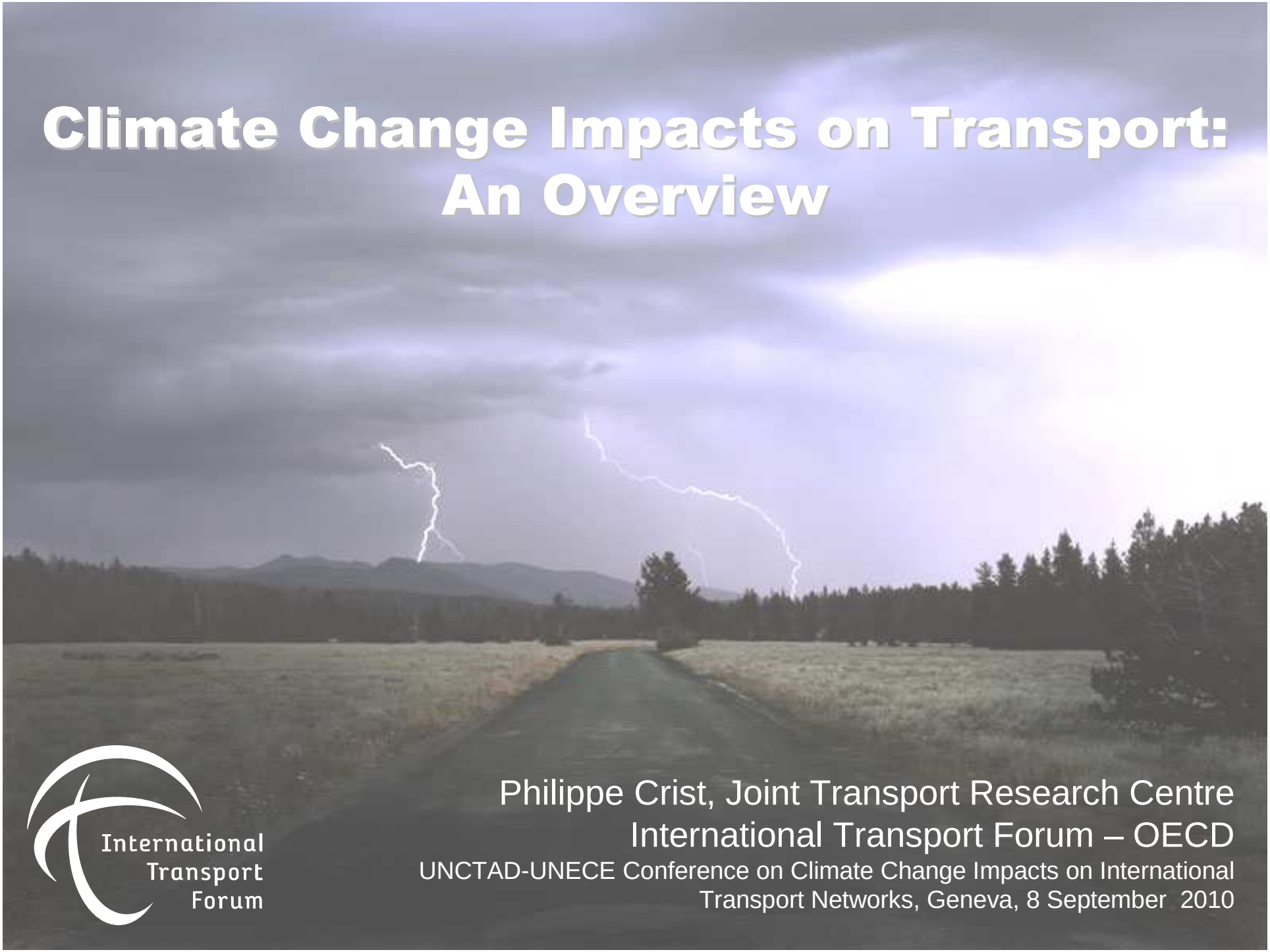
Climate Change Impacts on Transport: An Overview



