

Climate Change Impacts and Adaptation for Transport Networks and Nodes

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Work Groups/Committees: WMO/TRB/AMS

Introduction

(a) Identify and establish, if possible, inventories of transport networks in the ECE region which are vulnerable to climate change impacts, if possible in a geographic information system (GIS) environment;

(b) Use/develop models, *methodologies, tools and good practices to address potential extreme hazards (e.g. high temperatures and floods) to selected inland transport infrastructure in the ECE region under different scenarios of climate change*;

(c) Identification and analysis of case studies on the potential economic, social, and environmental consequences of the climate change impacts and provide a cost/benefit analysis of the adaptation options.



Toward Seamless Integration of Meteorological Service Delivery in Support of Multimodal Surface Transport

ad hoc WMO Expert Team

Overview

- The aviation, marine and surface transportation sectors have traditionally each taken different approaches to the requirements for safety, efficiency and continuity of operations in the face of adverse and high-impact weather.
- Rather than considering each network discretely, it is far more logical and effective that they should instead be approached and managed in an integrated, seamless manner
- The goals are to maximize the safe, effective and efficient operation of the global, national, regional and local transport networks through the production, dissemination, and application of accurate and timely weather information.

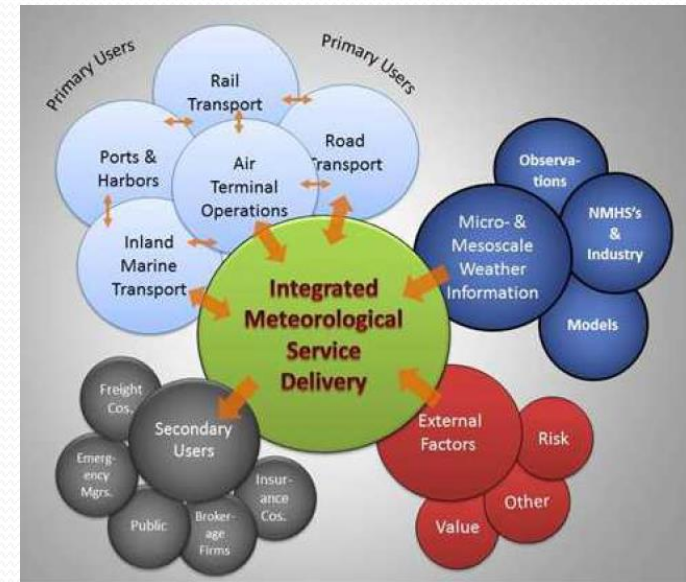


Toward Seamless Integration of Meteorological Service Delivery in Support of Multimodal Surface Transport

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Considerations

- With integrated service delivery, the reliability, relevance, quality and other key end-user value attributes of the weather information remain high across the transport modes and various time and space scales, ensuring seamless and integrated weather service delivery for all stakeholders associated with transport system management and usage
- Future impacts from a changing climate must also be addressed in designing an effective architecture for integrated service delivery. The following lists some of the weather phenomena that should be considered, both as they occur today and as they may change in the coming decades:



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Considerations

- It will be important to stay abreast of the many technical, cultural and climate changes that are likely to take place on time scales ranging from years to decades, and the impacts they may have on the integrated meteorological service delivery paradigm.
- Increased extreme precipitation events
 - Flash flooding
 - Resulting landslides
 - Transport infrastructure failures
 - Loss of electrical power
- Extreme high-temperature events
 - Rail buckling
 - Passenger discomfort/stress, etc.
 - Resulting wild fires
 - Electrical blackouts and brownouts
- Extreme storm events
 - Tropical cyclones
 - Severe convective events
 - Winter storms
- Increased dust/sandstorms
- Increased high wind events
- Drought
 - Impediments to safe navigation
 - Impacts on river locks



Transportation Research Board

Surface Transportation Weather (AH010)

