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[www.grid.unep.ch](http://www.grid.unep.ch)

# Extreme events from climate change :



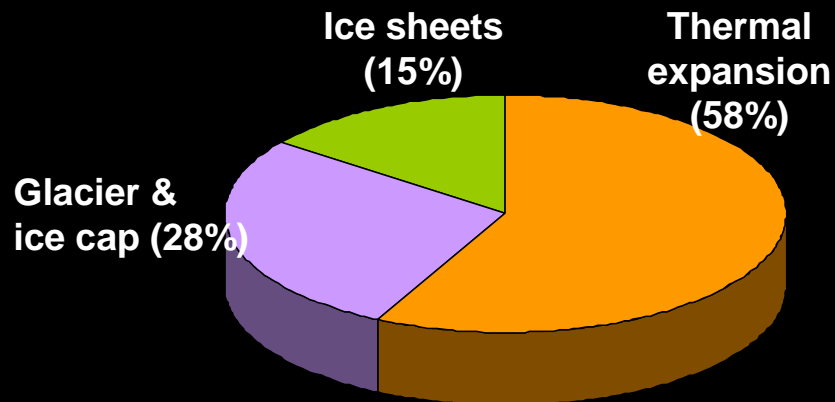
## their related impacts on transport & connectivity

UNECE-UNCTAD Conference  
Geneva, 8 September 2010

Pascal Peduzzi  
UNEP/GRID-Europe



# Driver 1: sea level rise



	1961 - 2003	1993 - 2003
Observed rate of sea level rise [mm/year]	$1.8 \pm 0.5$	$3.1 \pm 0.7$

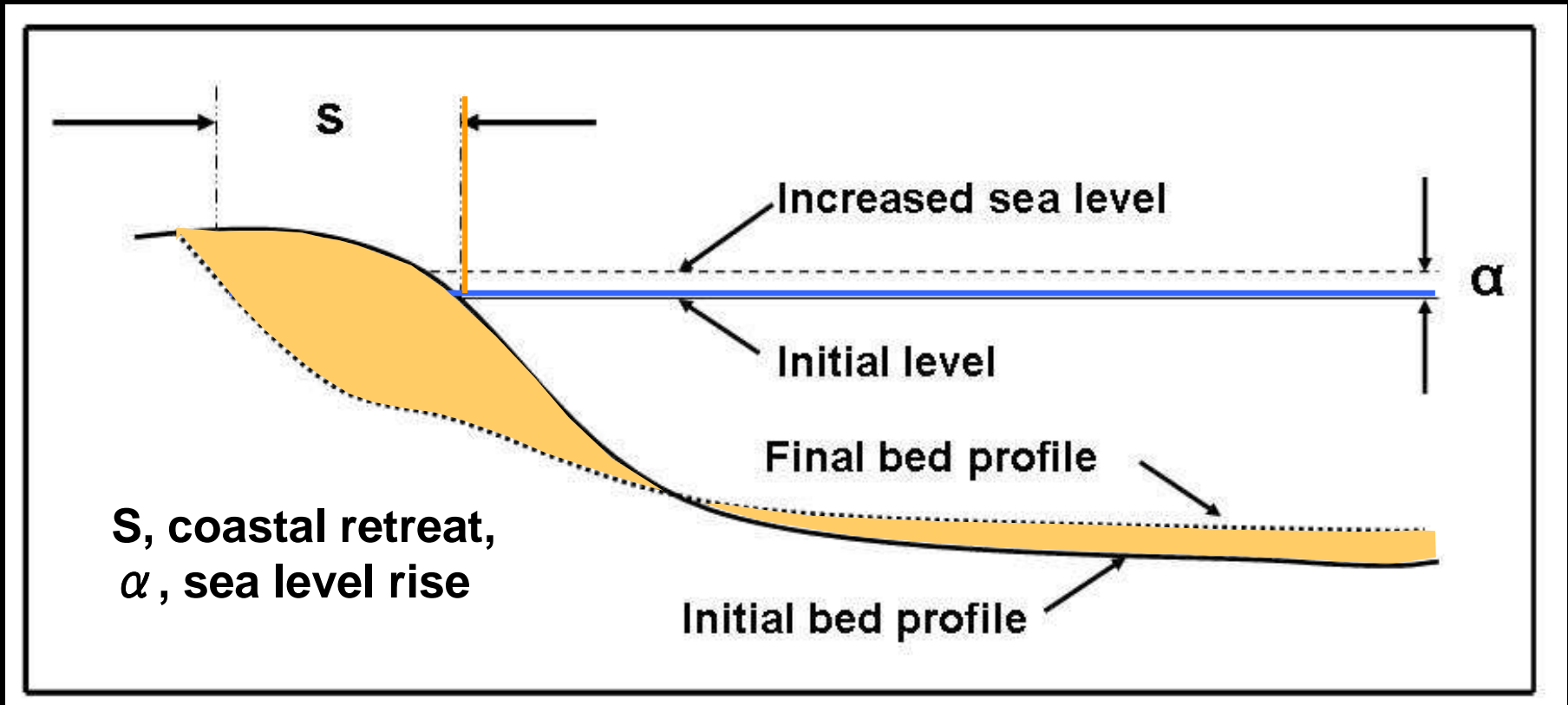
Sources: IPCC, AR4, Climate Change 2007: Working Group I: The Physical Science Basis.

