

# Climate Change Adaptation in Public Transit

**Derek Stewart**

*Coast Mountain Bus: Director, Safety,  
Environment & Emergency Mgmt.  
Vancouver, BC*

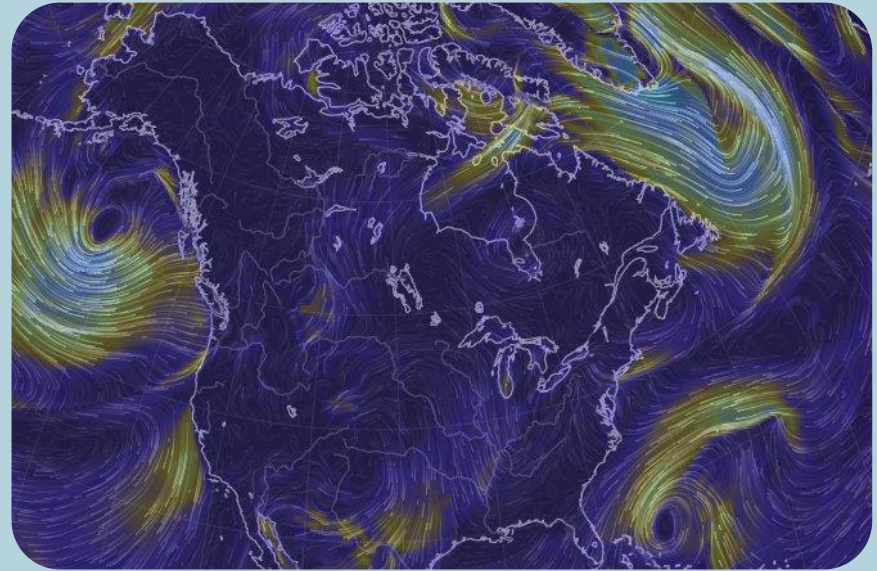
# Climate Change Adaptation in Public Transit

- Climate Change
- Operations vs. Infrastructure
- Impacts and Adaptation
  - High Winds
  - Flooding (regional and storm water)
  - Intense Heat
  - Drought and Forest Fires
  - Rising Ocean Levels
- Climate Change Mitigation



# Climate Change

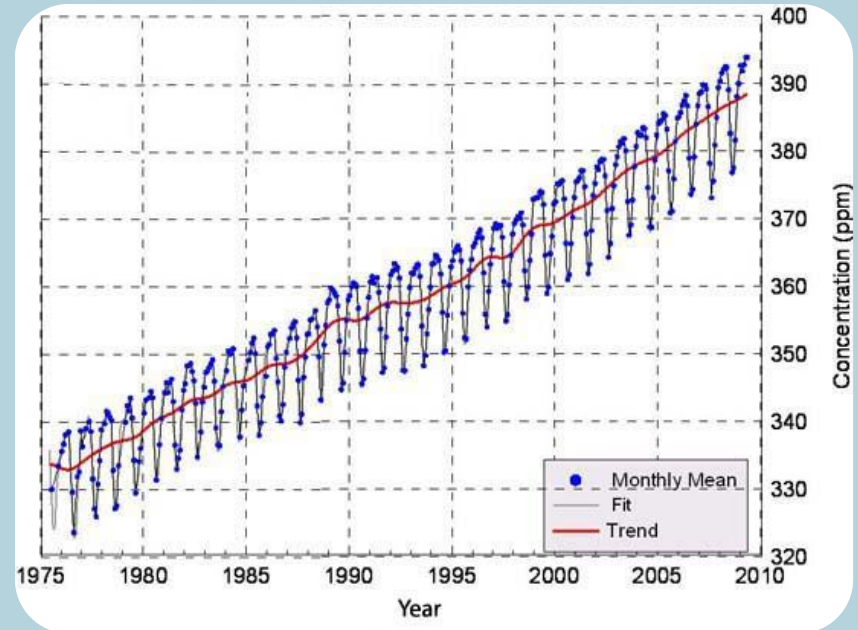
- We see weather
- Climate is averages
- Increasing average temperature
- Increasing intensity of heat, wind and rain events
- Sea level increase



