TRANSPORT AND CLIMATE CHANGE

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Outline

1 Introduction – the topic is vast. This paper, as presented today, concentrates on those areas where climate services can make a difference.

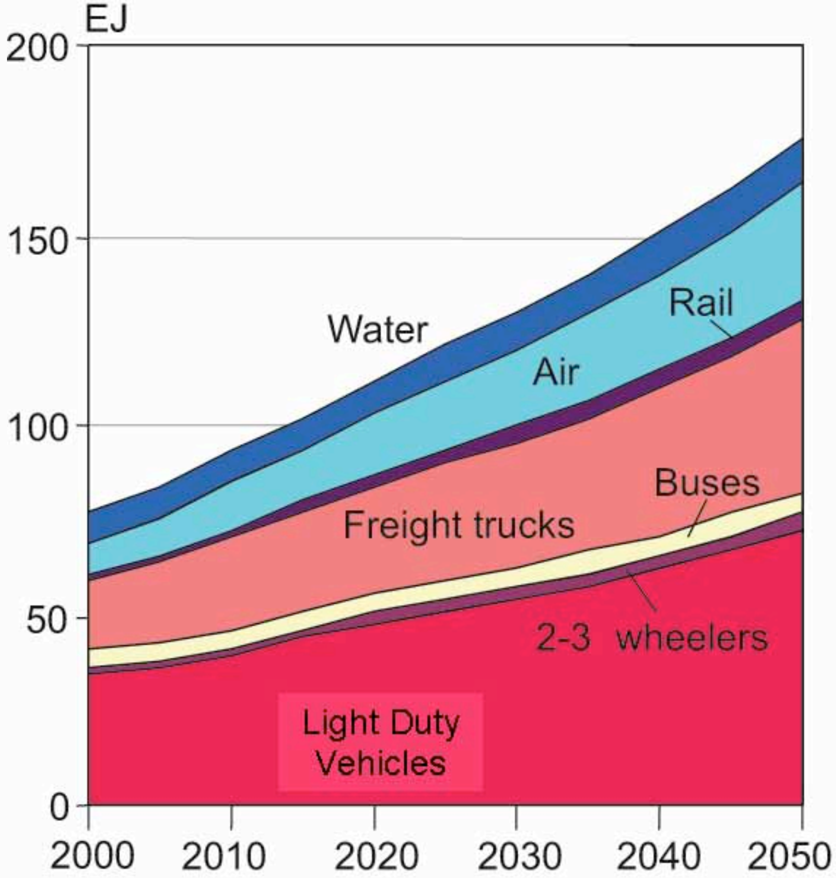
2 Transport as a contributor to human-induced climate change

3 Transport – Impact of hydro-meteorological extremes

4 Climate services that can assist in the adaptation to climate change and its impact on transportation systems and infrastructure.

5 Concluding remarks – some suggestions

Transport's contribution to human-induced climate change through GHG emissions



SECTOR	CO_2 EQ Mt	% of Total
Buildings	13,215	27.0
Industry	13,893	28.3
Transport	6,829	14.0
Agriculture	6,100	12.4
De-forestation	5,800	11.8
Waste	1,300	2.7
Other forest	1,862	3.8
TOTAL	49,000	100.0