**By 2100: 0.22 m to 0.5 m (some experts says up to 1 m!)**

## Impacts on transport through:

- Coastal erosion (retreat)
- Coastal flooding

# Driver 1: Sea level rise (ASLR), process



**Beach erosion (defined as irreversible coastline retreat) due to increased sea level**

# Main transport at threat: harbours



# Sea level rise impacts on harbours



# Increasing coastal exposure : Dakar (Senegal)



# Airport & sea level rise: Barbados



Date des images satellite : 21 mars 2009

Image © 2010 GeoEye

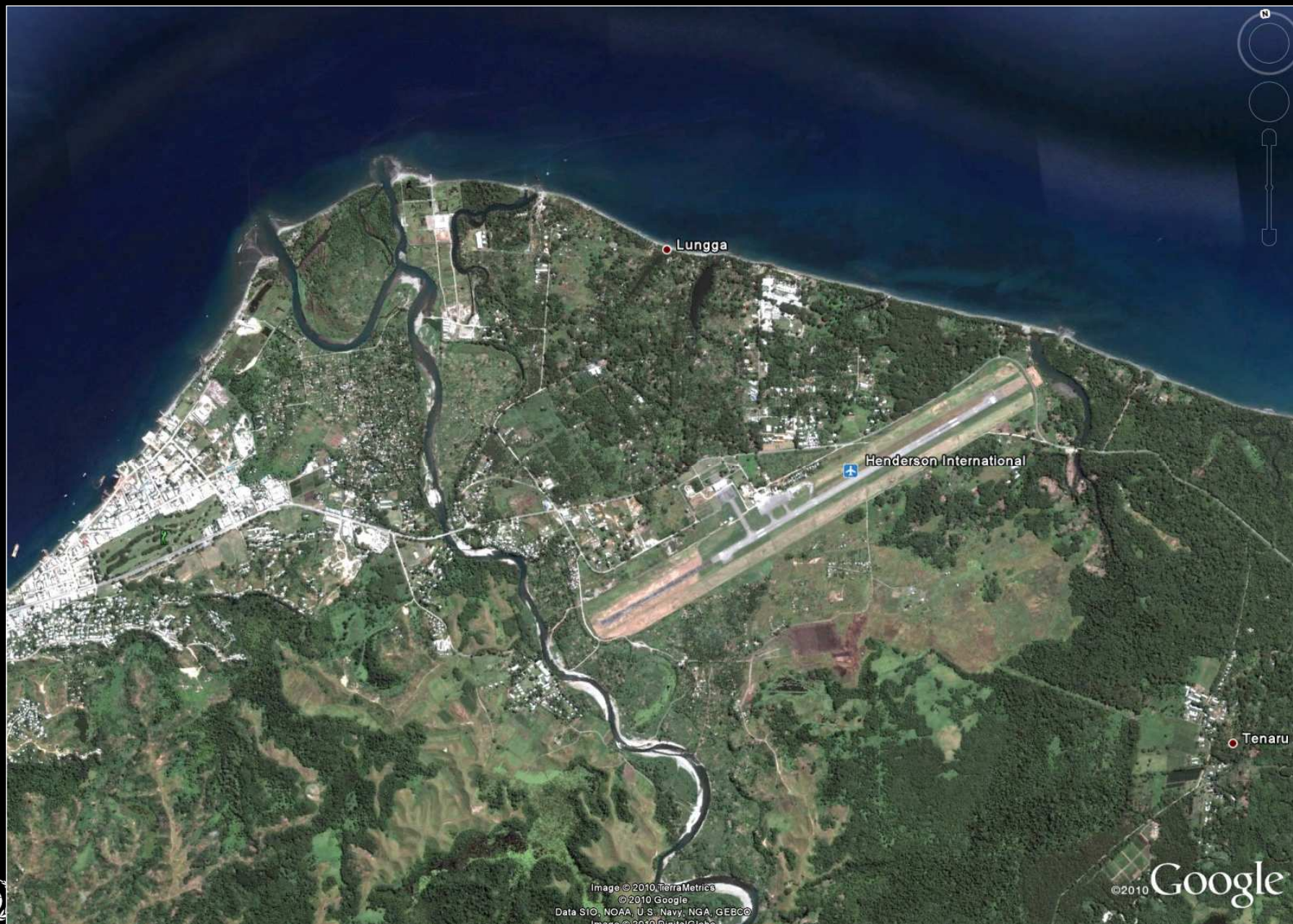
13°03'40.79"N 59°28'53.22"O élév. -5 m

©2010 Google

Altitude 4.29 km



# Sea level rise & airport: Solomon islands



# Sea level rise & airports: Honk Kong (China)



Date des images satellite : 20 fevr. 2008

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Image © 2010 TerraMetrics

Image © 2010 DigitalGlobe

22°16'55.73"N 113°55'35.24"E élév. 35 m

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Altitude 6.53 km

# Sea level rise & airports: Kingston (Jamaica)



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# Sea level rise & coastal erosion: roads