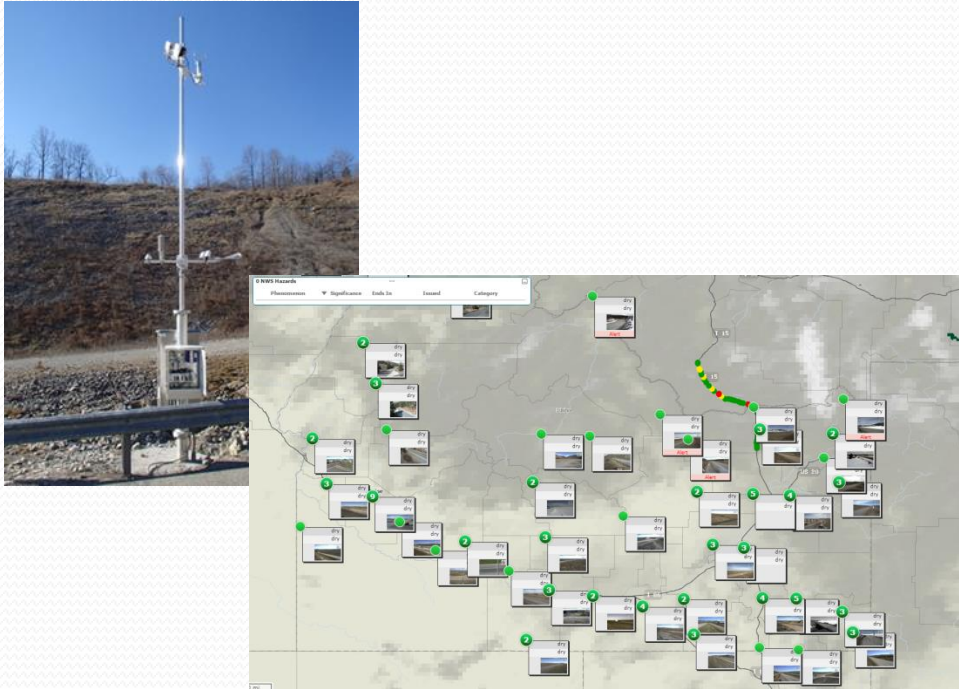
- Highlights of research needs from committee meeting on January 13, 2016.
 - Harnessing of big weather datasets for improved understanding of roadway operations and maintenance.
 - CTRE (Iowa State) has a current project linking road weather at the small scale road segment level utilizing RWIS and probe data.
 - Standards needed in describing different road weather events. What weather parameters are measured, how are these parameters measured, how are the data transmitted.
 - Some work has been done by European Standards Committee.
 - Combining road weather information remains a research challenge. Could weather datasets be compiled for a research data exchange?
 - Work being done in the Weather Data Environment. More information from the research community needed to ensure that the Weather Data Environment serves their needs. Issues on data availability/compatibility for different applications.
 - Data sharing agreements
 - Data integration between weather and non-weather data sources
 - Reliability

Currently a lack of global weather observation standards for inland transportation i.e. Roads, Rail & Inland waterways