<https://earth.nullschool.net>

# Climate Change

- Regional differences
- All changes will impact public transit
- Public Transit has growing mode share and needs to plan and prepare



[www.ec.gc.ca](http://www.ec.gc.ca)

# Operations vs. Infrastructure

- Operations:
  - Short term (hours/days/weeks)
  - Customer service impacts

Location	Mode	Effective
<b>Bus:</b> Service disruption	Bus	Oct 20 2016 9:50:AM
<p>An earlier accident at the Alex Fraser bridge has delayed <b>301, 314, 340, 388, 640 service</b>.</p> <p><b>301 service</b> terminating at Scottsdale Exchange. For service between Scottsdale Exchange and Newton Exchange, please board 319 service.</p> <hr/>		
<p>Due to an investigation on Glover Rd. <b>C62 service</b> is detouring from Langley Ctr via 56, 232, Springbook, Glover both directions.</p> <hr/>		
<p>Due to a police incident at 176 S &amp; Hwy 1 the following detours are in effect.</p> <p><b>501 Langley</b> Via Hwy 1, 160, 96 regular route</p> <p><b>501 Surrey Central</b> Via 176, 96, 156, 104 regular route</p>		

# Operations vs. Infrastructure

- Infrastructure:
  - Long term (years)
  - Maintenance Facilities
  - Roads & Bridges
  - Rails
  - Loops and Exchanges