Philippe Crist, Joint Transport Research Centre
International Transport Forum – OECD

UNCTAD-UNECE Conference on Climate Change Impacts on International Transport Networks, Geneva, 8 September 2010

International Transport Forum

Outline:

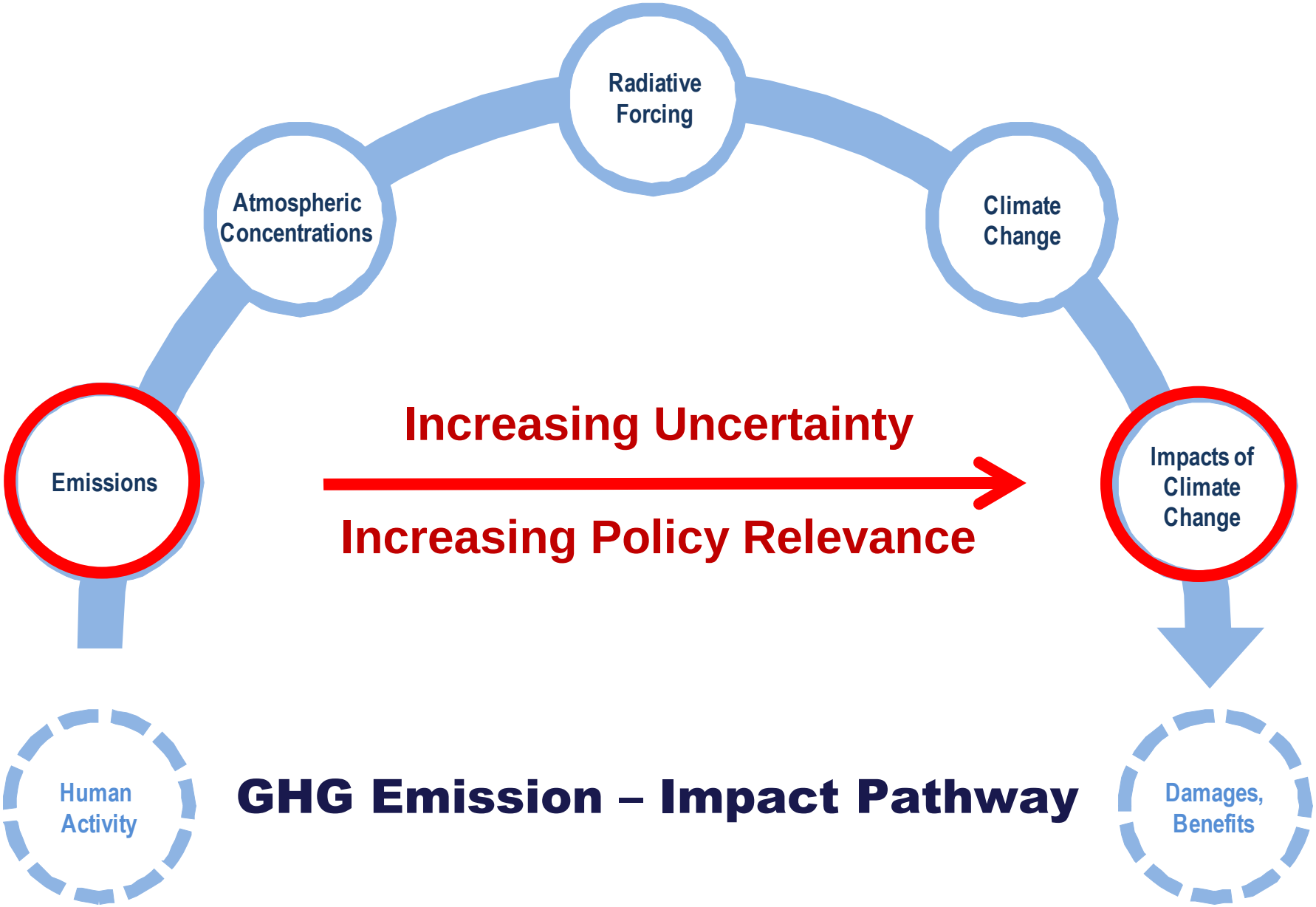
- Uncertainty
- Impacts
- Policy-making principles

