Abstract

The present study uses the Sedflux stratigraphic model to simulate the Late Pleistocene evolution of the Eastern Beaufort Continental Shelf, Canadian Arctic. During this period, the proximity and the dynamics of the Laurentide Ice Sheet (LIS) created a complex glacial environment. Modelling such environments thus presents challenges. Modules and input parameters have to be able to simulate major fluctuations in sea-level and sediment supply, an ever evolving source of sediments, a large outwash plain, sudden outburst floods, permafrost aggradation, glacial isostasy, etc. In addition, detailed understanding of glacially-influenced environments in general and the glacial history of the local region specifically make it difficult to estimate parameters such as sediment supply. This poster thus presents the challenges and the potential solutions in using SEDFLUX to simulate the stratigraphy of a glaciated shelf such as the Beaufort Shelf.

Mackenzie Delta:

Experiment on sediment supply:

Last 4500 years
Decelerating sea-level rise

Model challenge: Estimate sediment supply over long-time period, for which measurements are not available.

Results:

1. Up to 10 times the amount of the modern sediment supply estimate is necessary to approach the necessary volume to fill the trough.
2. The geometry of the delta is however not reproduced. Other processes, such as storms and sea-ice dynamics, may be responsible.

Beaufort Shelf:

Experiment on the effect of sea-level:

Constant sediment supply

Model challenge: Characterise the impact of sea-level fluctuations in an environment where detailed stratigraphy is lacking.

Objectives:

- Verify, based on stratigraphic and bathymetric interpretation, if the modern sediment supply used over a 500 year period is sufficient.

30 ka runs

Results run 4 & 5: Use the "empirical" relative sea-level (RSL) containing a knowledge effect and the statistical relative sea-level (SRL) curve under a constant sediment supply.

Results run 6 & 7:
1. The core section in Run 6 produces a stratigraphic pattern closer to the observed than the GSL curve.
2. A closer match could probably be achieved by using variable sediment supply more representative of the different epochs characterizing the last 30 ka.

120 ka run

Run 8: Models the stratigraphy since the last interglacial using a GSL curve combined with the RSL + characterizing the last 30 ka.

Results:

- Propagation (10 km) of the shelf.
- Thin deposition towards the shelf edge (100 m).
- The core section at Utik is as thick and similar in pattern as 6.
- The sediments are, however, much older (120-100 ka BP) and thus, do not match the existing data.

Future experiments:

Considering the last interglacial-glacial cycle, how would you define the specific and quantify the different model parameters for this region?

Introduction

The Eastern Beaufort Shelf is bounded to the west by the glacially carved Mackenzie Trough. The trough and the shelf were occupied by the Mackenzie ice sheet between 122 and 36 ka cal BP. During this latest glacial period, the Laurentide Ice Sheet (LIS) generated a glacial outwash 7 and the exposed shelf allowed permafrost aggradation 8. Between 11 and 5 ka cal BP, surficial peats from glacial Lake Aganie covered the region, leaving some evidence in the form of a bulldozer layer along the shoreline and a regional unconformity identified in the offshore stratigraphy 9. During the Holocene, the Mackenzie River became the principal source of sediment supply for the shelf: the supply mostly diverted into the Mackenzie Trough, but with a small contribution flowing towards Hanging Bay (KB) and Trough. Today, sea ice covers the region year around with the exception of the four summer months. Thus, most sediment is supplied to the offshore during open-water season and distributed according to the wind-driven currents and ocean storms 10.

References

- Blasco, personnal communication