Measure where it matters

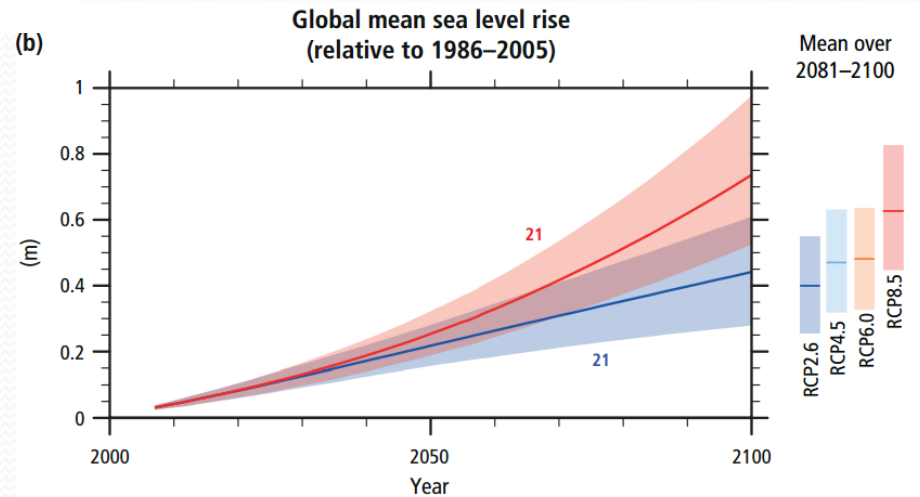
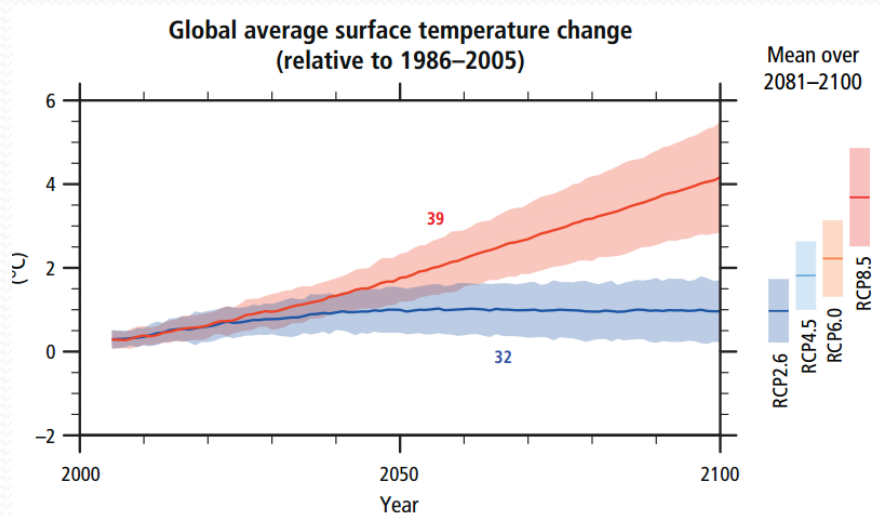
Develop a standardized global observation network for roads/rail/Inland waterways



- Establish standards and guidance for:
- Measurement parameters
- Measurement instruments/systems
- Maintenance and operation (this will be particularly important for developing nations)
- Siting
- Metadata
- QA/QC
- Data formats
- Analysis tools and methods
- Forecast methods at different time/space scales
- Decision support systems
- Communications