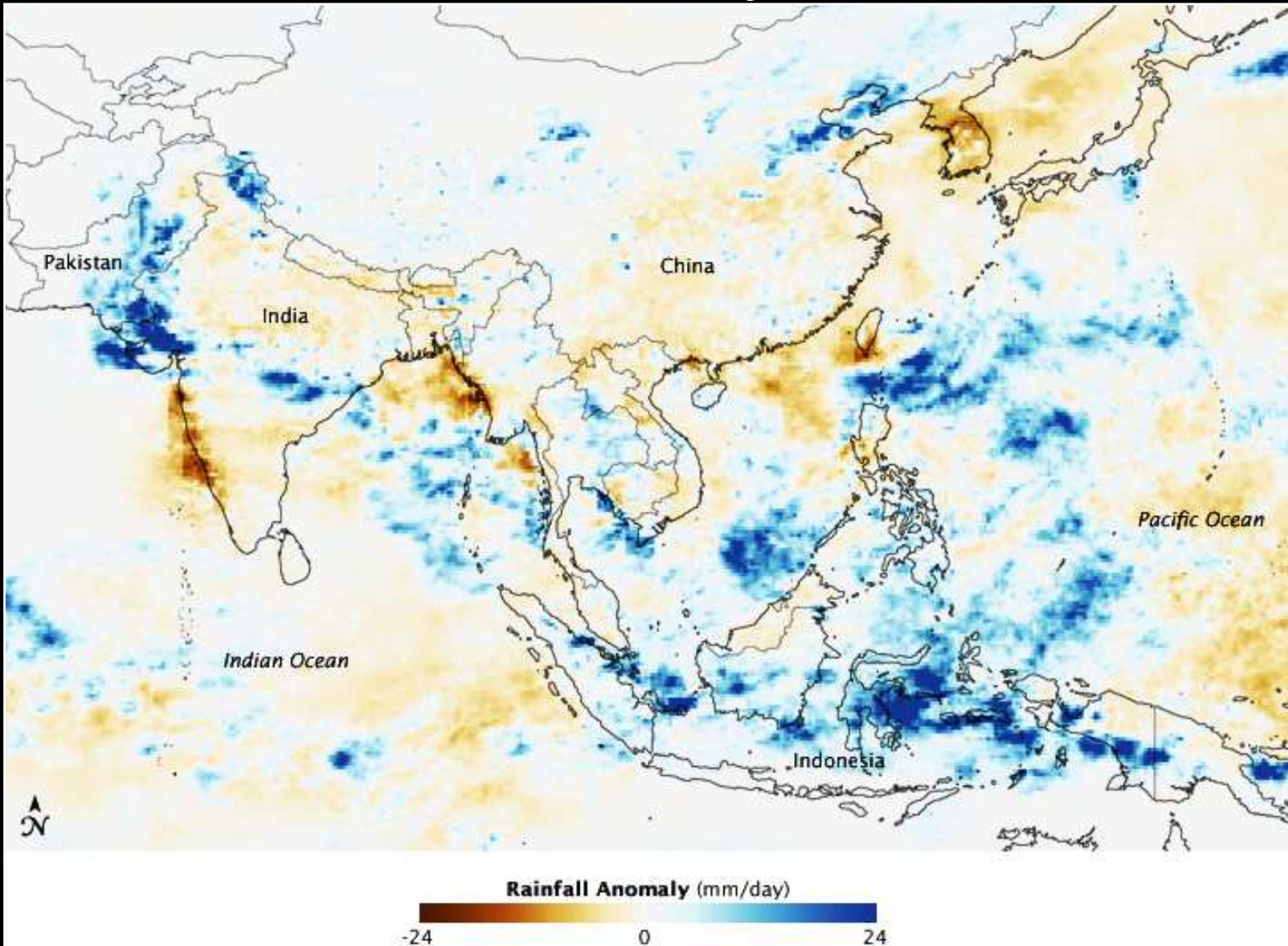
# Coastal flooding: impacts on roads



# Driver 2: extreme events

Phenomenon and direction of trend	Likelihood that trend occurred in late 20th century (typically post 1960)	Likelihood of a human contribution to observed trend	Likelihood of future trends based on projections for 21st century using SRES scenarios
Warmer and fewer cold days and nights over most land areas	Very likely	Likely	Virtually certain
Warmer and more frequent hot days and nights over most land areas	Very likely	Likely (nights)	Virtually certain
