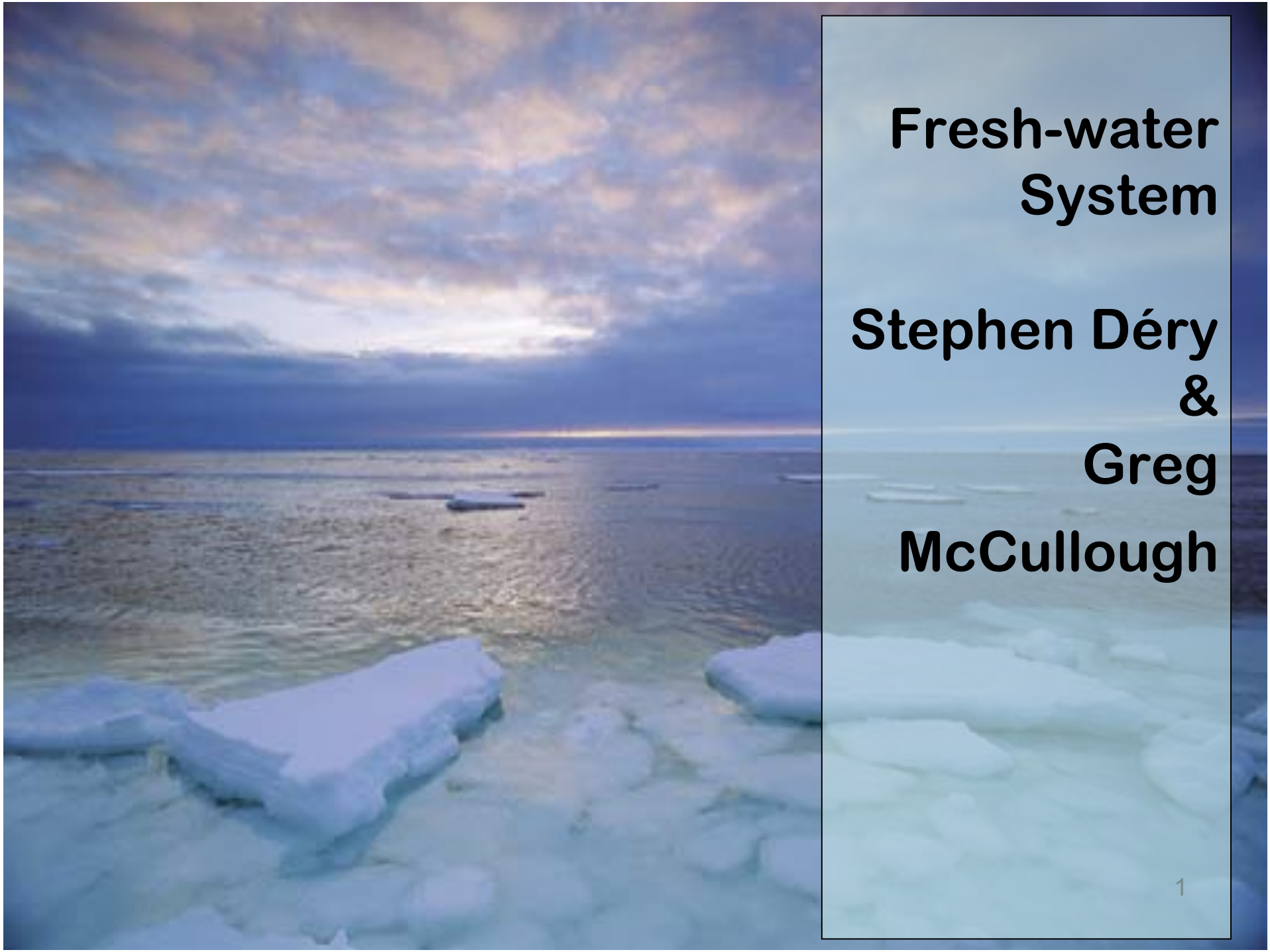

Fresh-water System

Stephen Déry
&
Greg McCullough

Knowns (1)

- Good understanding of streamflow input to Hudson Bay including the Nelson River for past ≈40-50 years.
- Flow regulation strongly affects streamflow seasonality affecting the bay's baroclinicity
- Increase in streamflow input to Hudson Bay over last two decades, reversing a previous declining trend.
- Atmospheric fluxes are secondary terms in the freshwater budget of Hudson Bay.

Knowns (2)

- Deep water formation with up to 6-16% of annual river discharge
- Extended plumes of freshwater under sea ice during spring that retract as ice melts and wind mix the waters
- Freshwater exchange between the boundary current and interior of Hudson Bay, storing up to 25% of river discharge
- Low inputs of nutrients for primary production being delivered by rivers

Knowns (3)

- Sediments in the Nelson-Hayes Estuary sourced more so by the marine environment rather than rivers (8 million vs 1.5-2 million tonnes)
- Rivers provide the largest input of mercury and CDOM to Hudson Bay
- Rivers are important for buoyancy-driven circulation and strong vertical stratification of Hudson Bay
- River waters contribute over 70% of freshwater export to the Labrador Sea

Knowns (4)

- River discharge impacts marine mammals such as belugas, bearded seals, etc.
- Future scenarios of the Winnipeg River Basin show greater range in extreme flow conditions
- Conawapa generating station unlikely to significantly impact Nelson River estuarine conditions

Known Unknowns (1)

- What are the roles of (terrestrial) anthropogenic disturbances & climate (and their cumulative effects) on Hudson Bay freshwater fluxes & stocks?
- What are the contributions of ungauged basins to the Hudson Bay freshwater budget? Access to data also a concern.
- What are the prospects for the future (reliability of numerical models)?
- What are the regional & global impacts of a changing Hudson Bay freshwater budget?

Known Unknowns (2)

- More information on the sediment budget needs to be established as relative contribution of watershed (rivers) and shores (nearshore littoral erosion) is not quantified.
- Nutrient loading information gaps remain. Only occasional sampling represents most rivers. Some loading will be influenced by anthropogenic loading and climate change (e.g. eutrophication of Lake Winnipeg)

Known Unknowns (3)

- Fate of sediments in Nelson estuary (are local bottom sediments transitory?)
- Significance to estuarine PP of increased under-ice vs. open water delivery of nutrients

Known Unknowns (4)

- Has flow regulation affected sea ice production in Hudson Bay?
- Why do the Churchill and Nelson rivers behave differently in delivering mercury to the bay?
- What is the annual cycle of nutrient delivery by Hudson Bay rivers?
- How are changing atmospheric fluxes impacting Hudson Bay's freshwater budget?

What we really need to know (?)

- How tightly coupled are the freshwater and marine environments of Hudson Bay and is that changing over time?
- How will future hydrological extremes evolve in a non-stationary environment and what will be their impacts on the marine environment?
- What are the linkages between freshwater and ecological functions/habitats, economic opportunities, tourism and recreation, cultural significance, etc.