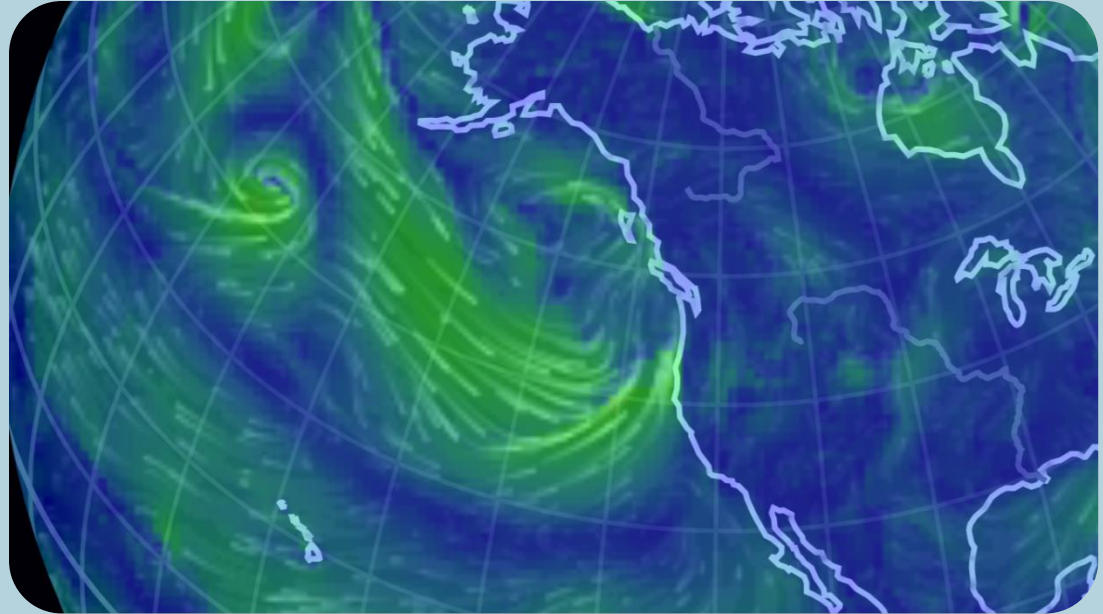


Paris Metro circa 1900



# High Winds

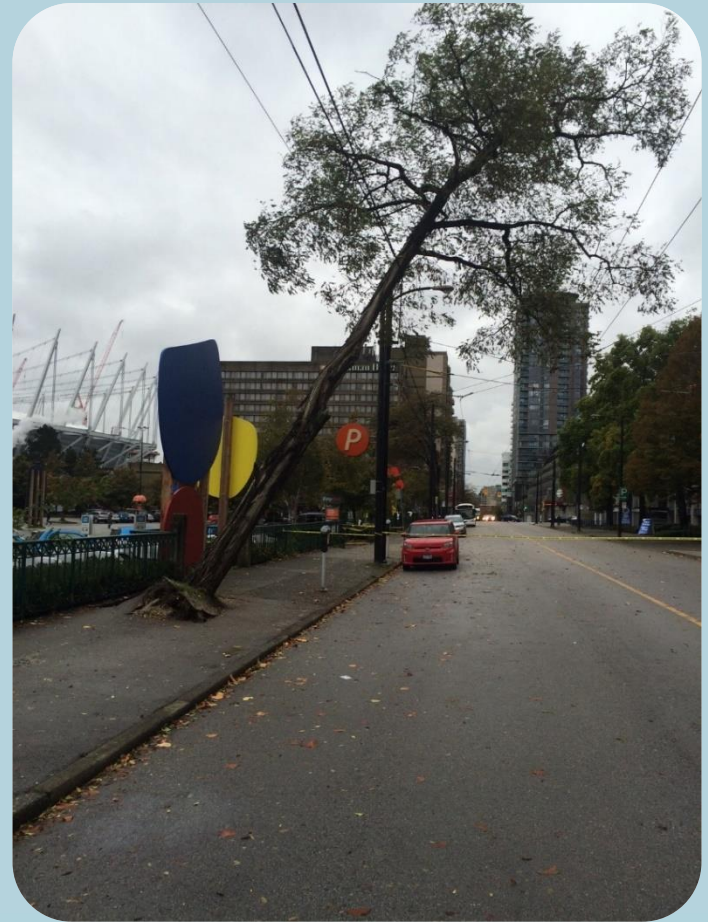
- Impact
  - Power outages
  - Blocked roads
  - Building damage
  - Damaged fleet
  - Inability to communicate
  - Worker safety concerns



<https://earth.nullschool.net>

# High Winds

- Operational Adaptation
  - Bus bridge for rail
  - Re-routes
  - Customer alerts
  - Coordination with stakeholders
  - Backup power





# High Winds

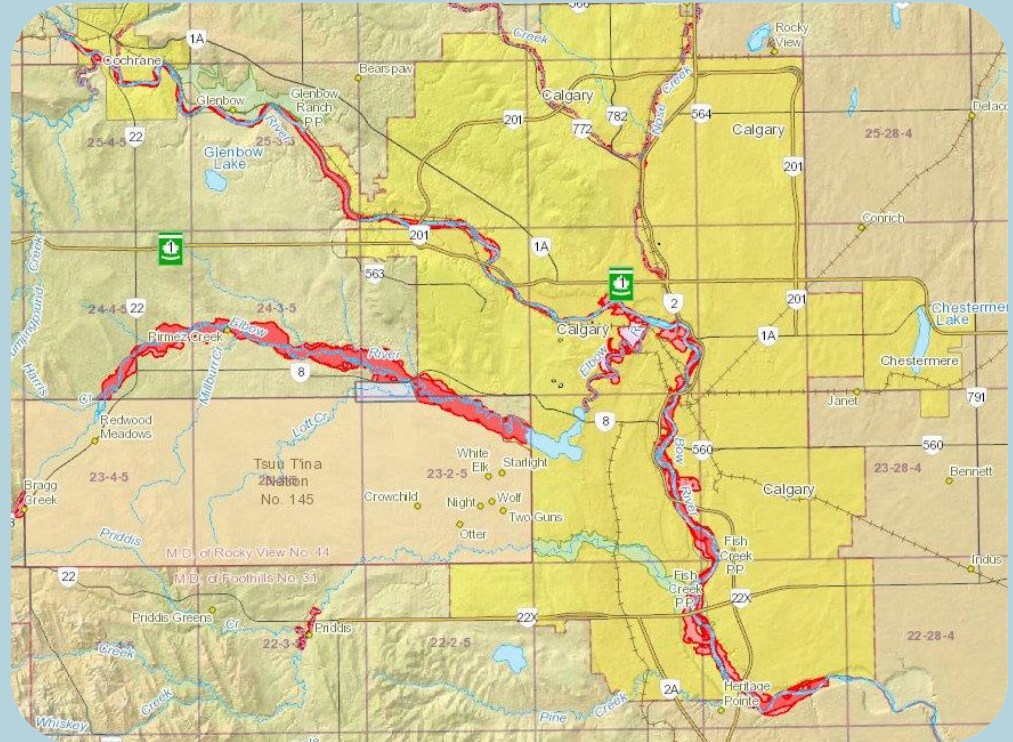
- Infrastructure Adaptation
  - Building design
  - Warning systems
  - Tree trimming
  - Backup power
  - Power line location