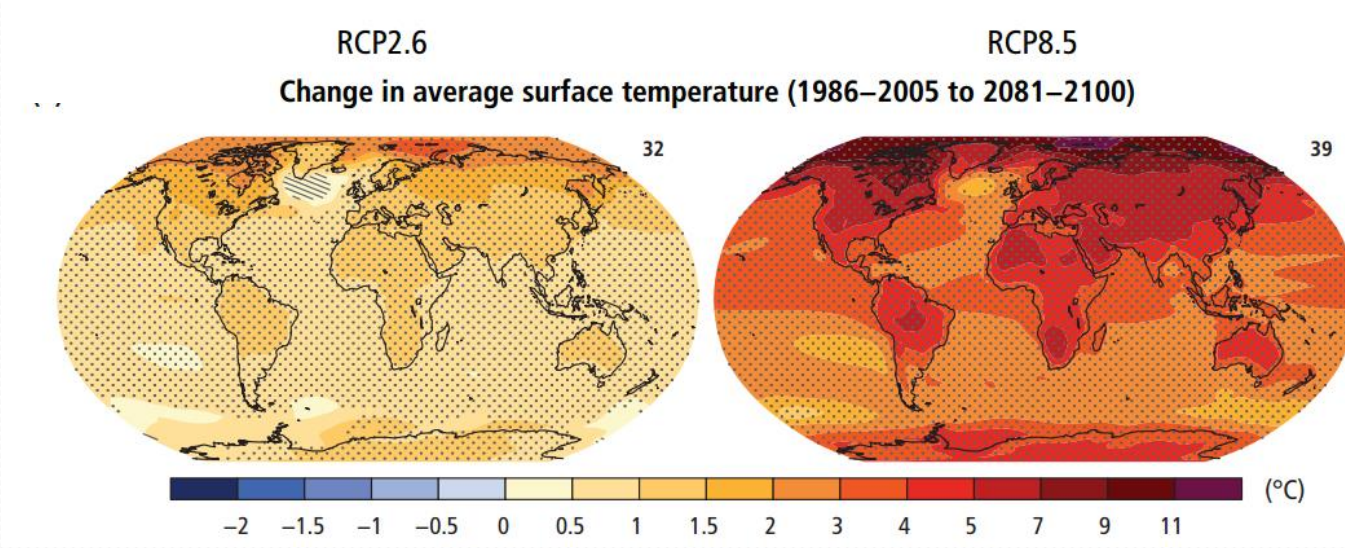
Projections

- Based on Representative Concentration Pathways (RCPs)
 - Stringent mitigation scenario (RCP2.6) → Very high Green House gas emissions (RCP8.5)



Projections - Temperature

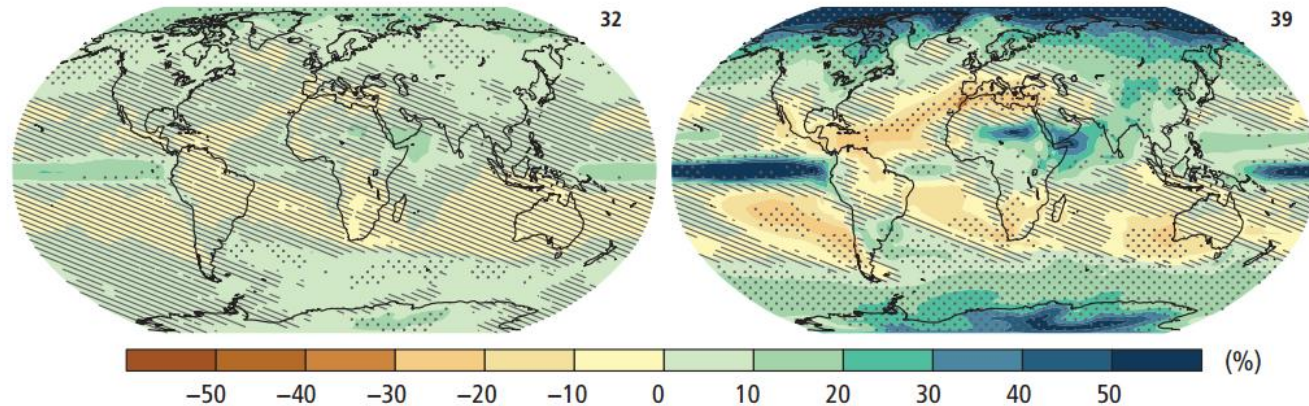
- Based on Representative Concentration Pathways (RCPs)
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Projections - Precipitation

- Based on Representative Concentration Pathways (RCPs)
 - Stringent mitigation scenario (RCP2.6) → Very high Green House gas emissions (RCP8.5)

Change in average precipitation (1986–2005 to 2081–2100)



Projections – Sea Level

- Based on Representative Concentration Pathways (RCPs)
 - Stringent mitigation scenario (RCP2.6) → Very high Green House gas emissions (RCP8.5)