Warm spells/heat waves. Frequency increases over most land areas	Likely	More likely than not	Very likely
Heavy precipitation events. Frequency (or proportion of total rainfall from heavy falls) increases over most areas	Likely	More likely than not	Very likely
Area affected by droughts increases	Likely in many regions since 1970s	More likely than not	Likely
Intense tropical cyclone activity increases	Likely in some regions since 1970	More likely than not	Likely

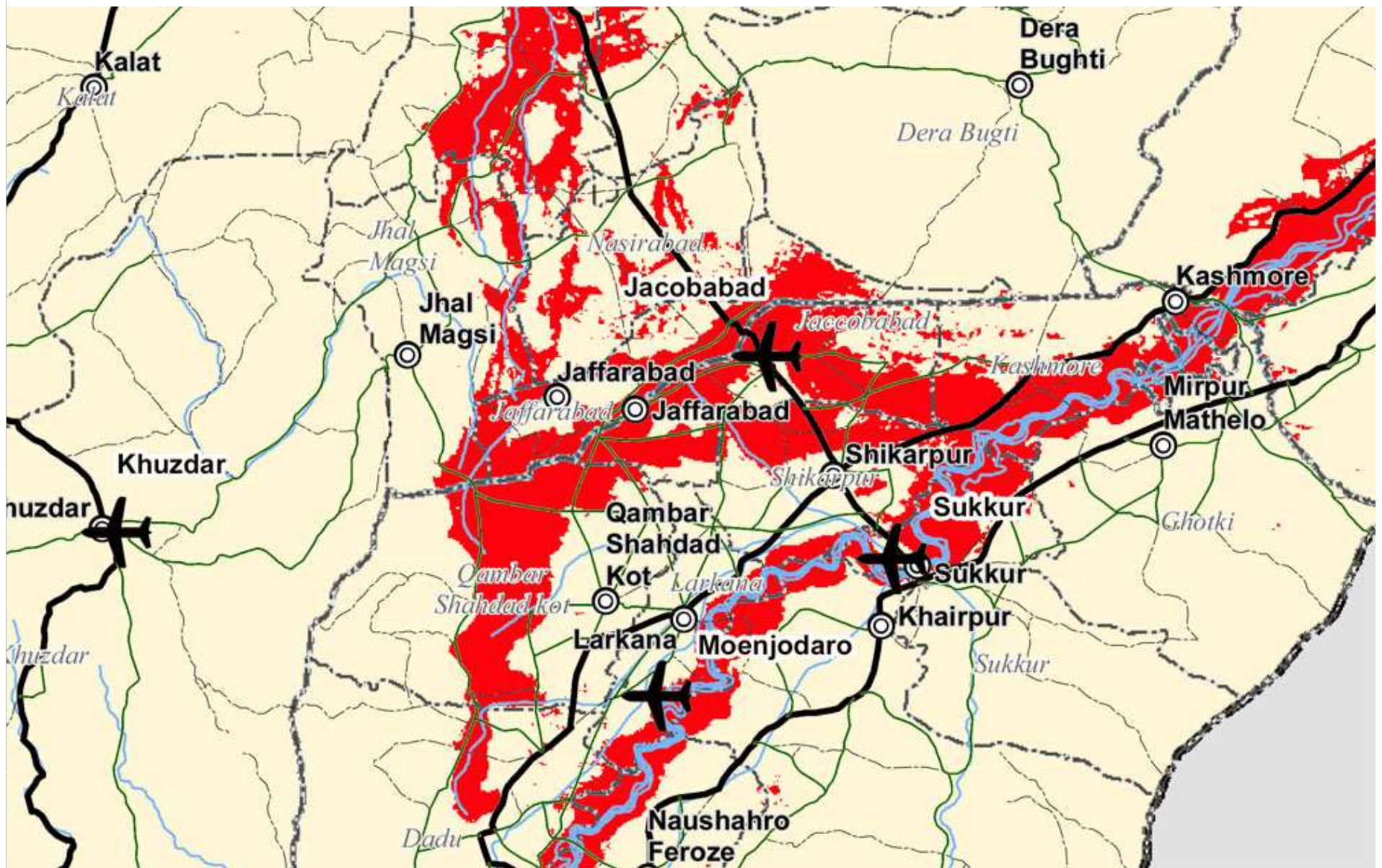
# 2010 Pakistan flood: unusually intense monsoon rains