2016 – Burnaby Transit Centre

# Flooding

- Impact
  - Roads flooded
  - Bridge damage
  - Customer impacts
  - Power disruptions
  - Airport disruptions
  - Facilities flooded



2013 Calgary Flood

# Flooding

- Operational Adaptation
  - Flood plans
  - Customer communications
  - Service re-routes
  - ICS/EOC
  - Weather/freshet alerts



Photo Credit – City of Calgary



# Flooding

- Infrastructure Adaptation
  - Dikes
  - Property elevations
  - Elevated critical infrastructure
  - Sump pumps/generators



Photo Credit – James McIntosh

# Intense Rainfall

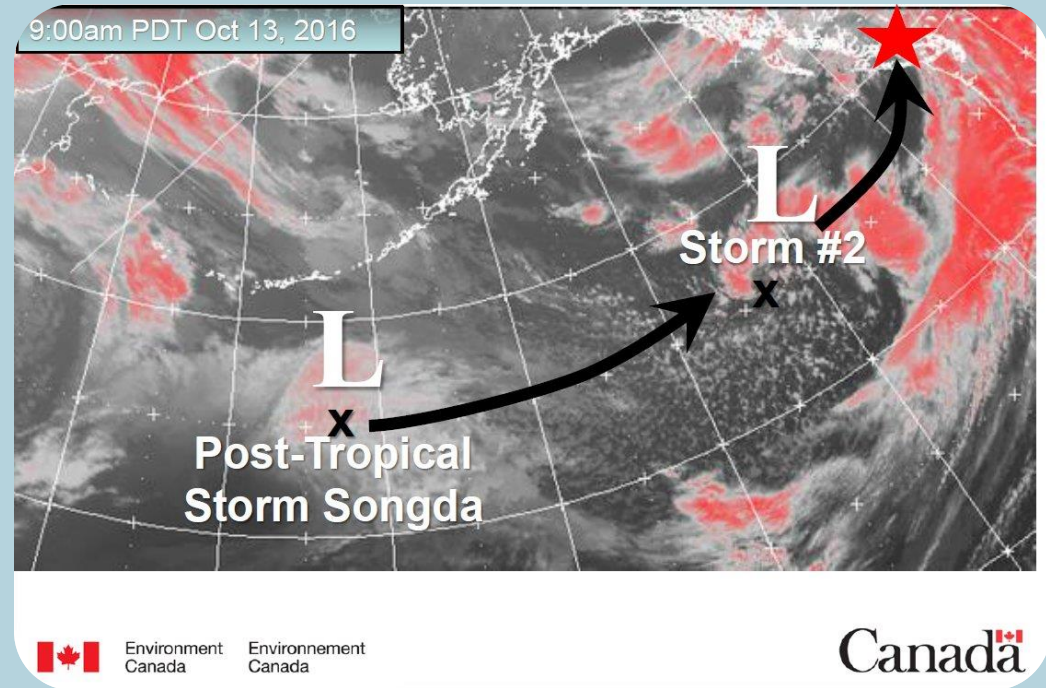
- Impact
  - Road flooding
  - Landslides
  - Storm drainage
  - Buildings flooded
  - Subway flooding
  - Reduce visibility
  - Service re-routes



