What the Science Tells Us & How Practitioners Can Use the Science

Presented at

APTA

Los Angeles, CA

Presented by

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Agenda

1. What science tells us
2. How transit agencies can use the science

Adapting to Climate Change

- According to U.S. Federal Government's Global Climate Change Research Program:
  - Sea level rise and storm surge will increase the risk of major coastal impacts, including both temporary and permanent flooding of airports, roads, rail lines and tunnels
  - Flooding from increasingly intense downpours will increase the risk of disruptions and delays in air, rail, and road transportation, and damage from mudslides in some areas

Adapting to Climate Change

- U.S. Federal Gov't cont.:
  - The increase in extreme heat will limit some transportation operations and cause pavement and track damage
  - Increased intensity of strong hurricanes will lead to more evacuations, infrastructure damage and failure, and transportation interruptions

Adapting to Climate Change

- What is adaptation?
  - A term still looking for a definition
    - IPCC plans a definition for its 5th Assessment Report due 2014
    - Sample definitions
      - IPCC TAR, 2001a: Adjustment in natural or human systems in response to actual or expected climatic stimuli or their effect, which moderates, harm or exploits beneficial opportunities
      - UNFCCC Secretariat: Practical steps to protect countries and communities from the likely disruption and damage that will result from effects of climate change, (ie; flood walls)

Adapting to Climate Change

- US EPA: Adaptation to environmental change is not a new concept. Throughout history, human societies have shown a strong capacity for adapting to different climates and environmental changes.