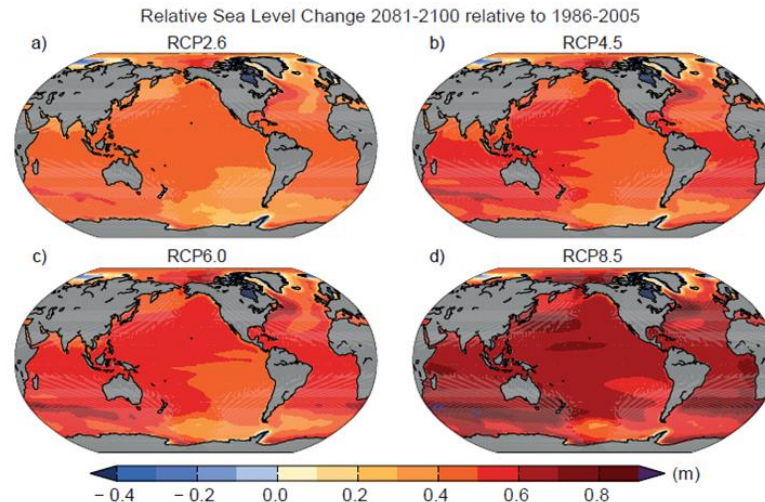
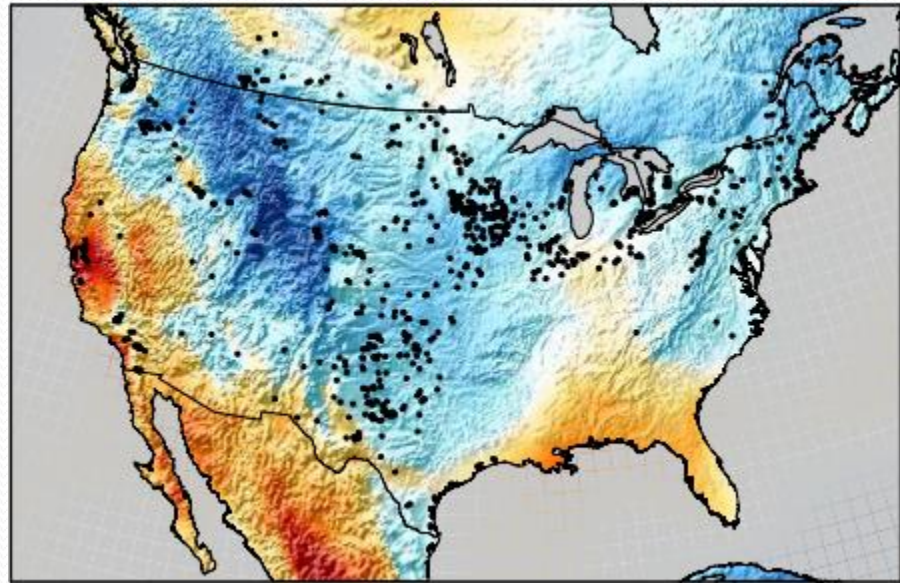


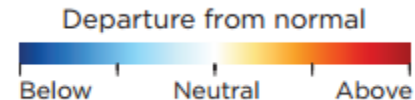
Figure TS.23 | Ensemble mean net regional relative sea level change (metres) evaluated from 21 CMIP5 models for the RCP scenarios (a) 2.6, (b) 4.5, (c) 6.0 and (d) 8.5 between 1986-2005 and 2081-2100. Each map includes effects of atmospheric loading, plus land-ice, glacial isostatic adjustment (GIA) and terrestrial water sources. (Figure 13.20)