Not covered (but crucial!):

- Costs
- Climate change impacts on transport/trade flows
- In-depth discussion of adaptation measures

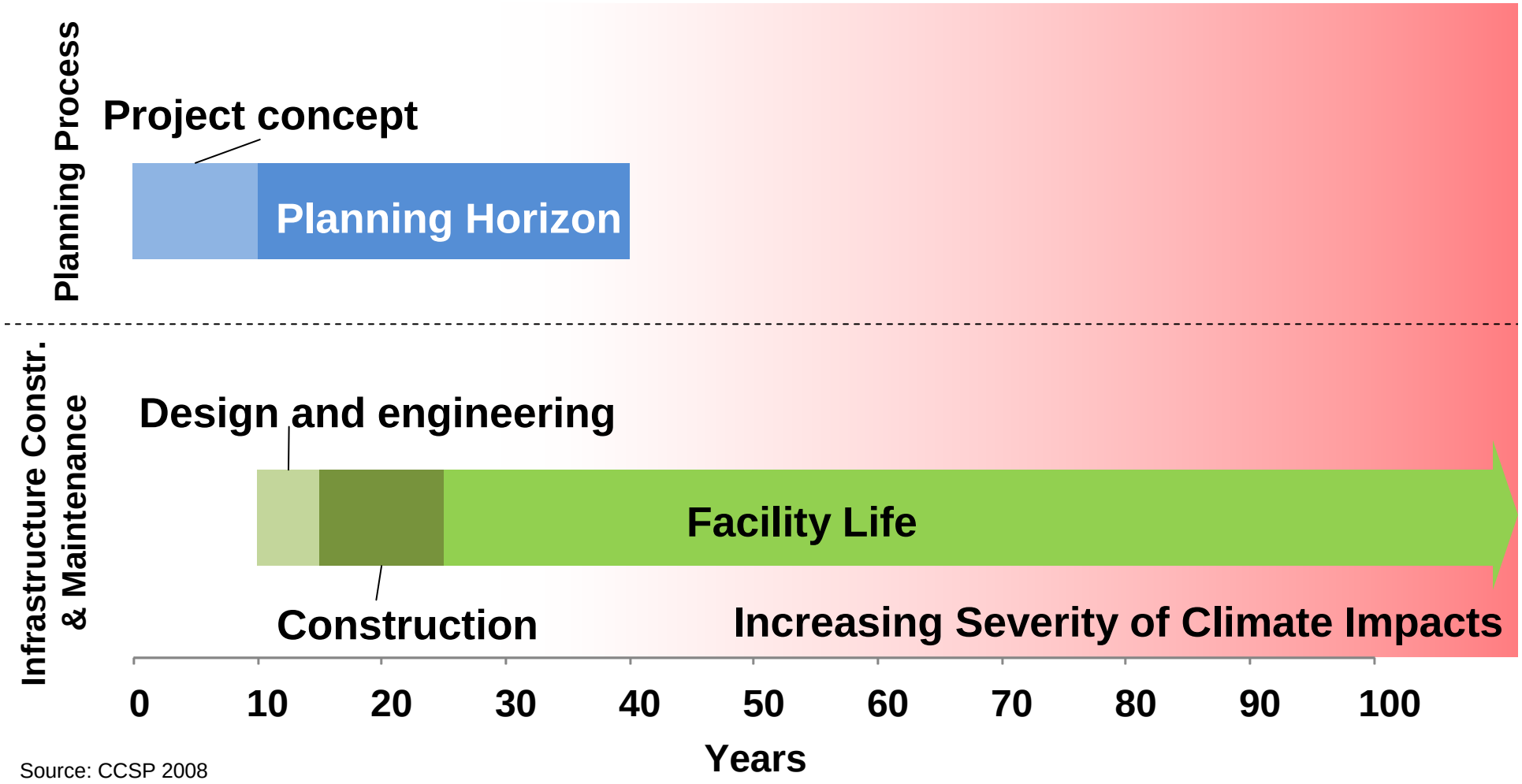
Climate vs. Weather

- **Climate** is how the atmosphere "behaves" over relatively **long** periods of time.
- **Weather** relates to atmospheric conditions over a **short** period of time (localised).