Sources: NASA 2010

[http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=](http://earthobservatory.nasa.gov/NaturalHazards/view.php?id=45177)

45177



Source(s): MapAction; United Nations Office for the Coordination of Humanitarian Affairs (OCHA)





**Should not come at a surprise:**

**Pakistan ranking**

**9 / 162 countries in terms of flood exposure.**

**UNISDR, UNEP, 2009**



# Landslides in mountainous areas



# Heatwaves, destabilisation of north slopes in high altitude areas: rock fall & impacts on roads



# Melting permafrost in mountainous areas & high latitudes: impacts on roads



# Melting permafrost in mountainous areas & high latitudes: impacts on pipelines



## Extreme precipitations in mountainous areas: impacts on roads and rails (Peru)



## Heat & train: rail dilatation

Badly designed railways can suffer from extreme temperatures

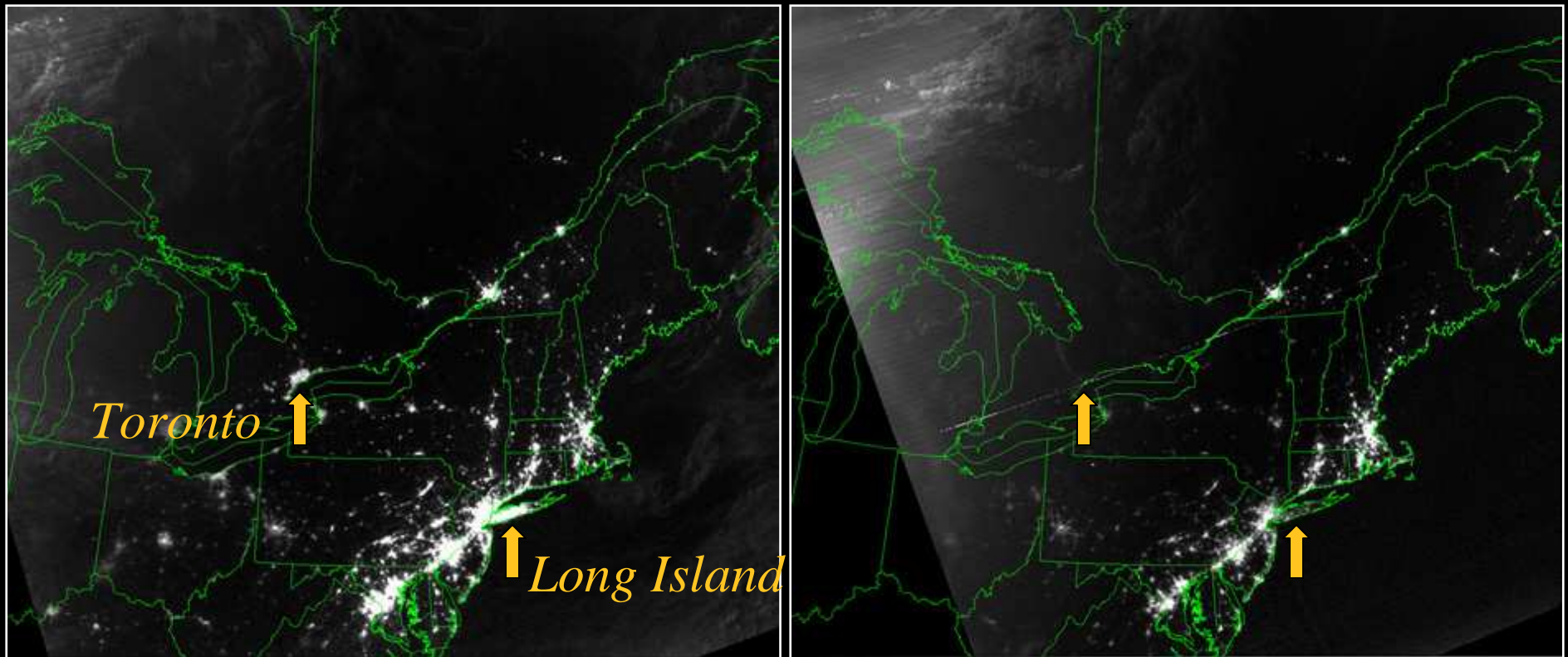


# Heat & train: rail dilatation in Canada



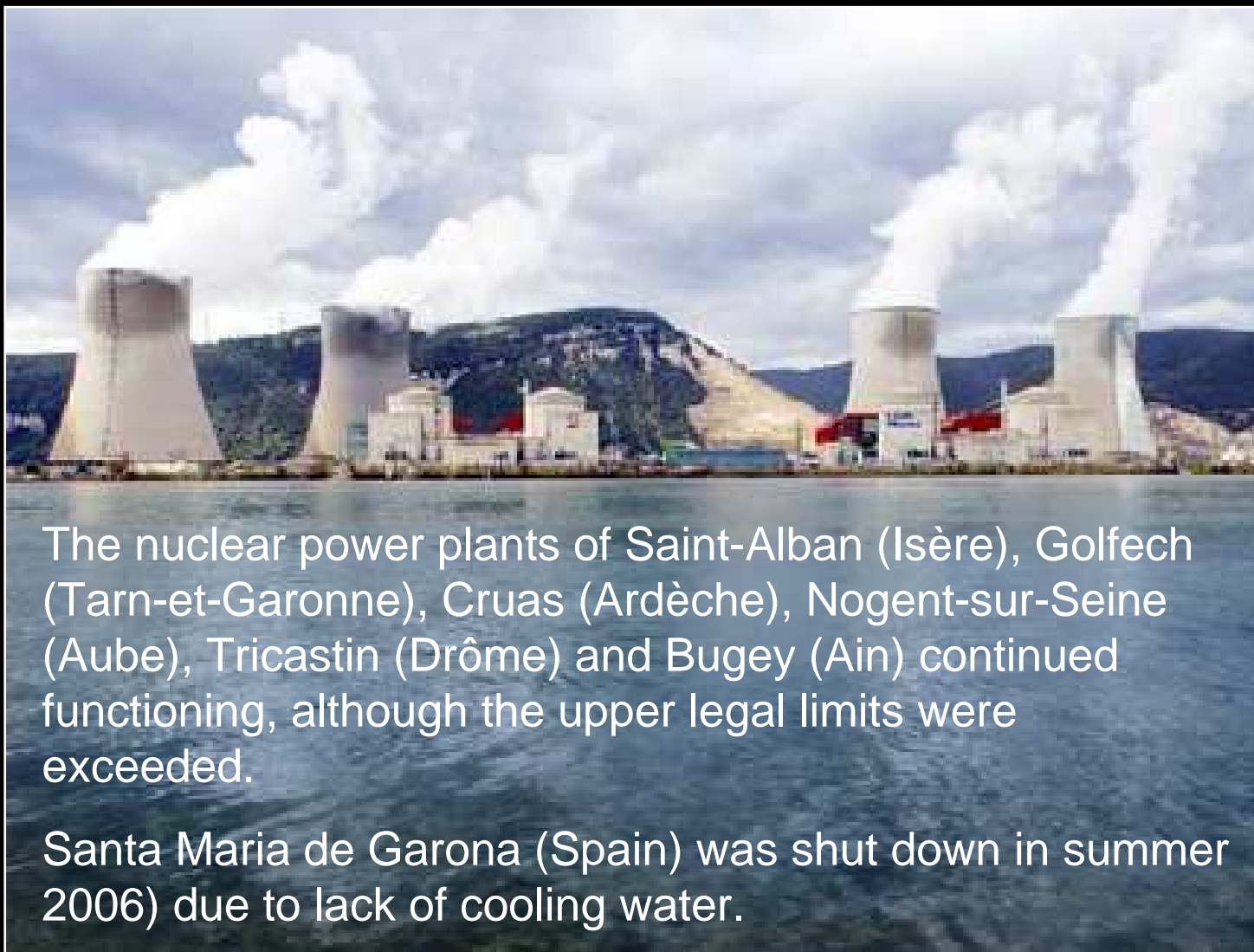


# Heat & electricity: high demand for air. Con. Led to blackout blocking trains and subways



14 August 2003, part of north-east USA and South-east Canada had a major blackout: 65 millions people affected.

## Drought & electricity production: nuclear power Plant in France (some shut down during 2003 heatwave)



The nuclear power plants of Saint-Alban (Isère), Golfech (Tarn-et-Garonne), Cruas (Ardèche), Nogent-sur-Seine (Aube), Tricastin (Drôme) and Bugey (Ain) continued functioning, although the upper legal limits were exceeded.

Santa Maria de Garona (Spain) was shut down in summer 2006) due to lack of cooling water.