Mitigation of transport's emissions

No 1 longterm strategy: Use renewable fuels

No 2 strategy: Use more efficient engines

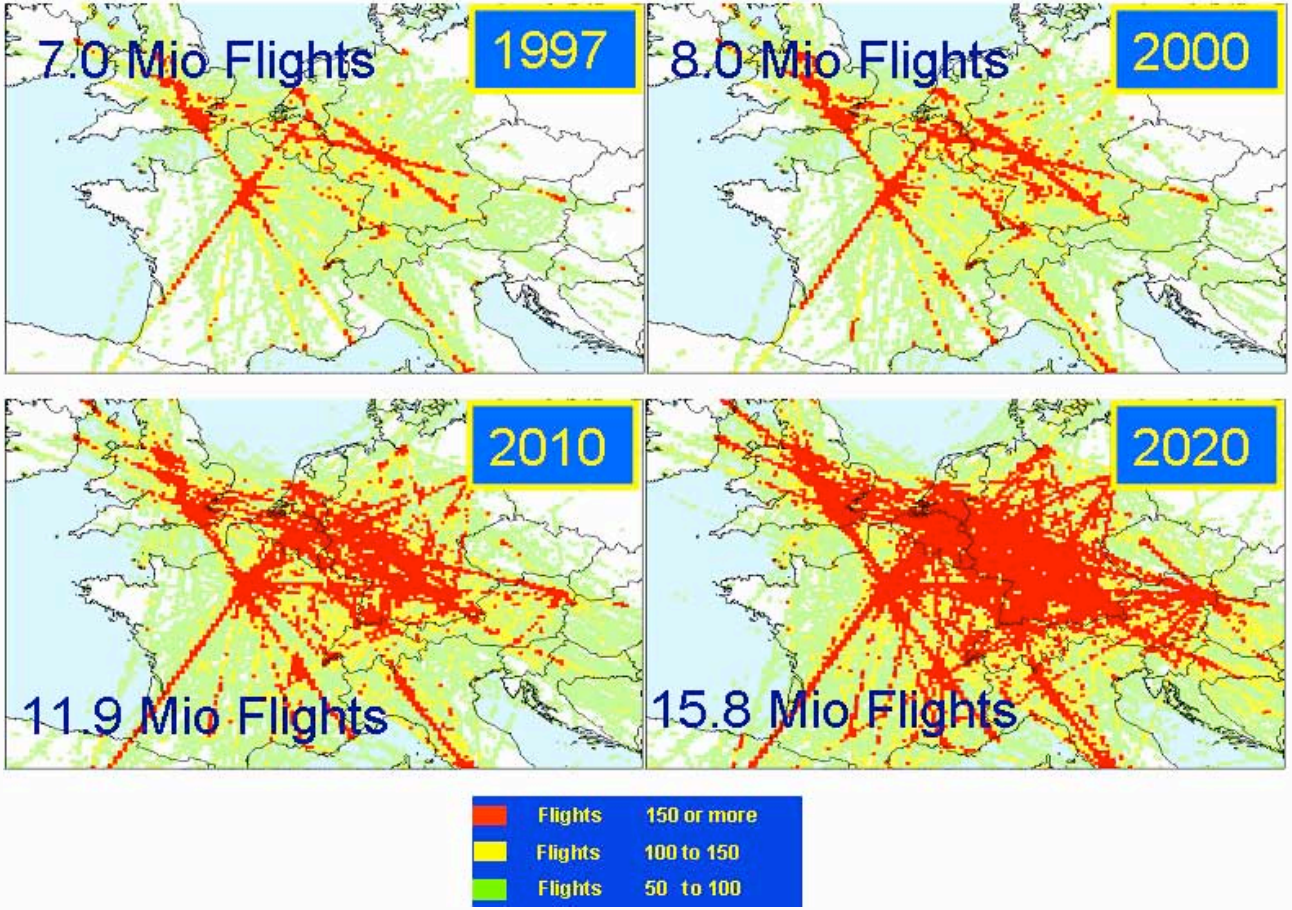
No 3 strategy: travel less

No 4 strategy: tax GHG emissions associated with travel to internalise the current environmental damage externalities.

None of these is a strategy to make a difference through better decisions based upon climate services so they are not considered further