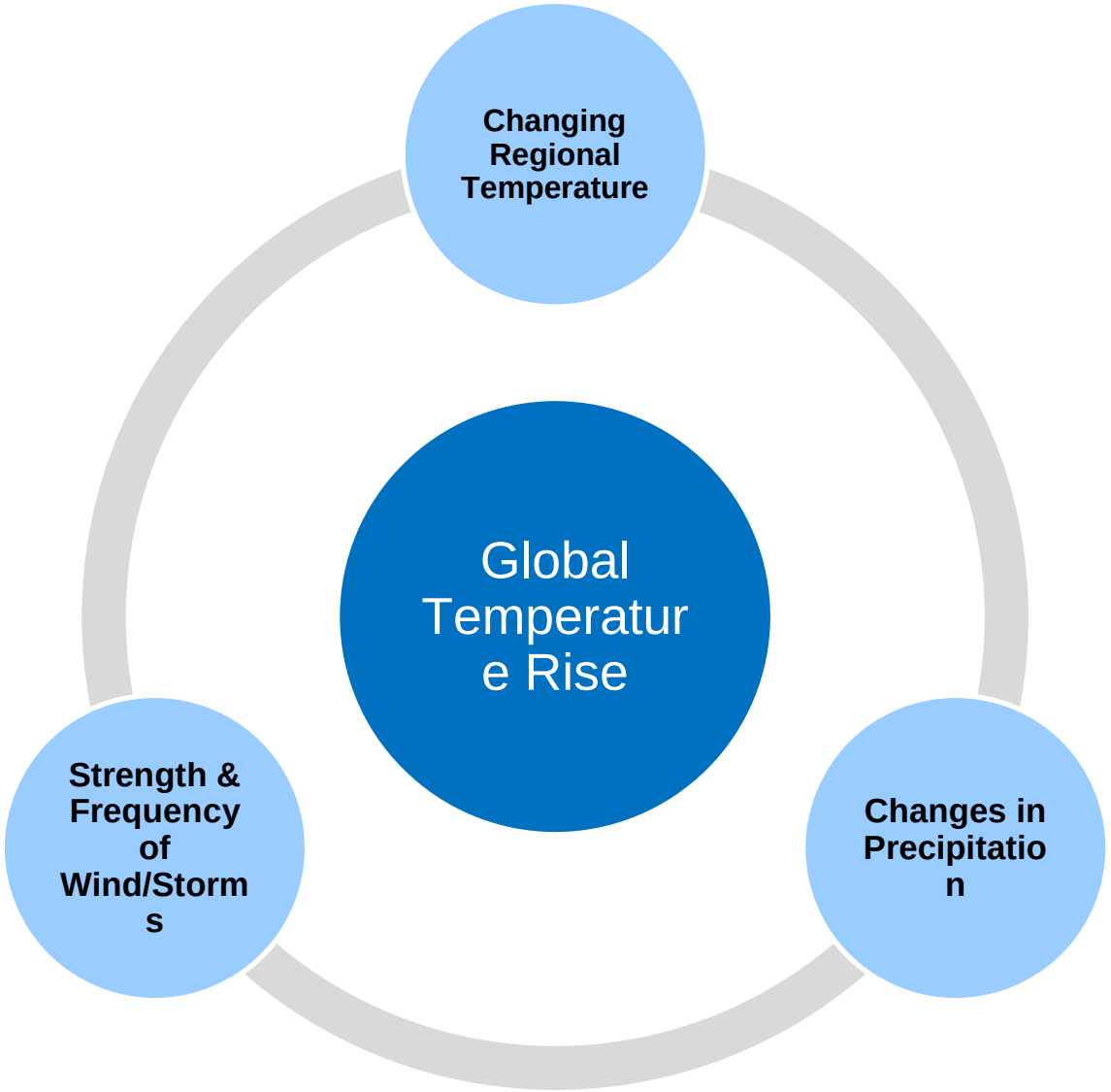
GHG Emission – Impact Pathway

Infrastructure planned and built with **past climate** and weather in mind – no longer a good predictor of **future** conditions



Source: CCSP 2008

Impact Vectors: Global vs. Regional



Global Temp. Change

Global Temperature Change (1/2)

Sea level rise (& tidal/storm surges)

- Road, rail, inland waterway and air infrastructure vulnerable because of location
- Intermittent or permanent flooding
- Erosion, road/railbed collapse, runway and road surface damage
- Scouring/weakening of critical infrastructure support (bridge pilings, levees, etc)

Global Temp. Change

Global Temperature Change (2/2)

Sea level rise (& storm surges)

- Damage to critical drainage infrastructure
- Exacerbates subsidence and salinity (corrosive effect on infrastructure)
