand

Possible response – Group of Experts on assessment of climate impacts and adaptation for inland transport as subsidiary body of WP.5 (ECE/TRANS/WP.5/2019/4)
Outcomes of the Group of Experts on Climate Change Impacts and Adaptation for Transport Networks and Nodes

Requested follow-up

- Geo-code AGTC network (CPs to send to UNECE shapefiles for their AGTC lines and installations) and AGTC Protocol’s network
- Support WP.6 in the collection of the traffic data
Outcomes of the Group of Experts on Climate Change Impacts and Adaptation for Transport Networks and Nodes