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CLIMATE IMPACT MAP · CLASSROOM EDITION · BRITISH COLUMBIA 🍁

LESSON PLAN · GRADES 10–12 · BRITISH COLUMBIA

Storm Surge & Extreme Weather: A Vancouver-Centred Investigation

📚 Grades 10–12 (ages 15–18) ⏱ 75 minutes 📍 British Columbia

🌐 theclimateimpactmap.com 🗓 [Date]

🌍 Required Tool: Climate Impact Map

This lesson is built around hands-on use of Climate Impact Map (theclimateimpactmap.com). Students should spend the majority of class time actively exploring the map. Ensure all students have device access before the lesson begins. Classroom licence unlocks all IPCC AR6 scenarios, storm surge, and infrastructure overlays.

Learning Objectives

By the end of this lesson, students will be able to:

1. Describe the key IPCC AR6 sea level rise scenarios and explain the difference between SSP pathways.
2. Use Climate Impact Map to identify flood risk for communities in British Columbia, including Vancouver.
3. Explain how storm surge & extreme weather affects people, infrastructure, and ecosystems differently based on location and socioeconomic status.
4. Connect global climate data to local risk in British Columbia using real NASA and IPCC datasets.

5. Reflect on the relationship between climate science and Indigenous knowledge traditions in this region.

Materials & Setup

- **Climate Impact Map** — theclimateimpactmap.com (Classroom licence required for full access)
- Device per student or per pair (tablet, laptop, or desktop)
- Student observation worksheet (create or adapt from this lesson plan)
- Whiteboard or shared digital document for class discussion
- Optional: printed map of Vancouver and surrounding region for reference

Teacher prep: Before class, navigate to theclimateimpactmap.com and confirm Classroom access is active. Pre-load the map centred on Vancouver and test all scenario buttons referenced in the Main Activity.

Background for Teachers

> 🛰️ **Live NASA Data Integration:** Climate Impact Map displays live Arctic and Antarctic sea ice extent from NSIDC (updated weekly) and active fire detections from NASA FIRMS VIIRS (updated every 24 hours). The Stats panel in the app shows current anomalies versus the 1981–2010 baseline. Reference this data during your introduction to ground the lesson in current conditions.

Storm surge — the abnormal rise of water generated by a storm's winds and pressure — is one of the deadliest and most destructive coastal hazards. During Hurricane Katrina (2005), storm surge reached 8.2 metres in some areas of the Gulf Coast. Hurricane Sandy (2012) drove a 4.3-metre surge into New York Harbor, flooding subway systems and destroying entire coastal neighbourhoods. As sea levels rise, storm surges ride on a higher baseline, reaching further inland with each passing decade.

The NOAA IBTrACS dataset, which powers Climate Impact Map's storm track overlay, contains 724,034 historical tropical cyclone track points dating back over a century. This data reveals clear patterns: storm intensification is increasing as ocean surface temperatures rise, and the geographic range of destructive hurricanes is expanding poleward. Category 4 and 5 storms that once primarily threatened tropical coastlines are now reaching higher latitudes with greater frequency.

Climate Impact Map's storm surge tool allows students to place a surge origin point anywhere on a coastline and model surge heights from Category 1 through Category 5, combined with any sea level rise scenario. This produces a combined inundation picture that reflects real-world emergency management challenges.

Local context — British Columbia: Metro Vancouver's Fraser River delta and Richmond sit at or below sea level, making them among Canada's most flood-vulnerable urban areas.

Lesson Plan

Introduction (11 min)

Begin by asking students: *"What would happen to Vancouver if sea levels rose by 1 metre? By 7 metres?"* Allow 2–3 minutes of discussion. Do not correct or confirm answers yet — capture predictions on the board.

Briefly introduce Climate Impact Map: explain that it uses real GEBCO terrain elevation data, IPCC AR6 projections, and live NASA satellite data. Show the Stats panel briefly to demonstrate that the tool connects to real-time observations.

Frame the lesson: today students will use the same data that climate scientists and emergency managers use to assess flood risk — and they will ground it in the specific geography of British Columbia.

Main Activity — Climate Impact Map Exploration (41 min)

Have students open Climate Impact Map on their devices. Walk through the interface briefly (scenario panel, overlays, Cities tab, click-to-explore). Then proceed through the following steps:

1. **Open the storm surge tool**

   On Climate Impact Map, click anywhere along the coastline nearest your study region. A surge origin marker will appear with preset category options.

2. **Model a Category 1 surge**

   Select **Cat 1 (2 m surge)**. Observe the inundation area. Record which infrastructure types (airports, nuclear plants, UNESCO sites) fall within the affected zone.

3 **Escalate to Category 5**

Switch to **Cat 5 (9 m surge)**. Record: how far inland does the surge reach? What is the estimated population in the affected zone?