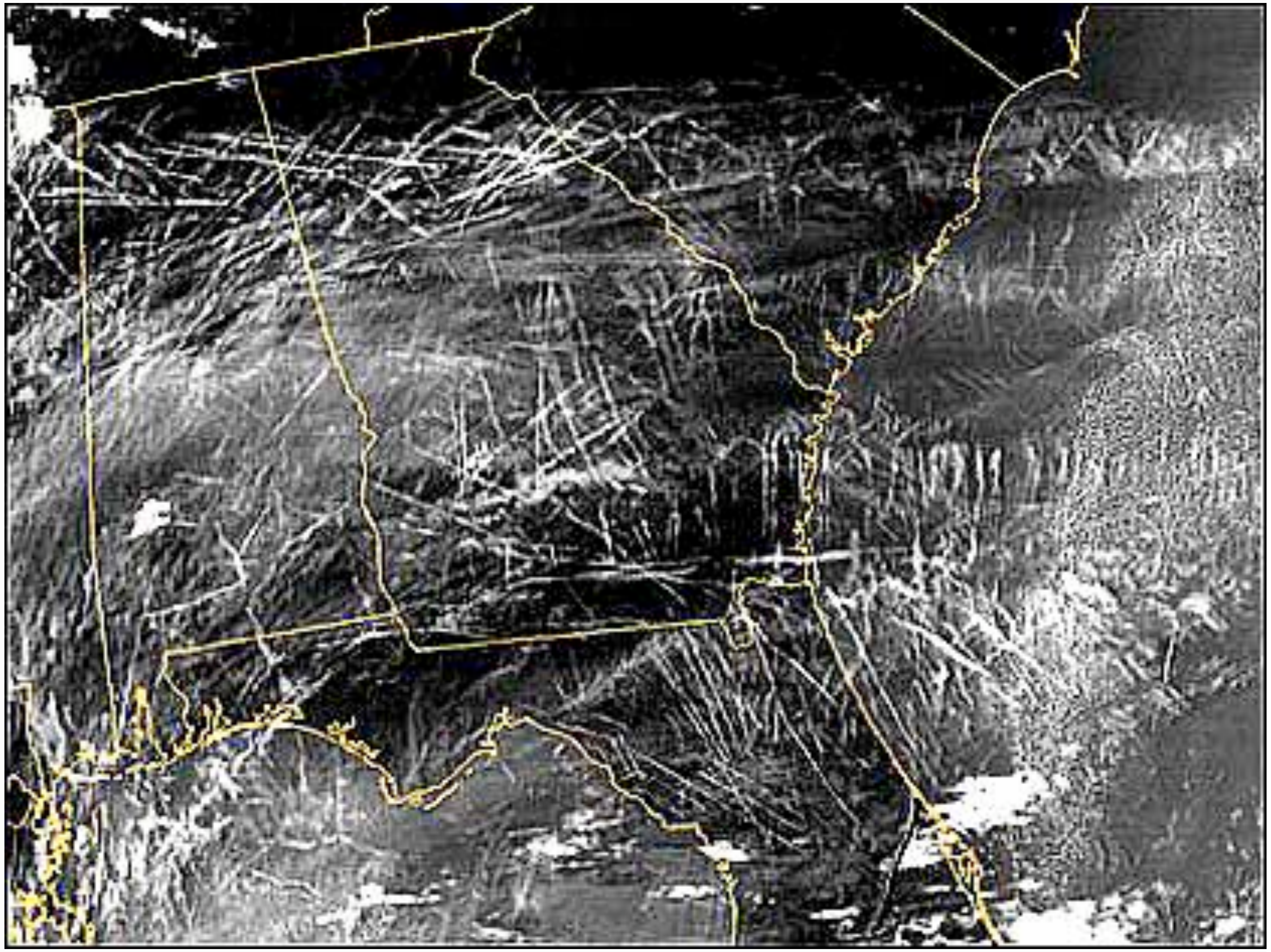
Aviation

People seem determined to travel more – and at rate that exceeds the expected increase in aircraft efficiency



Aviation

Furthermore, aircraft create contrails that also make a contribution to global warming



Aviation – GHG mitigation using meteorological (weather and climate) improved services

Two opportunities:

1. Flight planning based upon ever improving upper wind forecasts (less headwinds, more tailwinds)
2. Flight planning that takes account of en-route and destination airport weather such that aircraft do not take off when it is clear that they will have to hold in the air. Holding is more fuel efficient if carried out on the ground.