# Drought & electricity production



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# Drought & boat transport



# Panama canal

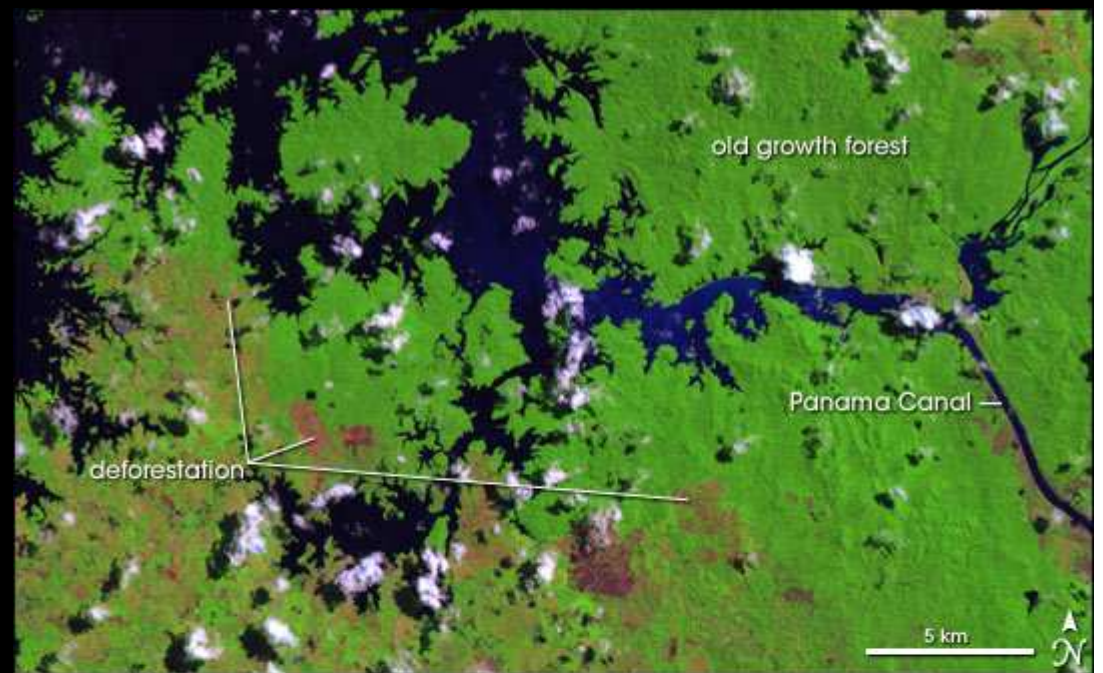


- In 2009, nearly 300 million tons of shipping. Yearly shipping may increase to 340 million tons in 2012.

- **Every lock going downward requests more than 100,000 m<sup>3</sup> of water to operate.**
- **Water management is a critical issue, both floods and droughts need to be controled.**



Deforestation might induce local change in precipitation patterns



May 28, 2002



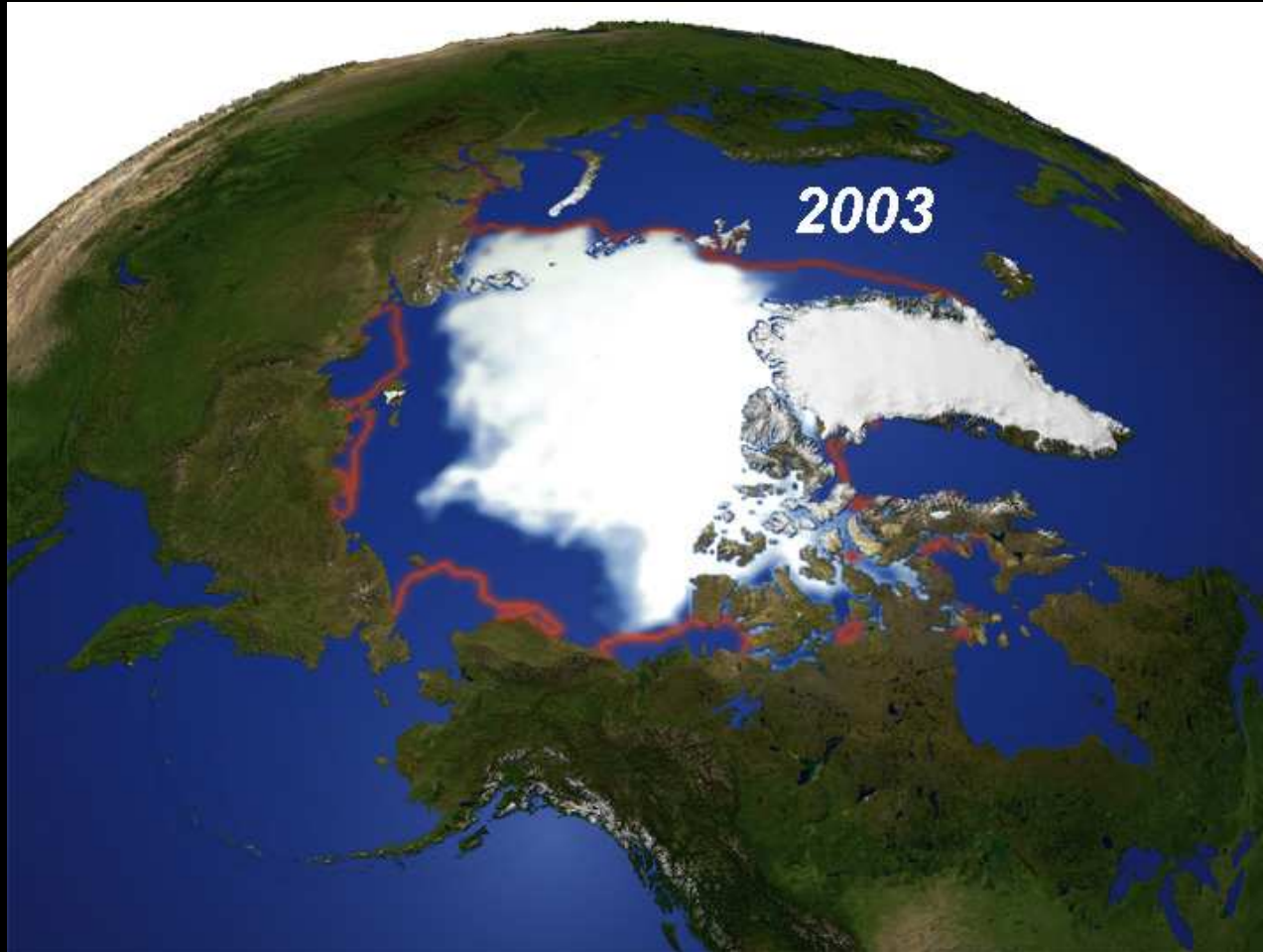
October 31, 1986



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## Arctic ice retreat: new shipping road(s)