Adapting to Climate Change

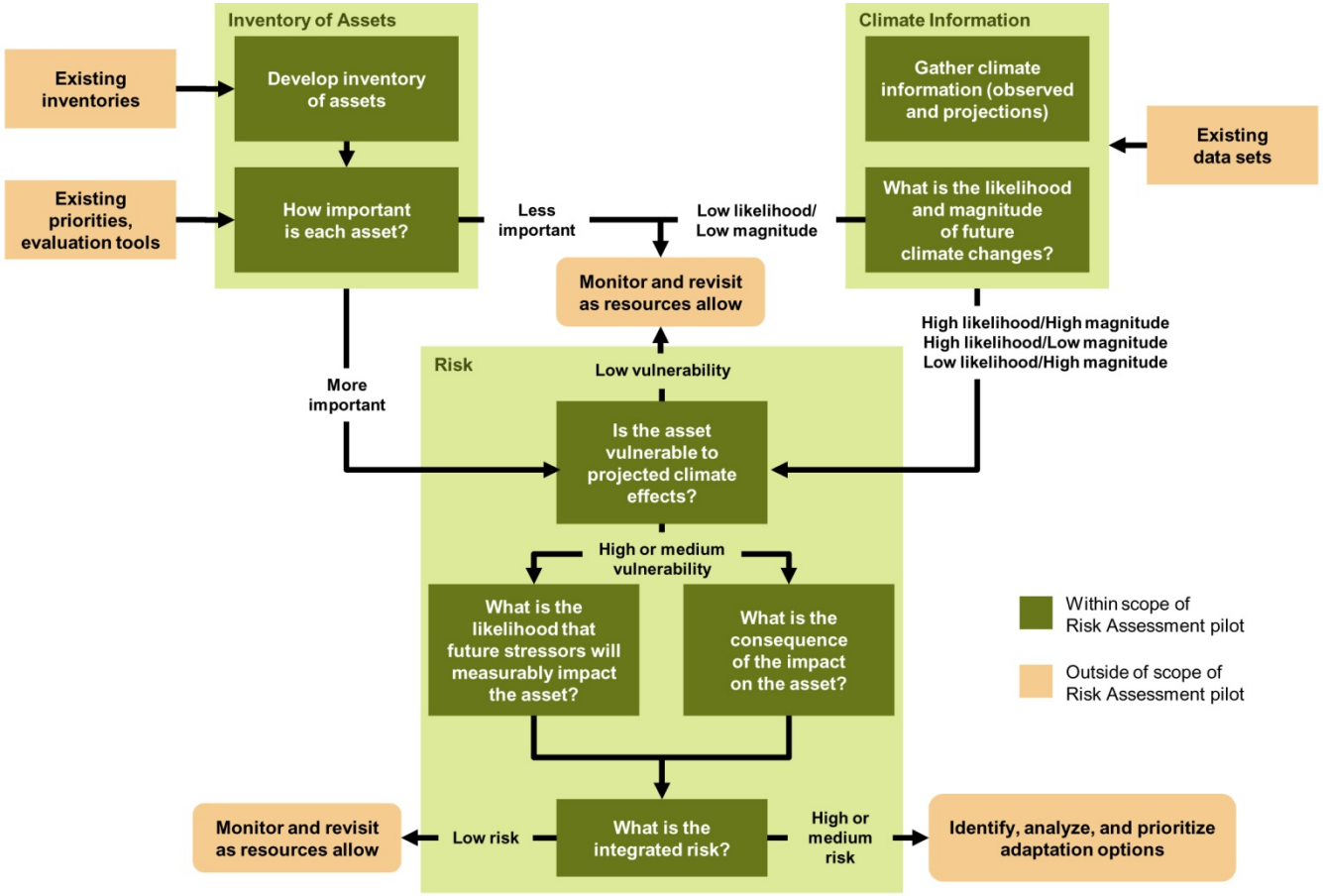

Figure 1: Structure of the conceptual Risk Assessment Model that will be piloted by State DOTs and MPOs

From: Assessing Vulnerability and Risk of Climate Change Effects on Transportation Infrastructure: Pilot of the Conceptual Model