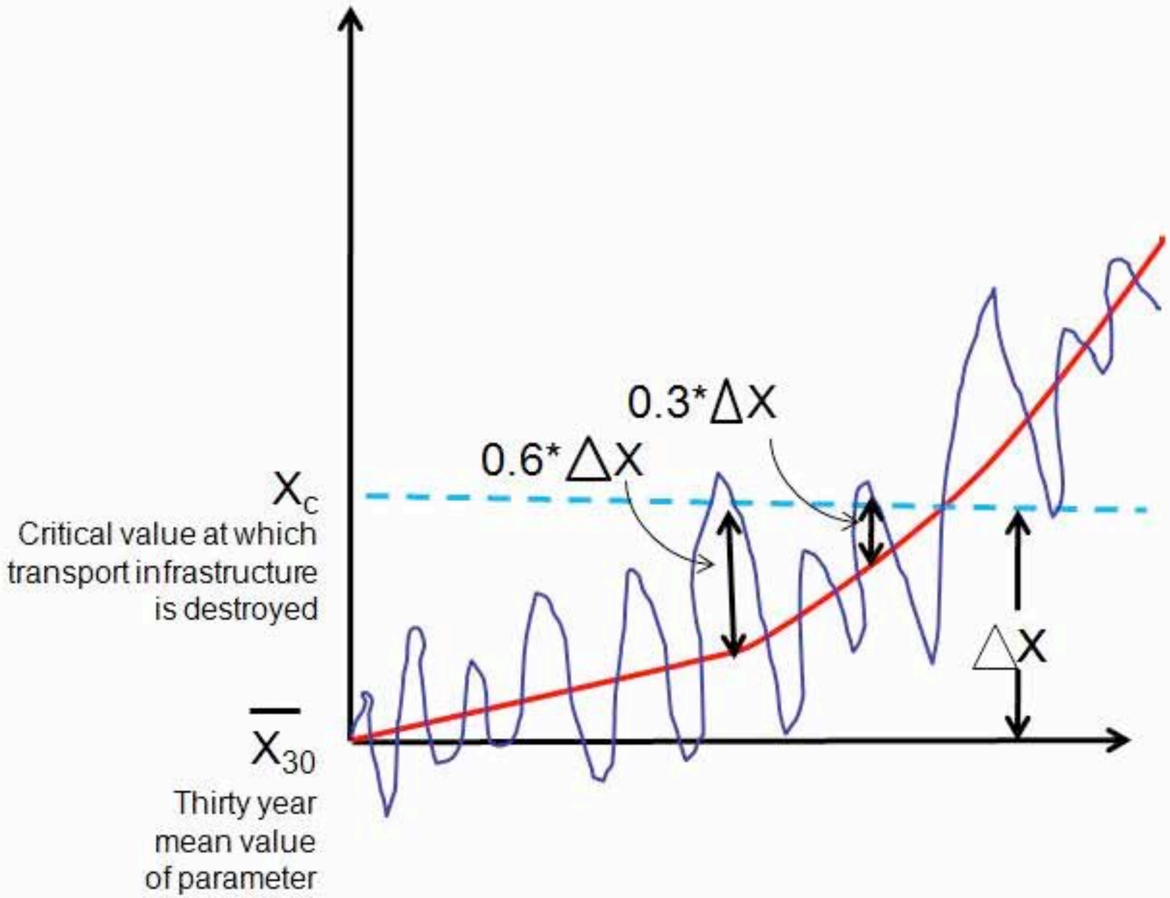
Shipping – GHG emission mitigation

Three opportunities:

1. Slow steaming
2. Better ship routing to take advantage of the optimal weather
3. The northwest passage in summer

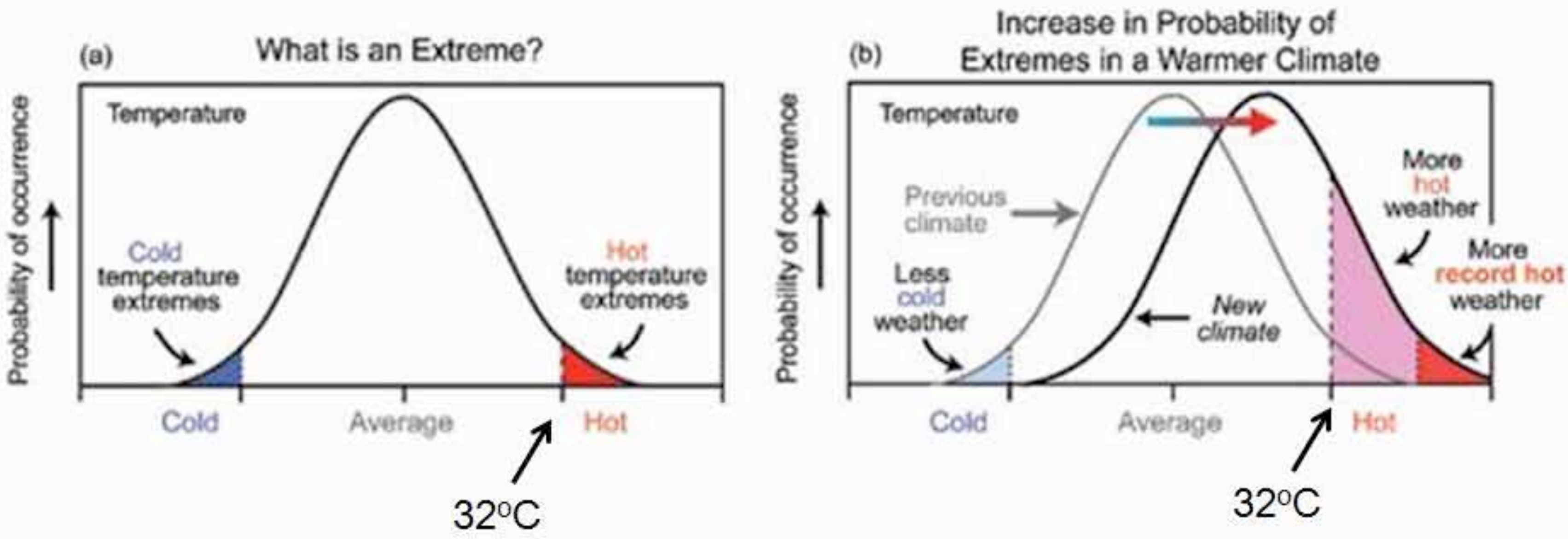
Since 1979 the size of the summer polar ice cap has shrunk more than 20%.