Toronto Transit Commission - 2012

# Intense Rainfall

- Operational Adaptation
  - Weather alerts
  - Flood plans
  - Internal/external communications
  - Drainage clearing
  - Facilities staff preparations
  - Regional coordination (EMBC)



Matt McDonald - Environment Canada



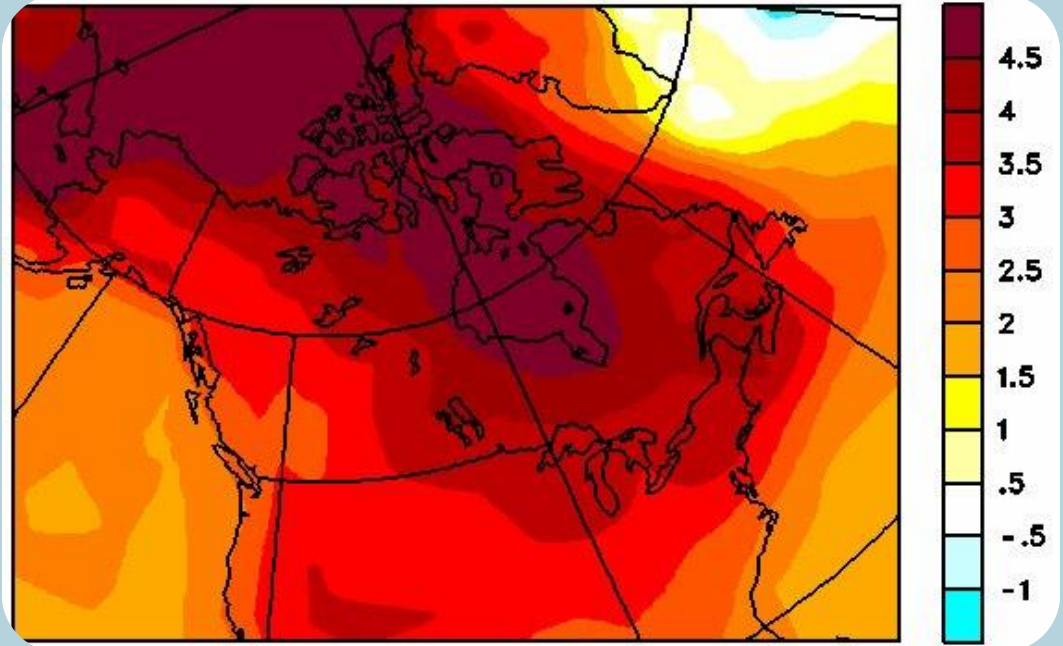
# Intense Rainfall

- Infrastructure Adaptation
  - Storm drainage specifications
  - Elevate assets
  - Sump pumps
  - Elevate key routes



# Intense Heat

- Impact
  - Road damage
  - Rail damage
  - Worker safety
  - Passenger comfort
  - Energy costs



Projected temp change by 2100. Environment Canada

# Intense Heat

- Operational Adaptation
  - Heat Stress communications
  - Ensure water availability
  - Uniform materials
  - Air conditioning

2017-07-31

SB 17-06-

## Safety Bulletin

### REMINDER: Heat Stress (Hot Weather Conditions and Heat-Related Illness)

With the expected high temperatures forecasted for this week, we would like to remind you to take all possible precautions to protect against heat stress.

During hot weather or when working in hot conditions heat-related illnesses may occur, and if not recognized and treated early can lead to serious medical issues (see below). There are some occupations more susceptible to heat related illnesses than others, such as fire fighters with heavy clothing or roofers doing physically heavy work in hot environments. Personal risk factors may increase susceptibility in some individuals, so reports of heat stress must not be overlooked.

Since people respond differently to heat, it is important for managers, supervisors and workers to be aware of how to prevent heat-related illness and recognize the early signs and symptoms of illness.