- Temporarily or permanently renders some infrastructure unusable (Quays, waterways under bridges, etc.)

Changing Regional Temps.

Changing Regional Temperatures (1/3)

Increased temperatures and heat waves

- Buckling/fissuring of road and runway asphalt, buckling of rails impact network performance.
- Damage to concrete and bridge expansion joints.
- Drought and prolonged evaporation from navigable waterways can render these un-navigable.

Changing Regional Temps.

Changing Regional Temperatures (2/3)

Increased temperatures and heat waves

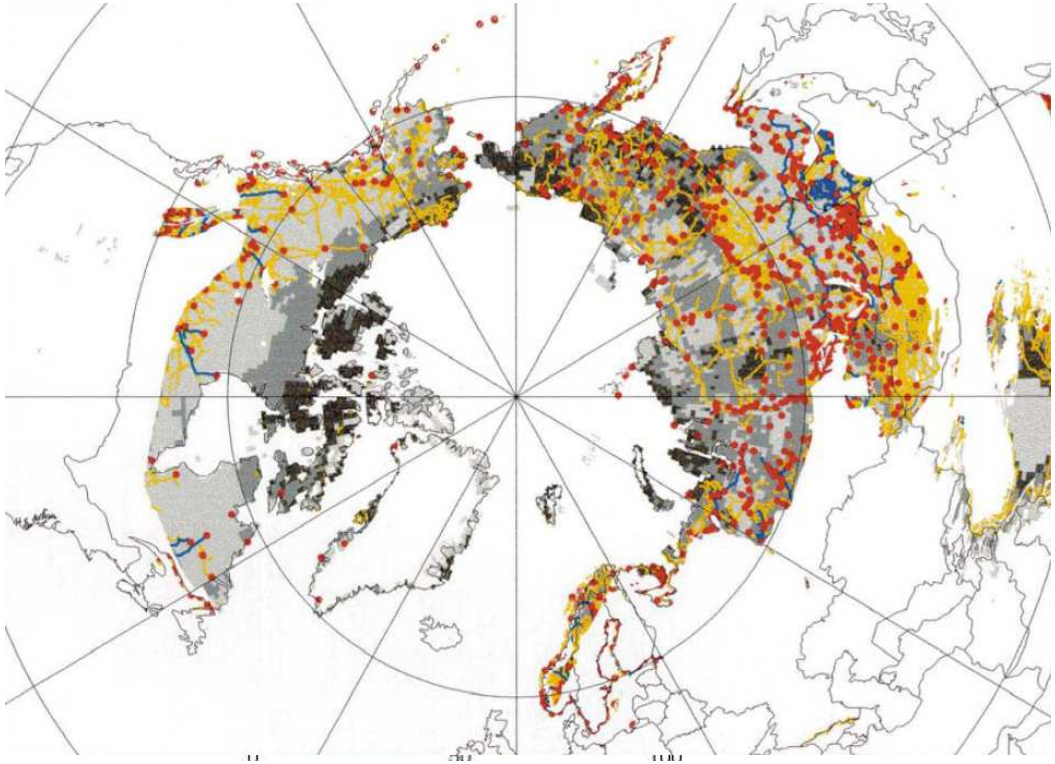
- Vehicle overheating and accelerated tire degradation for road transport,
- Degraded electricity transmission impacts rail services.
- Increased AC requirements impacts fuel economy
- Lower air density reduces permissible payload weights for aircraft – or calls for longer runways and changes in climb patterns.