Extreme events



Roads on permafrost

Increased probability of extreme events



Extreme hydro-meteorological events (1)

Weather parameter	Category	Impacts
Precipitation Elements	Freezing precipitation, snow accumulation, liquid precipitation, precipitable water vapour, soil moisture, flooding, in-land waterways and water body depths, fire weather	Loss of traction and control; delays; reduced speeds; stresses on vehicle components and tires; rules on tire chains; wet pavement; road spray; flooding causing road and airport closures; rerouting; weak and uneven braking; intermodal impacts; softened railroad beds; roadbed scouring Drought causing risk of dust and smoke reducing visibility; highway closures; increased forest fires with smoke and flames causing road closures; intermodal impacts from barge shutdowns due to low river levels

Extreme hydro-meteorological events (2)

Weather Parameter	Category	Impacts
Winds	Wind speed, upper air winds	Instability, loss of control, blowovers; re-routing; damage to vessel and aircraft
Visibility	Restrictions from fog, haze, dust, smog and sun glare, upper atmosphere restrictions from volcanic and desert dust	Delays; re-routing; airport closures; reduced speed; risk of collisions and damage from rapid change

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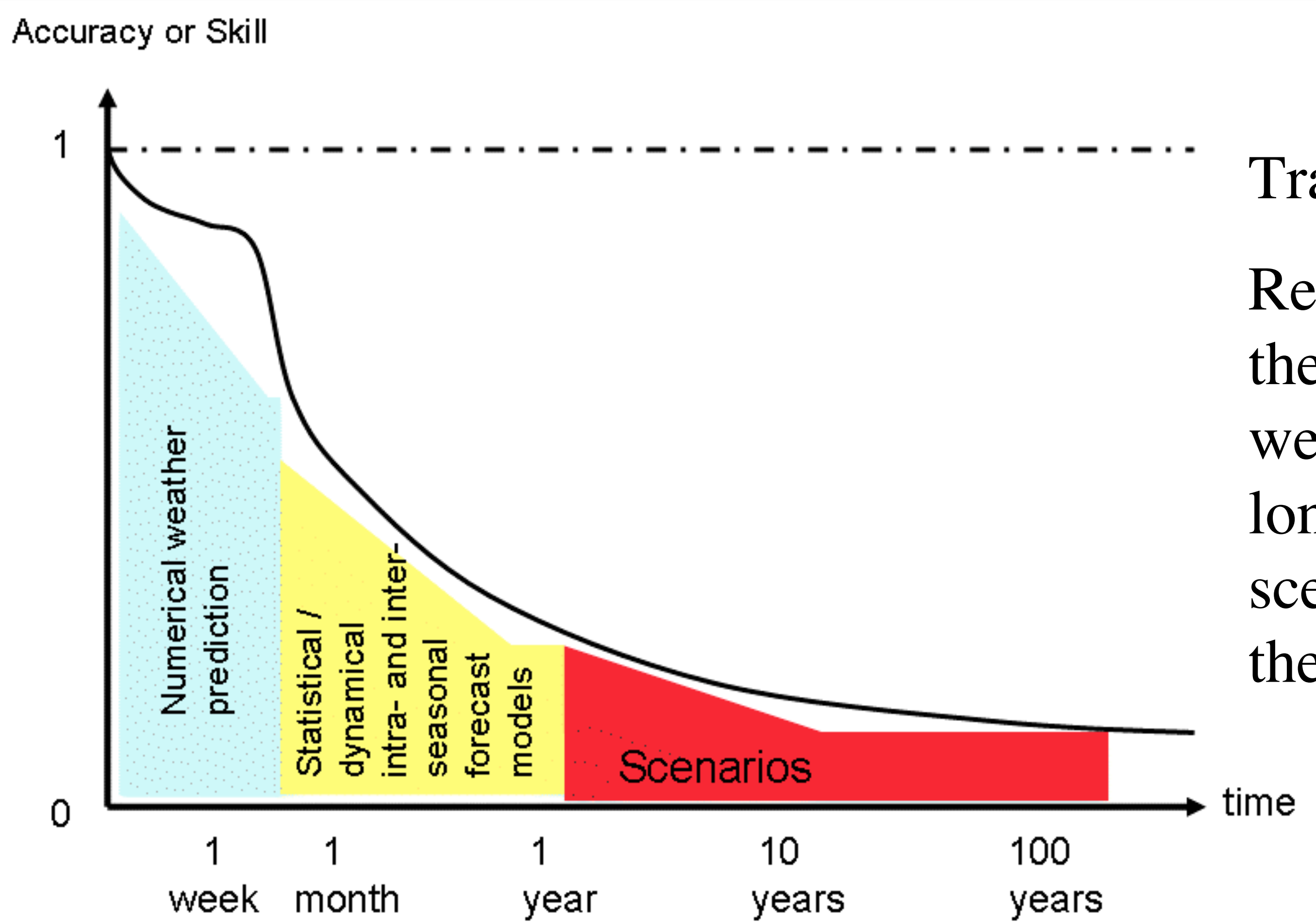
Extreme hydro-meteorological events (3)

Weather parameter	Category	Impacts
Thunderstorm Related	Severe storm cell tracks, lightning, hail	Acute; rapidly changing conditions with multiple risks of collisions and damage from loss of control; impaired visibility; rock slides causing risk of collisions and delays; damage to infrastructure; blocked railroads.
Temperature Related	Air temperature including maximum and minimum, first occurrence of season, heat index, cooling or heating degree days	Stresses on vehicle components; infrastructure; and at high temperature, perishable cargoes, rail buckling (sun kinks), reduced speeds on rails; new surface and air routes in Northern Regions, including road transportation in non-permafrost regions (it could reduce the costs of snow and ice control; and would make travel conditions safer); less lift due to high temperature affecting take offs and landings at airports