4 **Combine with sea level rise**

Keep Cat 3 surge active and add **SSP5-8.5 (+1.0 m)** sea level scenario. Observe how the combined effect differs from surge alone. This represents a likely scenario by 2080.

5 **Review historical storm tracks**

Enable the **Storm Tracks overlay** from the overlays panel. Identify historical storms that have affected your region. How do their paths relate to current population centres?

6 **City stats comparison**

Use the Cities tab to compare two coastal cities — one that has experienced major storm surge historically and one that has not. Compare their risk profiles.

Discussion & Analysis (15 min)

Bring the class together. Use the following discussion questions to deepen analysis and connect data to broader themes:

- How does the combined effect of storm surge + sea level rise differ from either hazard alone?
- Looking at historical storm tracks, has your region been affected by major storms? How has urban development changed since those events?
- What would Category 5 surge mean for evacuation planning in your nearest coastal city?
- Why do lower-income communities often face greater storm surge risk? Use specific examples from Climate Impact Map.

Closing & Exit Ticket (8 min)

Ask students to complete a brief exit ticket (written or verbal) responding to: *"What is one thing you learned today that surprised you, and one question you still have?"*

Collect responses to inform follow-up instruction. Consider sharing standout observations in the next class as a warm-up.

Indigenous Knowledge & Storm Surge & Extreme Weather

The land on which Vancouver stands is the traditional territory of the Musqueam, Squamish, Tsleil-Waututh, and other Coast Salish peoples. Climate change is not an abstract future threat to Indigenous peoples — it is a present reality reshaping relationships with land, water, and community that have been sustained for thousands of years.

Traditional ecological knowledge held by Indigenous peoples in this region provides a long-term record of environmental change that predates Western scientific instrumentation by centuries. Changes in seasonal timing, species behaviour, water levels, and weather patterns observed by knowledge keepers offer invaluable context for interpreting Climate Impact Map data.

When using Climate Impact Map to explore storm surge & extreme weather scenarios, consider: whose land are you mapping? Whose communities appear in the flood zones? How does Indigenous land stewardship — including practices like cultural burning, salmon habitat management, and coastal resource governance — relate to climate resilience?

Reflection Prompt

How can Western scientific data (like IPCC AR6 projections and NASA satellite data) and Indigenous traditional ecological knowledge complement each other in understanding and responding to climate change? What would it look like to genuinely centre Indigenous voices in climate adaptation planning for this region?

Suggested resource: Consult the First Peoples' Cultural Council (BC), Ontario Native Education Counselling Association, or your region's tribal nation websites for climate-related traditional knowledge resources.

Assessment Rubric

Criteria	Beginning (1)	Developing (2)	Applying (3)	Extending (4)
Analyzes IPCC AR6 scenarios with accuracy	Shows limited understanding; requires significant support to complete tasks.	Shows basic understanding; completes tasks with some guidance and occasional errors.	Demonstrates solid understanding; completes tasks independently with minor errors.	Demonstrates thorough understanding; extends thinking beyond task requirements with insight.
Evaluates regional risk with supporting evidence	Shows limited understanding; requires significant support to complete tasks.	Shows basic understanding; completes tasks with some guidance and occasional errors.	Demonstrates solid understanding; completes tasks independently with minor errors.	Demonstrates thorough understanding; extends thinking beyond task requirements with insight.
Synthesizes CIM data into coherent arguments	Shows limited understanding; requires significant support to complete tasks.	Shows basic understanding; completes tasks with some guidance and occasional errors.	Demonstrates solid understanding; completes tasks independently with minor errors.	Demonstrates thorough understanding; extends thinking beyond task requirements with insight.
Critically examines equity and policy dimensions	Shows limited understanding; requires significant support to complete tasks.	Shows basic understanding; completes tasks with some guidance and occasional errors.	Demonstrates solid understanding; completes tasks independently with minor errors.	Demonstrates thorough understanding; extends thinking beyond task requirements with insight.

Extension Activities

1. Research the Emergency Management plan for your nearest coastal municipality. Does it model combined storm surge + sea level rise scenarios similar to what you explored? Write a 1-page assessment.

2. Using NOAA IBTrACS data (available at ncei.noaa.gov), identify the five most destructive storms to affect your region in the past 50 years. Map their tracks and surge heights alongside Climate Impact Map projections.
3. Design a "climate-adapted" coastal neighbourhood that could withstand Cat 3 surge + 1 m sea level rise. Include infrastructure choices, building standards, and evacuation routes.

Curriculum Connections

Curriculum Standard: British Columbia Ministry of Education — Science, Social Studies, Environmental Learning

This lesson addresses outcomes related to: Earth and environmental science; climate systems and human impact; geographic inquiry and spatial thinking; data literacy and scientific reasoning; social justice and equity in environmental contexts; Indigenous perspectives and land relationships.

Cross-curricular connections: Social Studies (geopolitics of climate change), Mathematics (data interpretation, percentages, scale), Language Arts (persuasive writing, research), Indigenous Education.