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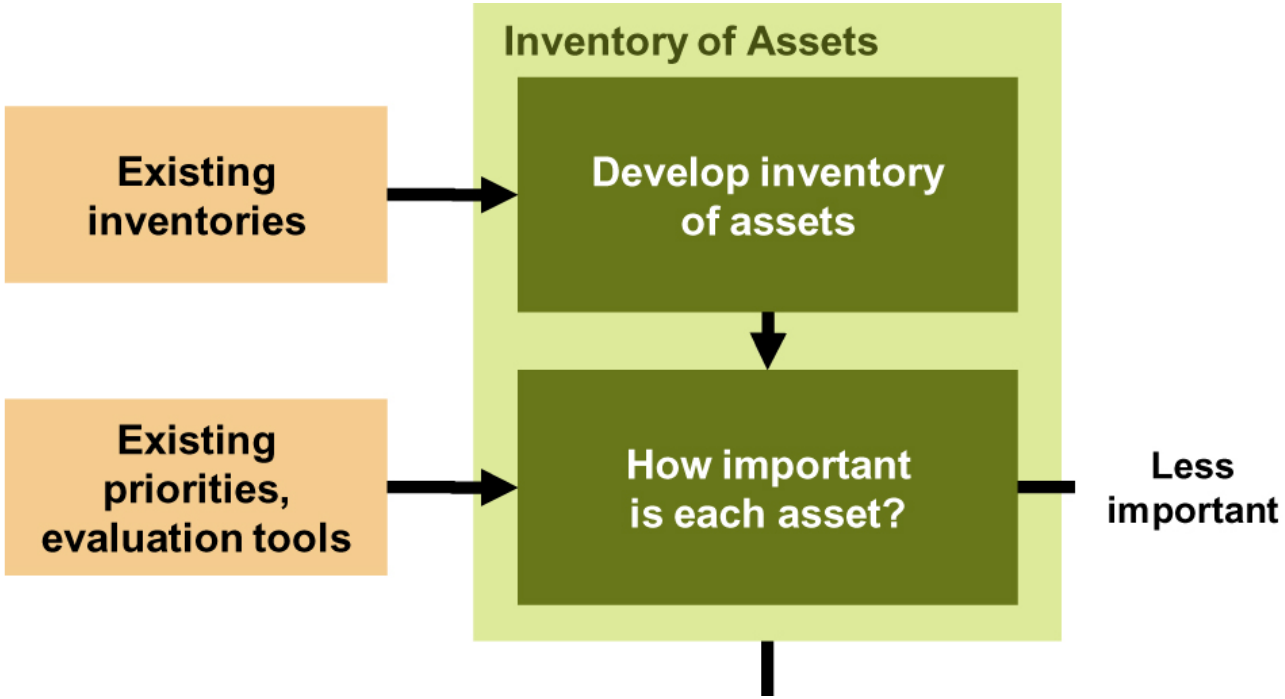