Services: seamless and skillful?



Transport Sector:

Requirements at the short-term, weather end and long-term climate scenario ends of the spectrum

Planning for infrastructure

Coastal zone, sea level rise (wharves, roads, airports, etc

Railways/subways, temperature range for lines and air conditioning

Roads, asphalt pot holing in heat, permafrost melt, flash floods

Airports – optimal locations

Services to support adaptive management

To deal with climate change an adaptive management approach will be required that is underpinned by a Global Framework for Climate Services that properly supports:

- Planning and designing infrastructure to account for climate uncertainties
- Informing the community broadly as well as professionals from a wide variety of disciplines such as meteorology, hydrology, engineering, statistics, ecology, biology, economics and financial management.
- Taking a whole-of-life approach to the management of infrastructure
- Constantly updating risk assessments and the benefits and costs analyses of adaptive strategies
- Strengthening emergency management and preparedness plans for extreme events that current science indicates are likely to increase in frequency under the range of generally accepted climate change scenarios.

Characteristics of an effective climate service

The Global Framework for Climate Services will need to be:

- Accessible to all (low cost, high volume basic climate information)
- Driven by ongoing research
- Constantly improving climate forecasts for specific regions and localities and expressed in a way that makes them easily used by all manner of decision makers
- Improving the range and geographical extent of the collection of Earth-system data, and the exchange of these data between agencies undertaking climate change-related research and infrastructure development.

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Thank you for your attention