Changing Regional Temps.

Changing Regional Temperatures (3/3)

Fewer cold days and shorter winters

- Reduced snow removal but increased freeze-thaw degradation of asphalt , substructures
- Less ice-disruption of inland waterways but reduced operation of regionally important snow and ice roads
- New shipping routes may deliver significant time gains in Asia-EU and Asia-N. America trades (old routes impacted as well)



Transport Infrastructure Vulnerable to Permafrost Melting

yellow lines=winter trails
blue lines=railroads
red dots=airfields

Changing Regional Temps.

Changing Regional Temperatures (3/3)

Fewer cold days and shorter winters

- Reduced snow removal but increased freeze-thaw degradation of asphalt
- Less ice-disruption of inland waterways but reduced operation of economically important snow and ice roads
- New shipping routes may deliver significant time gains in Asia-EU and Asia-N. America trades
- **Permafrost upheaval damaging to critical northern road, pipeline and air infrastructure**

Precipitation

Changing Precipitation Patterns (1/1)

Increase in extreme precipitation

- May overwhelm drainage infrastructure
- Erosion, scouring, slope failure, rapid sedimentation (dredging)

Decrease in precipitation

- Decreased soil moisture leads to subsidence of road and rail beds
- Lowers inland waterway levels,
- Summer wildfires can lead to denuded soils prone to slope failure under rain

Wind/Storms

Extreme Wind and Storms

Increase in frequency/strength of storms

- Warming compounds natural variation and may contribute to more frequent and/or stronger storms.
- Storm surge damage to infrastructure, damage from increased wave height and strength
- Wind damage to bridges, gantries, signs, electricity networks, radars and lighting.
- Wind reduces airport operations – long-term shifts in wind patterns may render runway orientation sub-optimal

Policy Implications

•3 adaptation strategies:
Avoid (retreat), **Protect** and/or **Accommodate**

- **Network unreliability** impacts at least as great as physical impacts on infrastructure.
- **Prioritisation** on network-essential infrastructure important – different strategies for different parts of the network
- **Design standards** and practices must account for increased uncertainty re. climate
- Focus on **robustness** for key infrastructure as well as network **redundancy** and **resilience**

Thank You...

SAVE THE DATE

25-27 MAY 2011
Leipzig, Germany

TRANSPORT & SOCIETY

	Certainty	Probability
Global Warming: Sea Level Rise	Virtually certain	≥99%
Regional Temperature Changes		
• Decreases in very cold days	Virtually certain	≥99%
• Increases in Arctic Temps.	Virtually certain	≥99%
• Later onset of freeze, early onset of thaw	Virtually certain	≥99%
• Increases in very hot days/heat waves	Very likely	≥90%
Precipitation Changes		
• Increase in extreme events	Very likely	≥90%
• Increase in drought	Likely	≥66%
• Change in patterns/seasons	Likely	≥66%
Storms		
• More intense/frequent hurricanes/typhoons	Likely	≥66%
• More intense cold-season storms, with more intense/frequent winds, waves, surge	Likely	≥66%

Sea Level Rise and Coastal Infrastructure: Bridges and Waterways