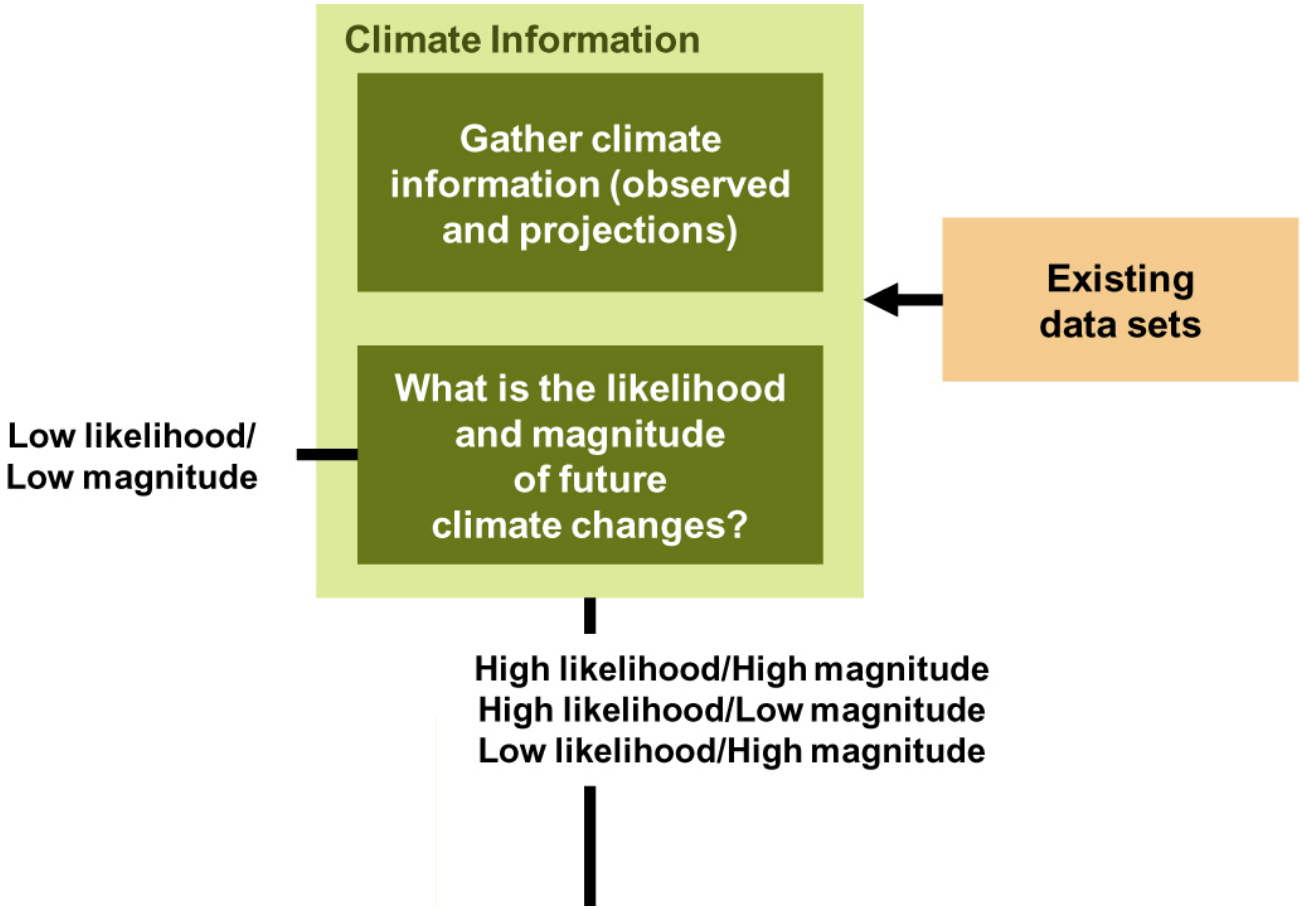
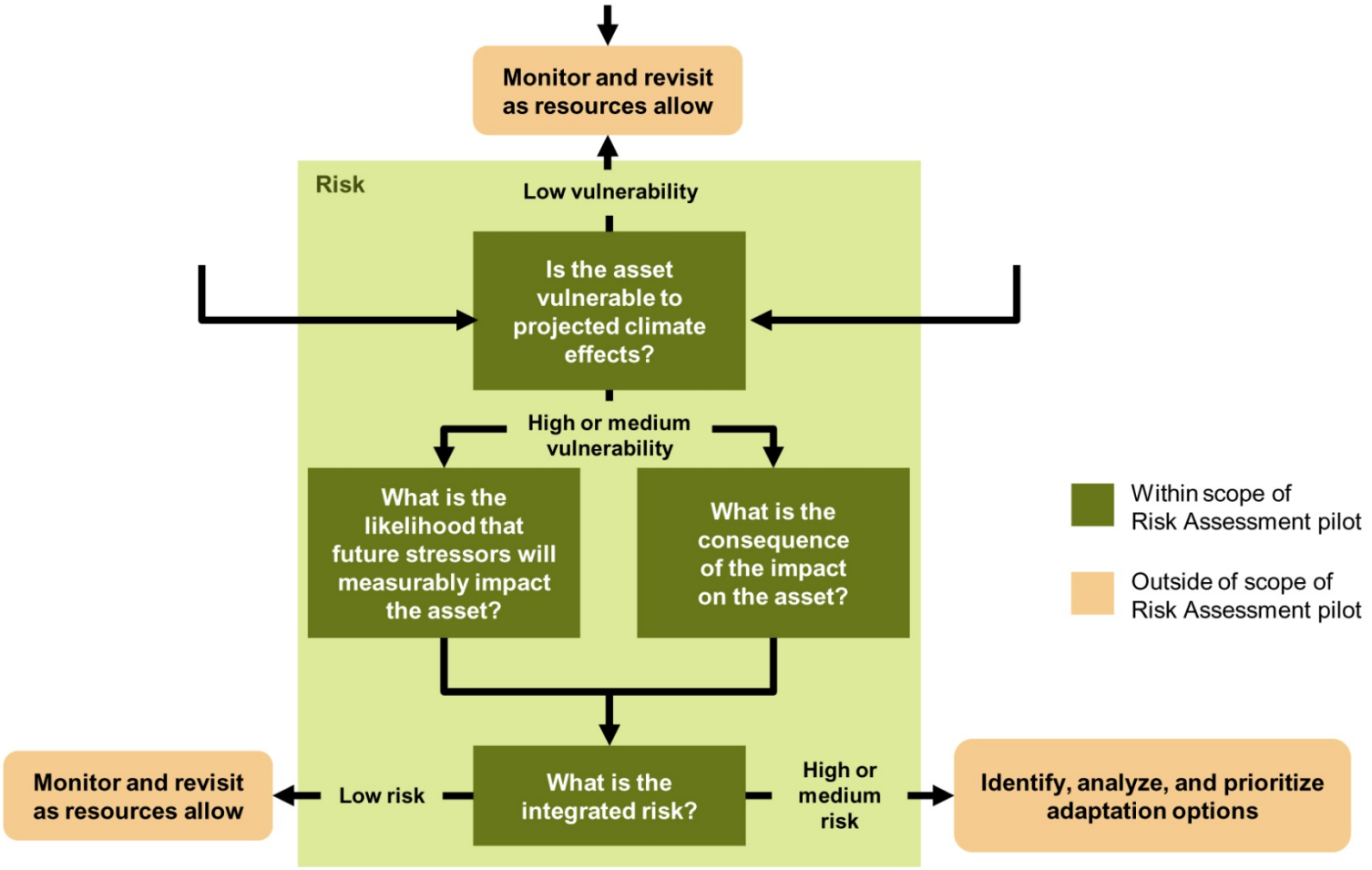
Adapting to Climate Change