1979-2003:  
Progressive loss  
of ice in arctic  
ocean

Sources: UNEP (2005) *One planet Many People*

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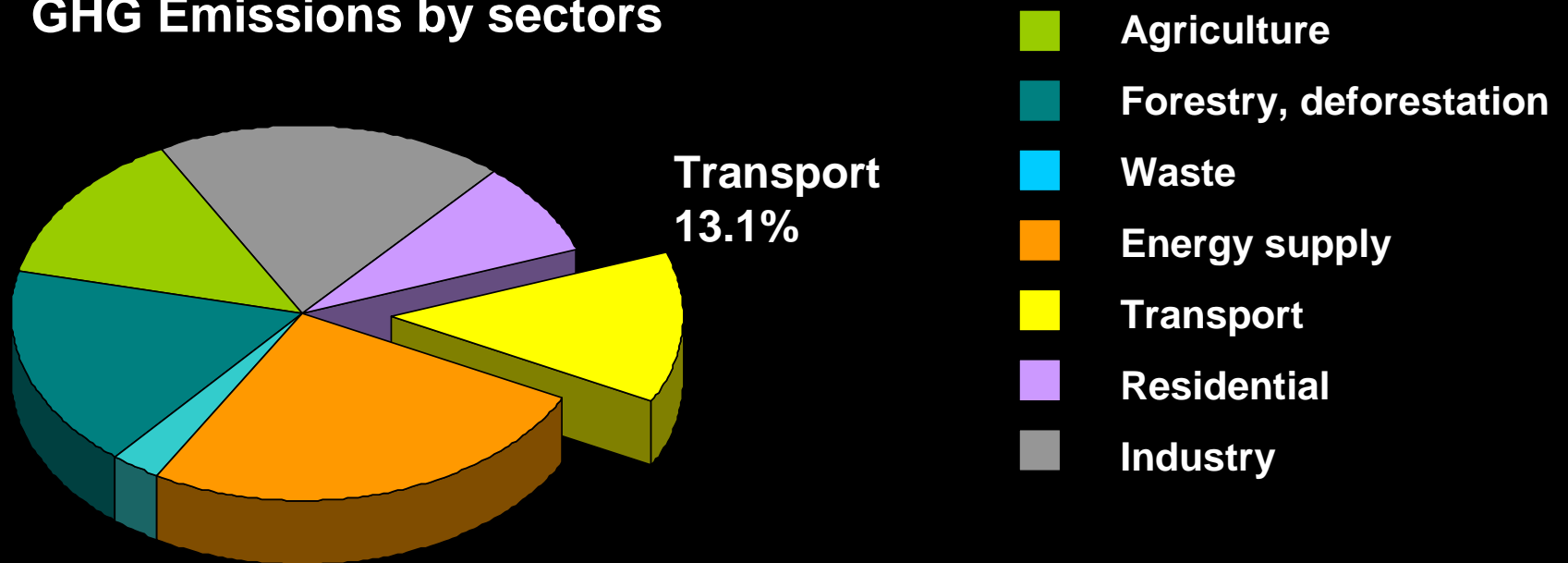
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# Transport is not **only** a victim from climate change

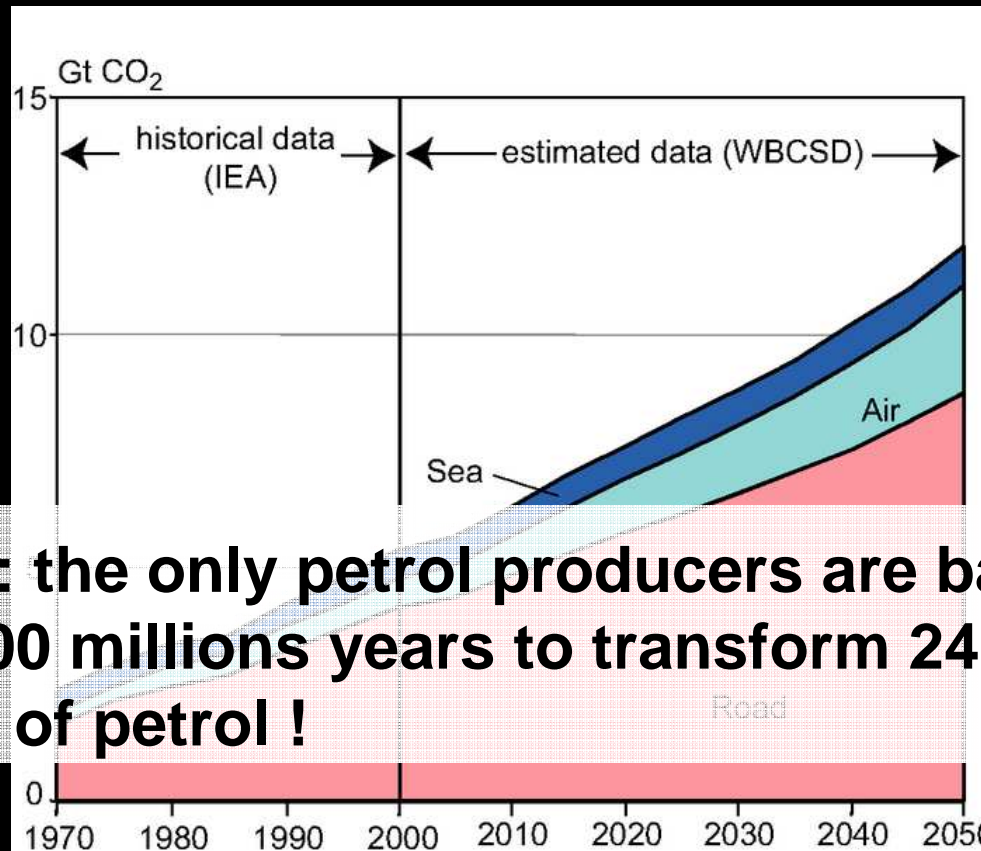
## GHG Emissions by sectors



Sources: IPCC, AR4, Climate Change 2007: Working Group I: The Physical Science Basis.