Projections – Wind

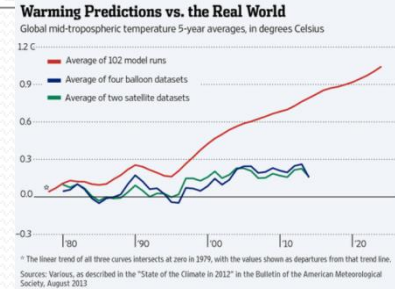
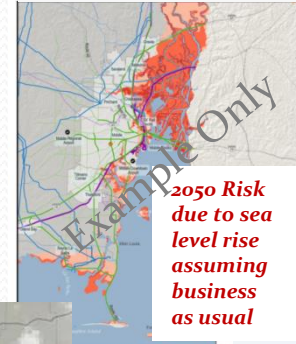
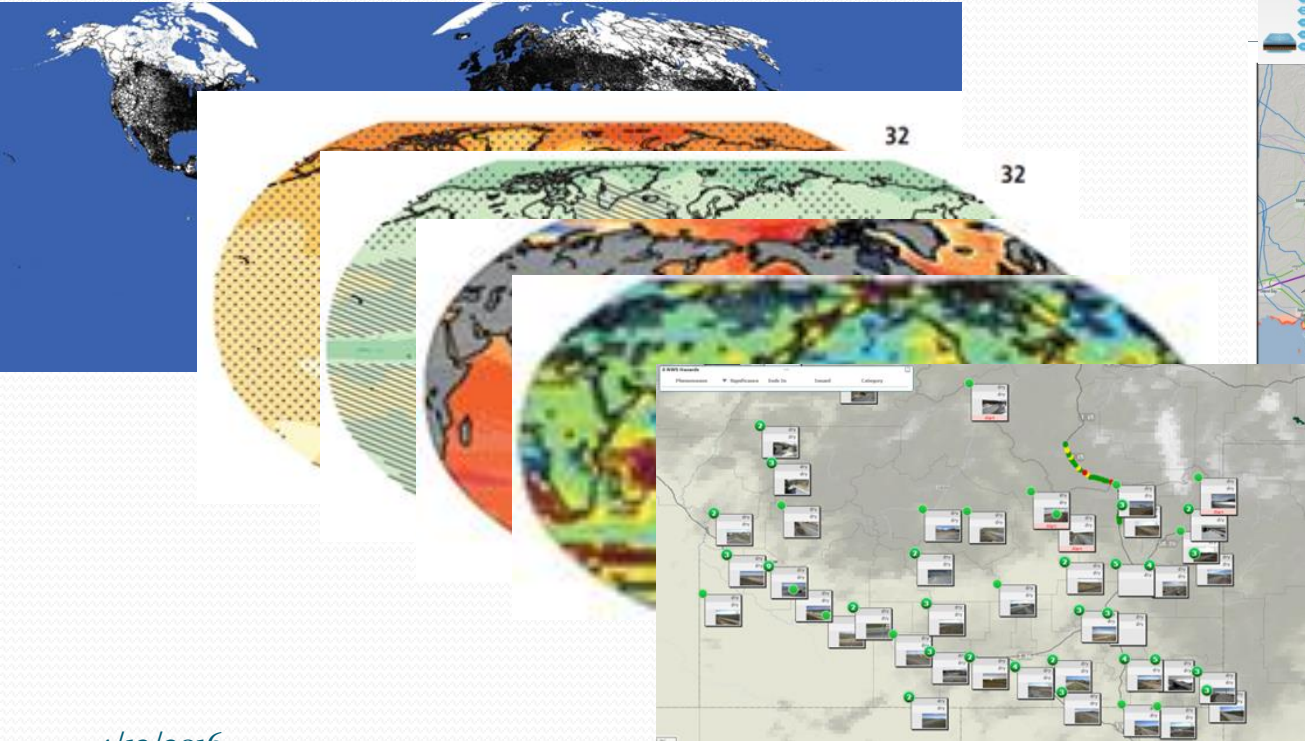
- No spatial wind projections found within IPCC reports
 - Not a standard output from climate models, as inferred from temperature gradients
- The example shown opposite is produced commercially for wind energy clients
 - These forecast types can be produced out to 30 years
 - Compiled with data including output from IPCC reports



2015 Q4 6 month
100m Wind Forecast



Merging data sets



Summary

- Climatic data set projections exist
 - Provide necessary guidance i.e. focus on 'most likely' scenarios
 - Ensure projections are relevant by linking traffic focused observations
- Measure where it matters
 - Standardized observation network for roads/rail/inland waterways
 - Reference/Monitoring
 - Best practice
 - Proven cost/benefits
 - Resilience to address potential extreme hazards