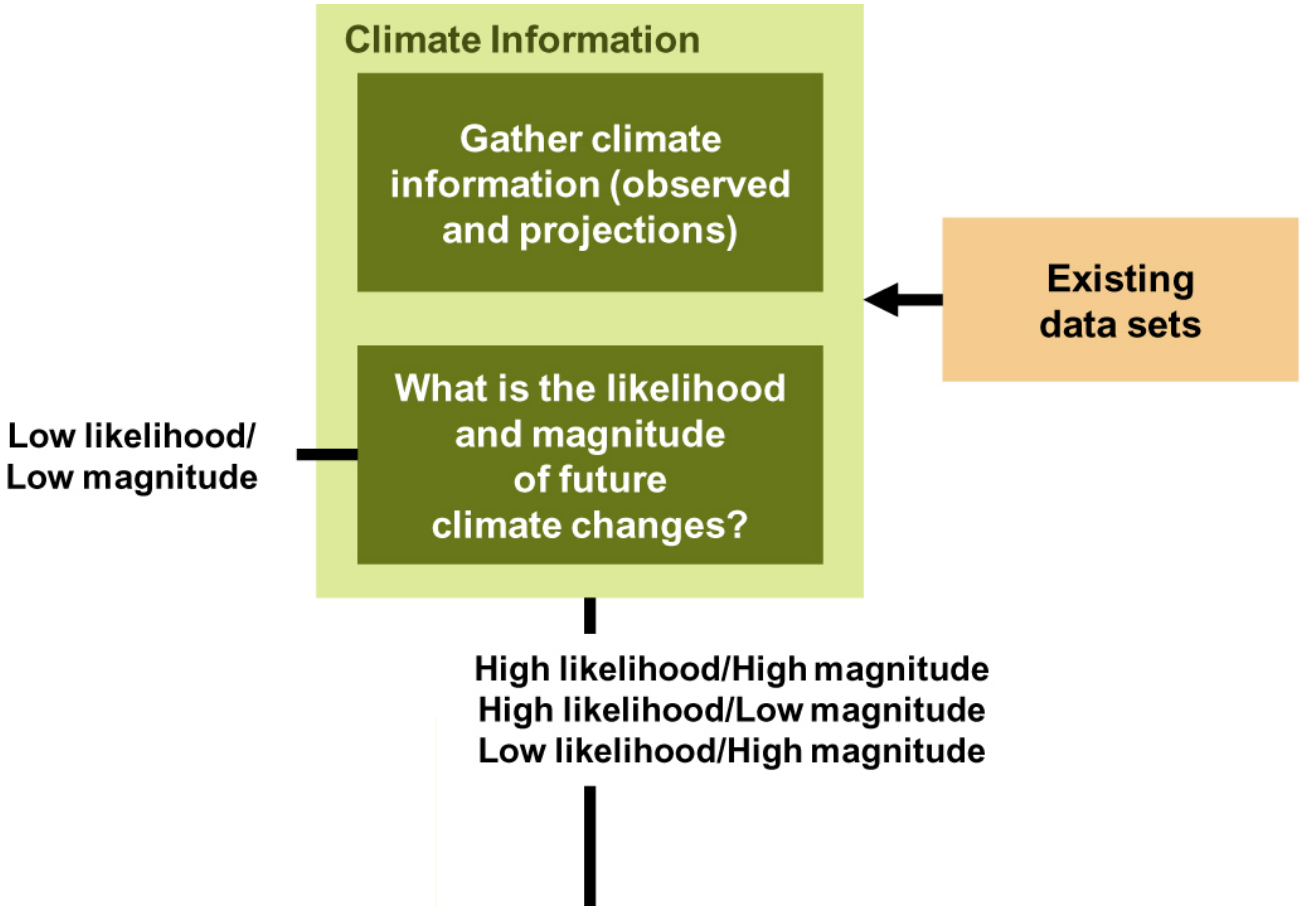
Adapting to Climate Change



Adapting to Climate Change



Adapting to Climate Change



Adapting to Climate Change

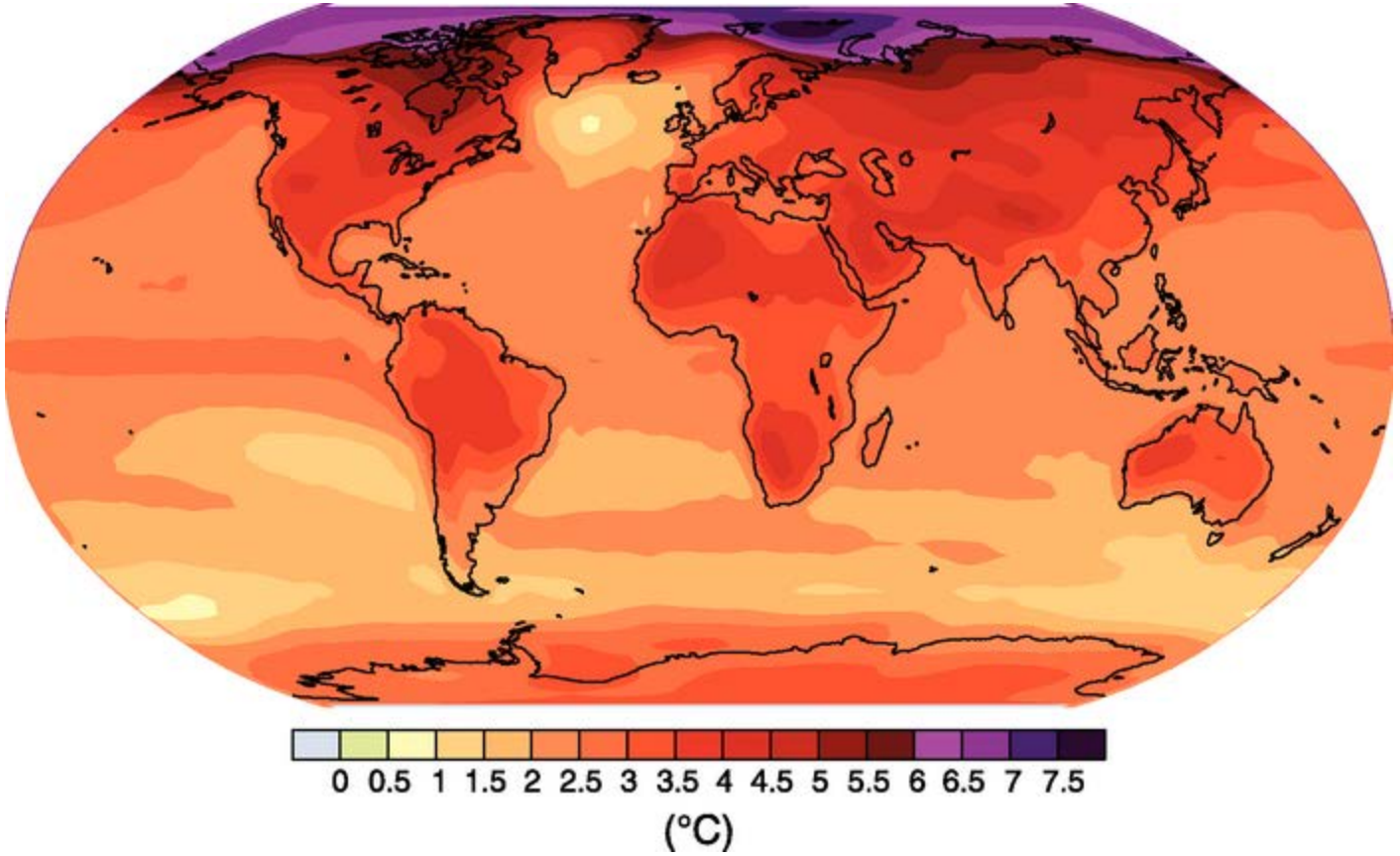
- IPCC 4th Assessment Report (AR4)
  - **There is now higher confidence in projected patterns of warming…**
    - Warming is greatest over land and at most high northern latitudes, continuing recent observed trends.
    - Contraction of snow covered area, increases in thaw depth over most permafrost regions and decrease in sea ice extent. Arctic late-summer sea ice disappears almost entirely by the latter part of the 21st century.

