Characterizing marine heatwaves in British Columbia waters

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The classic NE Pacific Marine Heat Wave: The Blob

Sea Surface Temperature in Feb 2014

Persistent Alaska warmth this fall has brought back ‘the blob.’ If it lasts, it could mean a wild winter in the Lower 48.

Livingston, I. 2018. Persistent Alaska warmth this fall has brought back ‘the blob.’ If it lasts, it could mean a wild winter in the Lower 48. Washington Post, October 18, 2018. 
https://www.washingtonpost.com/weather/2018/10/18/persistent-alaska-warmth-this-fall-has-brought-back-blob-if-it-lasts-it-could-mean-wild-winter-lower/
Questions

• Do the marine heat wave statistics at coastal lighthouses reflect those seen on the shelf? This would allow for analysis of records extending back 80-100 years.

• What can we say about the origins of the 2018-19 Marine Wave in northern BC?
BC Shore Station Monitoring Program
Data

• Compute daily SST from a network of weather buoys that has existed since about 1990.
• Using daily measurements from the lighthouses
• Compute mean annual cycle and 90th percentile for the reference period 1990-2019 or record length if we don’t have 30 years.
• With 30 years of data, there will be almost 1100 days with SST in excess of the 90th percentile.
• Marine Heatwaves are those events lasting for 5 or more days.
### The Blob Years

#### Station Number of days

<table>
<thead>
<tr>
<th>Station</th>
<th>Number of days</th>
<th>$i_{\text{max}}$</th>
<th>$i_{\text{cum}}$</th>
</tr>
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<tbody>
<tr>
<td>Amphitrite Light</td>
<td>205</td>
<td>0</td>
<td>3.95</td>
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<tr>
<td>La Perouse Buoy</td>
<td>186</td>
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#### Weather Buoy

- 90th
- 10th
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<th>$i_{max}$</th>
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<td>94</td>
<td>0</td>
<td>3.54</td>
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<tr>
<td>La Perouse Buoy</td>
<td>81</td>
<td>5</td>
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<td>Amphitrite Light</td>
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<td>5.07</td>
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<td>La Perouse Buoy</td>
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<td>4.76</td>
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<td>Bonilla Light</td>
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<td>2.48</td>
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<tr>
<td>North Hecate Buoy</td>
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<td>3.67</td>
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<td>(i_{\text{cum}})</td>
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<tr>
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<tr>
<td>North Hecate Buoy</td>
<td>428</td>
<td>5.68</td>
<td>733</td>
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Satellite SST ANOMALY
18-24 November 2018

Persistent Alaska warmth this fall has brought back ‘the Big Freeze’
If it lasts, it could mean a wild winter in the Lower 48.
North Hecate 2018-2019

North Hecate - 2018 to 2019

- 2018 no cooling in Sept/Oct
- Then cools at normal rate
- 2018 ends warm
- 2019 starts warm
- 2018 first warming event
- 2019 lack of fall cooling

NOAA MHW press release
Sept 5, 2019
October 2018 - the peak of the SST anomaly along the west coast

• October 2018 - the peak of the SST anomaly along the west coast

• High pressure keeping weather systems from reaching the west coast.

• This pressure anomaly is high enough in the atmosphere to be an indicator of jet stream activity.

• Notice the east west dipole.

• This system is pushing air into the Arctic over the north Pacific and that air then comes back down across continental North America.

• September and November showed a similar pattern.
2018-19 Story for BC

• Lack of cooling (as opposed to warming) is an important part of the MHW story in the fall.

• In 2018, the lack of fall cooling was likely due to the lack of fall storms (there were none).

• Then when the storms resumed they cooled the ocean at the usual rate. Which means the warm anomaly remained well into the winter.

• Anomaly remains until there are a series of stronger than ‘normal’ storms. So you don’t need the 500 mb height anomaly to persist all fall and winter.

• This is likely part of the story for the 2014-2016 Blob event as seen at the weather buoys.
Days in excess of 90th percentile: 2010-2019

Maximum value is a bit less than 1100 days. Expected value for 10 years is about 360 days.
Cat1+ Marine Heatwave days: 2010-2019
Potential links between Marine Heat Waves and Drought

The proximal cause of California’s multiyear drought is the remarkable persistence of a region of mid-tropospheric high pressure known as the “Ridiculously Resilient Ridge”. Swain 2015.

Notice the anomaly is centred at the latitude of Victoria not California.

In 2018 the ridge was centred in Alaska and we had a drought in NW BC.

Any relationship between Marine Heat Waves and drought will be mediated by how the atmospheric ridge modifies the circulation and affects the transport of moisture.