#### RECOGNIZING THE SYMPTOMS

# Intense Heat

- Infrastructure Adaptation
  - White or green roof to reflect or absorb
  - Large overhangs
  - Deciduous tree shade
  - North facing clerestory



New Hamilton Transit Centre



# Drought and Forest Fires

- Impact
  - Air quality concerns
  - Staff booking off
  - Asset damage or loss
  - Evacuation of service area
  - Water usage limitations



August 2, 2017 - [www.nasa.gov](http://www.nasa.gov)

# Drought and Forest Fires

- Operational Adaptation
  - Regional fire bans
  - Monitoring air quality
  - Reduced bus washing
  - Evacuation plans
  - ICS/EOC training
  - Reduce flammable materials buildup



Fort McMurray, Alberta Fire [www.cbc.ca](http://www.cbc.ca)



# Drought and Forest Fires

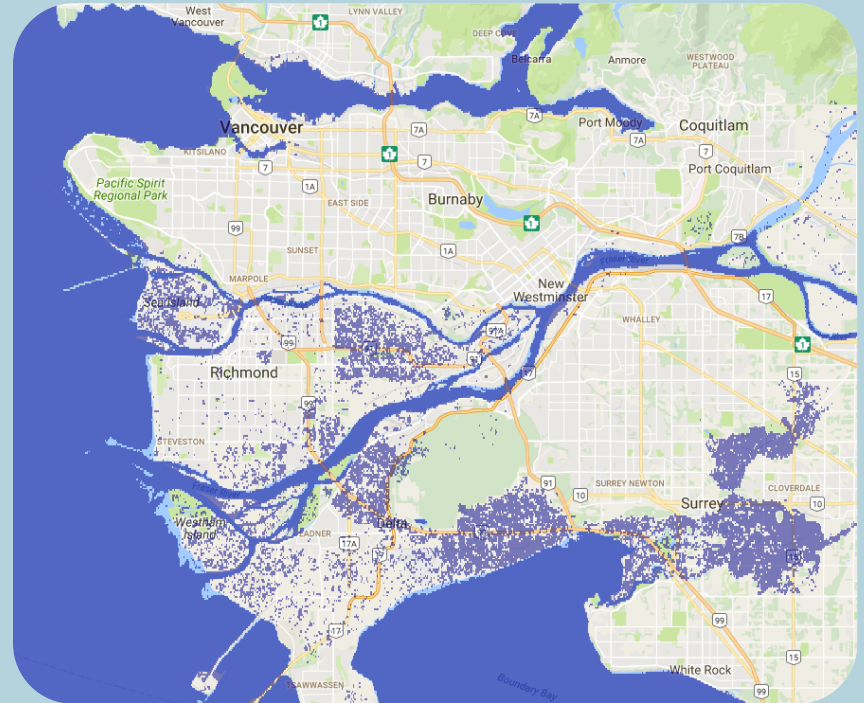
- Infrastructure Adaptation
  - Air intake filtration
  - Asset location
  - Landscaping choices
  - Buffers between assets and forest
  - Fire resistant materials



2016 Fort McMurray, Alberta Fire. [www.cbc.ca](http://www.cbc.ca)

# Rising Ocean Levels

- Future Impact
  - Ocean level increase of 80 to 120 cm in PNW by 2100
  - Increased erosion
  - Damage to infrastructure
  - Ineffective storm drainage
  - Water inundation



Lower Mainland, BC, 1m ocean level rise:  
<http://flood.firetree.net>

# Rising Ocean Levels

- Operational Adaptation (future)
  - Road closures
  - Service re-routes
  - Flood and relocation planning
  - Vulnerability assessments
  - New ferry services?



# Rising Ocean Levels

- Infrastructure Adaptation

- Land use planning
- Dikes/pumps
- Shoreline hardening
- Storm water system redesign/rebuild
- Municipal, regional and/or federal cooperation



Hamilton Transit Centre  
Dike Construction

# Climate Change Mitigation

- Increase transit mode share
- Convert fleets to low/zero emissions
- Reduce facilities emissions
- Sustainable practices



TransLink pilot electric bus



# Climate Change Adaptation in Public Transit

- Climate Change is happening and we must adapt
- We can be part of the solution to mitigate how bad things get





# Climate Change Adaptation in Public Transit

Thank You!

Derek Stewart

[derek.stewart@coastmountainbus.com](mailto:derek.stewart@coastmountainbus.com)