# Transport is not **only** a victim from climate change

**Demand in energy for transport might double by 2050**

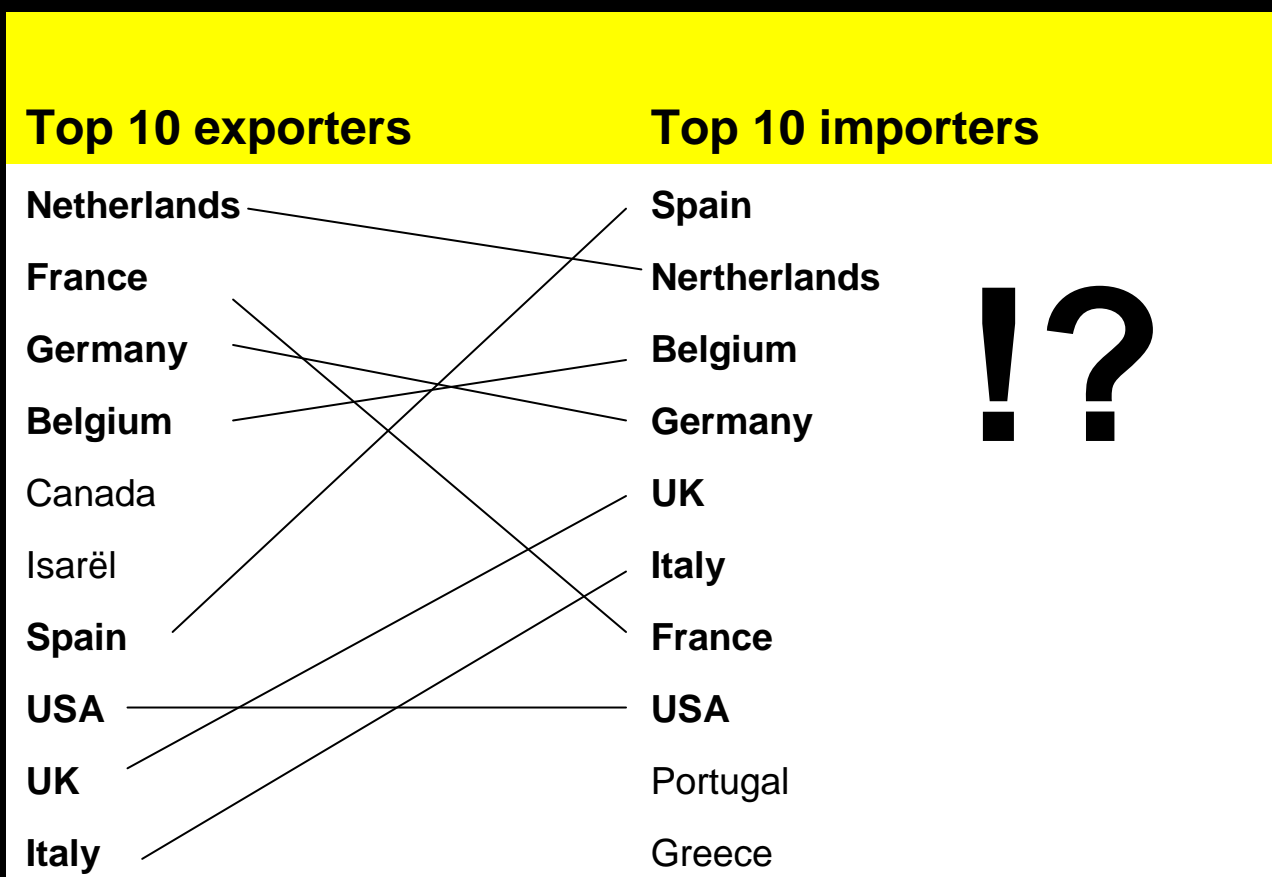


**Energy crisis: the only petrol producers are bacteria ... it takes them 200 millions years to transform 24 tons of fern into one litter of petrol !**

Sources: IPCC, AR4, Climate Change 2007: Working Group I: The Physical Science Basis.

# Transport: more rational thinking is needed

An example on world top importers / exporters of potatoes



# Conclusions

- Transport activities will be affected by climate change.
- Main drivers are sea level rise and extreme events.
- Coastal, mountainous and high latitude areas will face the highest consequences.
- But...transport is partly responsible for climate change.
- In the next few decades, energy crisis is very likely to have much more impact on transport than climate change.

# Conclusions

## Due to :

- Climate change impacts on transport
- Impact of transport on climate
- The energy crisis
- Current waste in transport practices

A shift in transport policies is needed !



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# Summary on sea level rise impacts

- Increase coastal erosion
- Submerge infrastructures

## This can impact:

- Harbours
- Airports
- Coastal roads & railways

# Summary heat impacts:

- High energy demand (blackout)
- High ground ozone level.
- Forest fires (and smoke for flights)
- Destabilisation of slopes (rock fall, landslides,...)
- Dilatation of (badly designed) railways
- Melting of permafrost (in northern latitudes and high altitudes).



# Summary on drought impacts:

- Reduces (or prevents) river navigation capacities
- Reduce electricity supply from both nuclear power plant (cooling) and dams thus may affecting trains, subways and other transports depending on electricity.

# Summary on extreme precipitation events

Heavy precipitations may lead to:

- Floods,
- landslides,

blocking or destroying transport infrastructures (roads, bridges,...)