Temporal and spatial variations in coastal dynamics along the Yukon coast, Canada

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Background

- 1/3 of all coasts worldwide consist of permafrost
- Permafrost contains 2 x more carbon as is circulating in our atmosphere
- Arctic coasts erode up to 30 meters per year
Methods: Field studies

GPS Data

Field surveys

Previous GSC field surveys

- Re-calculate values using CSRS-PPP*

cm-accurate GPS data

Cliff profiles

Rel. cliff position changes btw. time periods

*CSRS-PPP: Canadian Service Reference System Precise Point Positioning

- Accuracy: < 10 cm
- Coverage: 8 GSC monitoring sites
Methods: Remote sensing

Remote Sensing Data

- Aerial imagery (1950’s, 1970’s, 1990’s)
- Intermediate DEM
  - Yukon Geomatics DEM
  - LiDAR
- GeoEye and World View scenes (2011)
- Shoreline digitalization

DSAS

- * Esri ArcGIS: Digital Shoreline Analysis System
- DSAS results
- Long-term shoreline change statistics
  - Time span: 1951 – 2011
  - Accuracy: < 10 m
  - Coverage: Entire Yukon coast

Shoreline changes btw. time periods
Results: Whole coast

DSAS statistics show that during the time period 1952 – 2011:

- 13% of all transects recorded accumulation > 0.5 m/a
- 87% of all transects recorded erosion > 1 m/a
Results: Whole coast

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Results: Yukon-Alaska Border

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Erosion Rate [m/a]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-2015</td>
<td>3.3</td>
</tr>
<tr>
<td>2006-2012</td>
<td>1.1</td>
</tr>
<tr>
<td>1999-2006</td>
<td>1.2</td>
</tr>
<tr>
<td>1991-1999</td>
<td>1.1</td>
</tr>
</tbody>
</table>

8/10
## Results: Stokes Point west

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<tr>
<th>Time period</th>
<th>Erosion rate [m/a]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2004-2015</td>
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<tr>
<td>2007-2014</td>
<td>8.8</td>
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<tr>
<td>2006-2007</td>
<td>0.5</td>
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<tr>
<td>1999-2006</td>
<td>0.2</td>
</tr>
<tr>
<td>1997-1999</td>
<td>1.1</td>
</tr>
</tbody>
</table>

The background aerial image is a GeoEye scene from 2011. It is covered by a georeferenced aerial imagery from 1996.
Conclusions

- Arctic coastal erosion shows high spatial and temporal variability.

- The variability of erosion seems to be multi-causal. It cannot be solely explained by internal factors like exposure or ice-content.

- The overall trend goes towards accelerating coastal erosion.
Research funding:

Thank you for your attention