Adapting to Climate Change

- IPCC 4th Assessment Report (AR4)
  - Increase in frequency of hot extremes, heat waves and heavy precipitation
  - Increase in tropical cyclone intensity; less confidence in global decrease of tropical cyclone numbers
  - Poleward shift of extra-tropical storm tracks with consequent changes in wind, precipitation and temperature patterns

Adapting to Climate Change

Geographical pattern of surface warming



From www.ipcc.ch: Figure SPM.6. Projected surface temperature changes for the late 21st century (2090-2099). The map shows the multi-AOGCM average projection for the A1B SRES scenario. Temperatures are relative to the period 1980-1999.

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Adapting to Climate Change

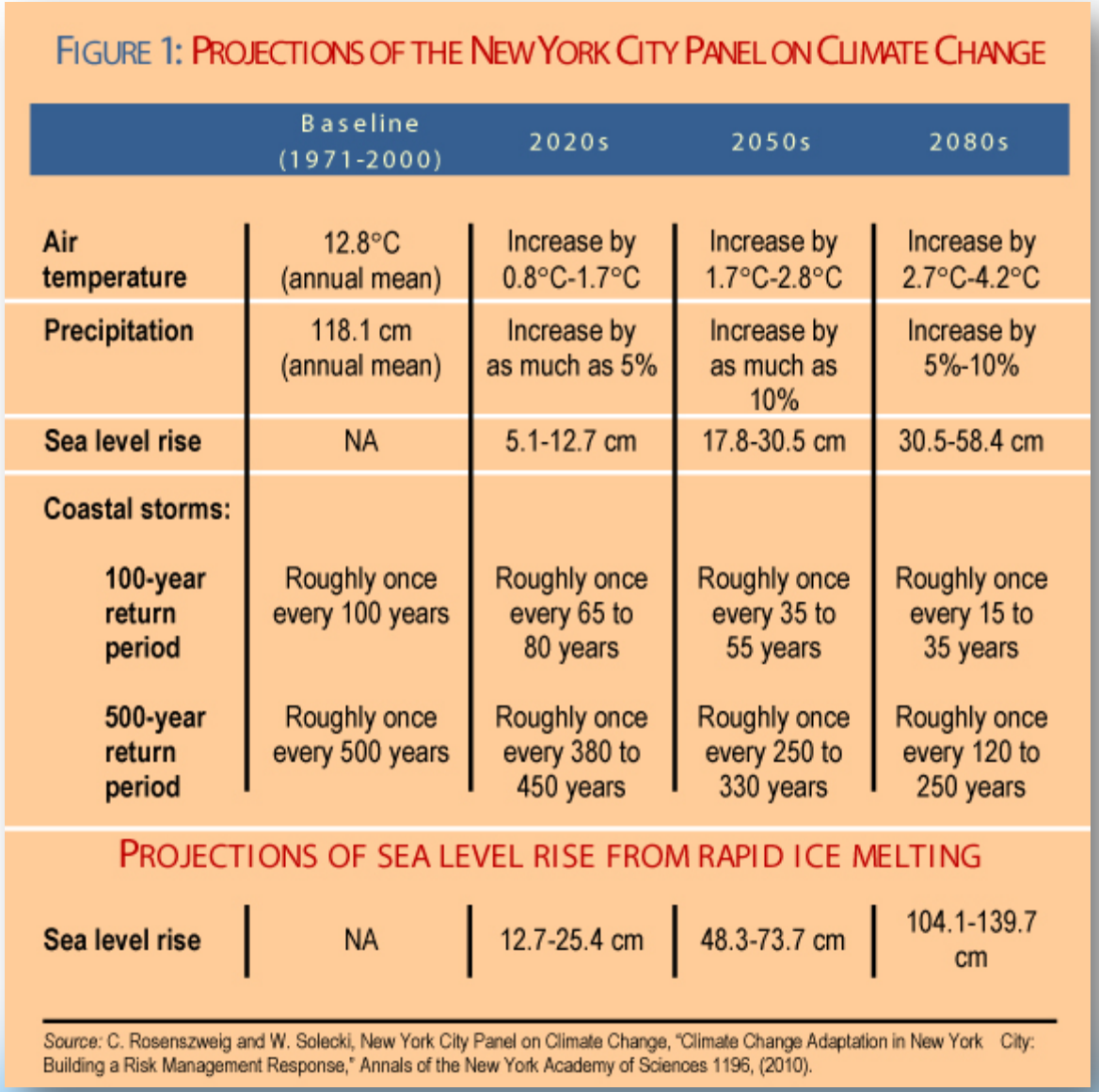

FIGURE 1: PROJECTIONS OF THE NEW YORK CITY PANEL ON CLIMATE CHANGE

	Baseline (1971-2000)	2020s	2050s	2080s
Air temperature	12.8°C (annual mean)	Increase by 0.8°C-1.7°C	Increase by 1.7°C-2.8°C	Increase by 2.7°C-4.2°C
Precipitation	118.1 cm (annual mean)	Increase by as much as 5%	Increase by as much as 10%	Increase by 5%-10%
Sea level rise	NA	5.1-12.7 cm	17.8-30.5 cm	30.5-58.4 cm
Coastal storms:				
100-year return period	Roughly once every 100 years	Roughly once every 65 to 80 years	Roughly once every 35 to 55 years	Roughly once every 15 to 35 years
500-year return period	Roughly once every 500 years	Roughly once every 380 to 450 years	Roughly once every 250 to 330 years	Roughly once every 120 to 250 years
PROJECTIONS OF SEA LEVEL RISE FROM RAPID ICE MELTING				
Sea level rise	NA	12.7-25.4 cm	48.3-73.7 cm	104.1-139.7 cm

Source: C. Rosenszweig and W. Solecki, New York City Panel on Climate Change, "Climate Change Adaptation in New York City: Building a Risk Management Response," Annals of the New York Academy of Sciences 1196, (2010).

From: Civil Engineering, "Anticipating Climate Change" April 2011

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Adapting to Climate Change

- What scientists are predicting now:
  - Large scale weather events will be more frequent, have greater intensity, last longer and have impacts that will be more extreme than we are accustomed to
  - Since 1950 the number of extreme cold days has decreased – while number of hot days has increased

Adapting to Climate Change

- It is expected that on the global scale, 1-in-20 year hottest weather days will become 1-in-2 year by end of 21st Century
  - Except in higher latitudes of the northern hemisphere where it is likely to be 1-in-5 year

Adapting to Climate Change

- Summary
  - Single numbers can't be used in risk analysis
  - Atmosphere is gaining new energy which is changing the dynamics, though we don't know how the dynamics are changing
  - We do know that extremes will be extreme
  - We have to anticipate extremes and run scenarios

Adapting to Climate Change

- Need to check Transit's long-term planning and investments in light of climate change
  - Long Beach Island, NJ:
    - How much do we invest?
      - Over the past 20 years beach is disappearing
      - High water mark is less then 18 inches below the ground
  - ICE Train (Germany) AC built to 32 degrees extreme
    - How do we determine design criteria given current uncertainty ?
- Heavy rain events will increase. 1:20 year events expected to occur 1:5 years
  - Exposure of tunnels, vent shafts, air vents

Adapting to Climate Change

- Integrated polices must understand risks and prepare for the worst.
  - Develop Asset Inventory
  - Collect information on each asset
  - Collect weather data
  - Understand the trends
  - Prioritize most important assets
  - Consider costs

Adapting to Climate Change

- IPCC 5th Assessment Report expected to focus on Risk Assessment
- Old model for managing risk insufficient

Adapting to Climate Change

- Goal: Reduce Exposure
- Requires careful planning
  - Use multiple measures to assess risk
  - Must be flexible to react to changes in environment
  - Communicate the risk
- Set priorities
  - Can't cover it all
  - Must assess cost implications
  - (Rockaways) Be aware of population shifts/moves

Questions?

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