# A Multi-methods Analysis of Vertical Land Movement in Coastal Washington

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# Motivation

- Provide an estimate of vertical land motion from diverse datasets to assist sea level rise assessments

# Method

- 3D linear interpolation which incorporates regional data, their uncertainties, and a tectonic uplift model

# Inputs


**Geodetic Leveling**

**GPS**


**Tide Gauges**

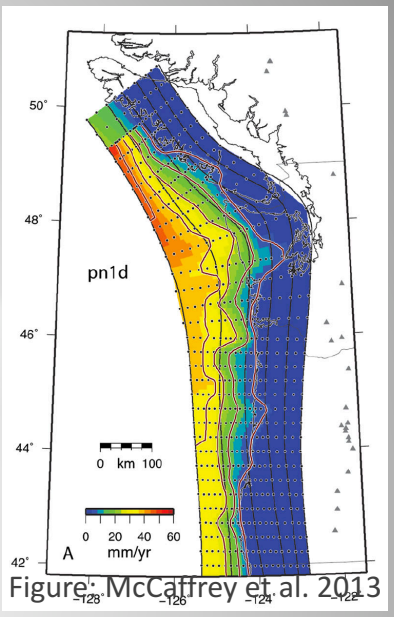


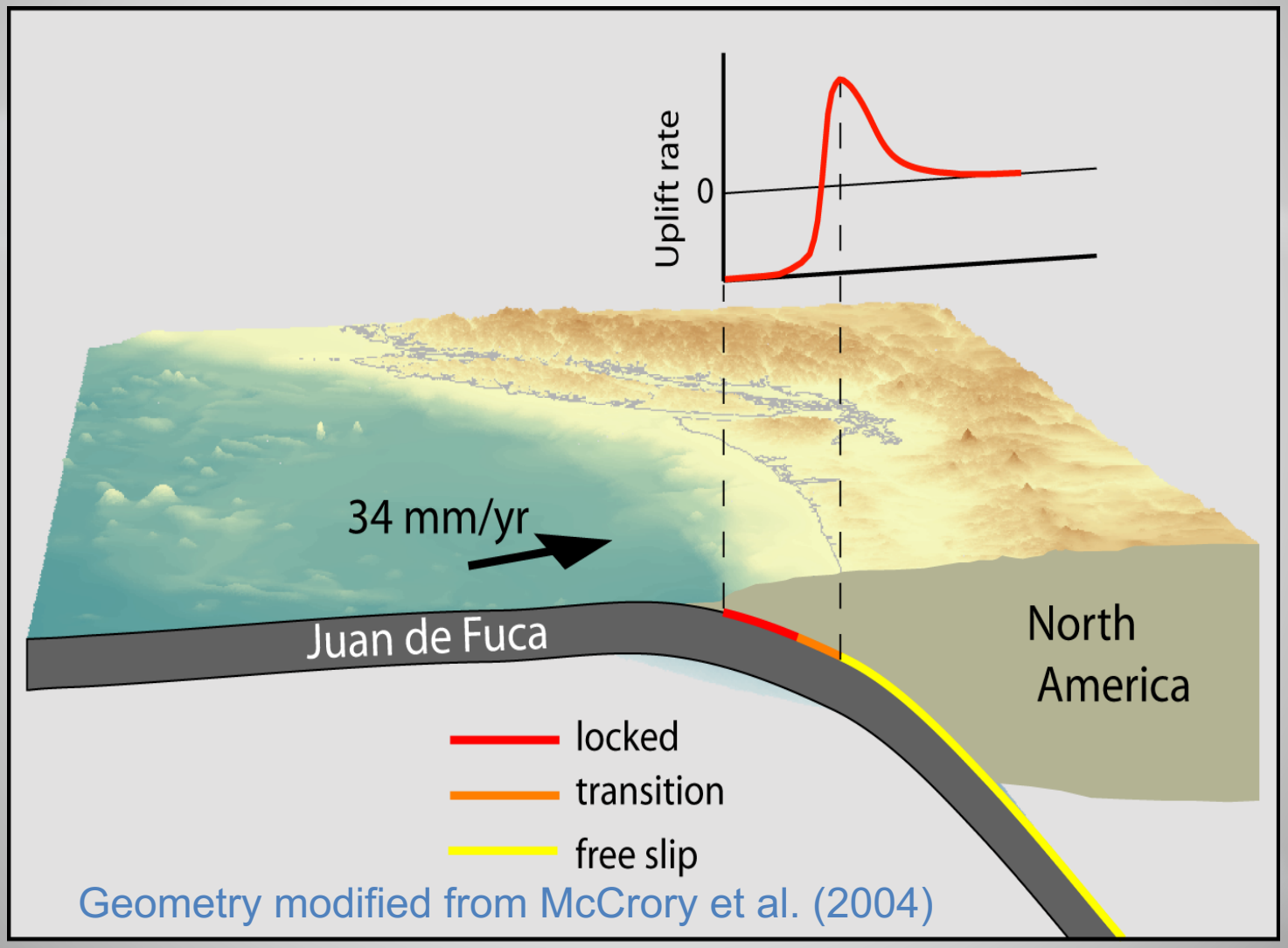

Figure: McCaffrey et al. 2013

**Locking Model**

# Data Coupling

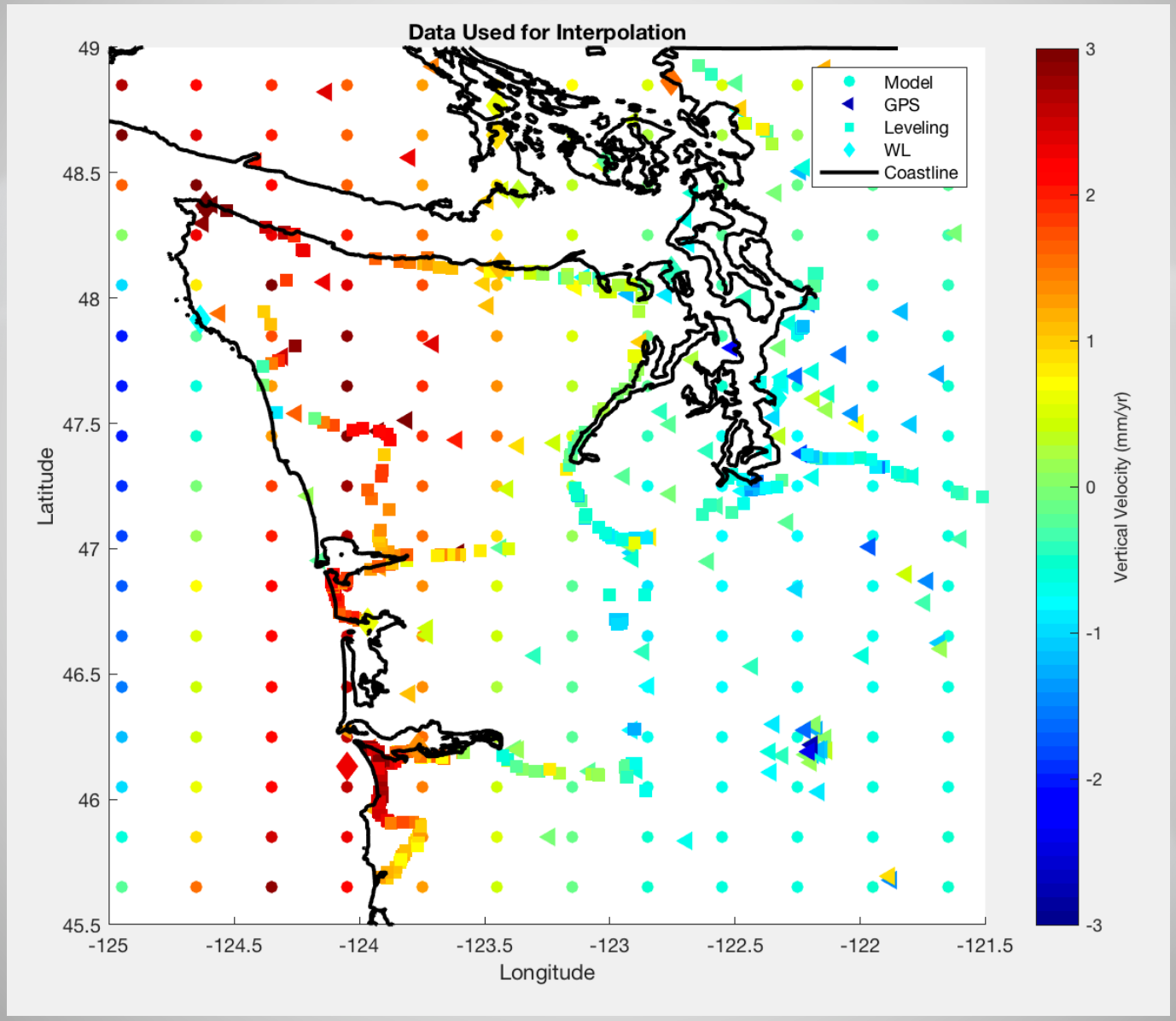
- Data is adjusted to a common reference frame with propagated uncertainties.

# Locking Model

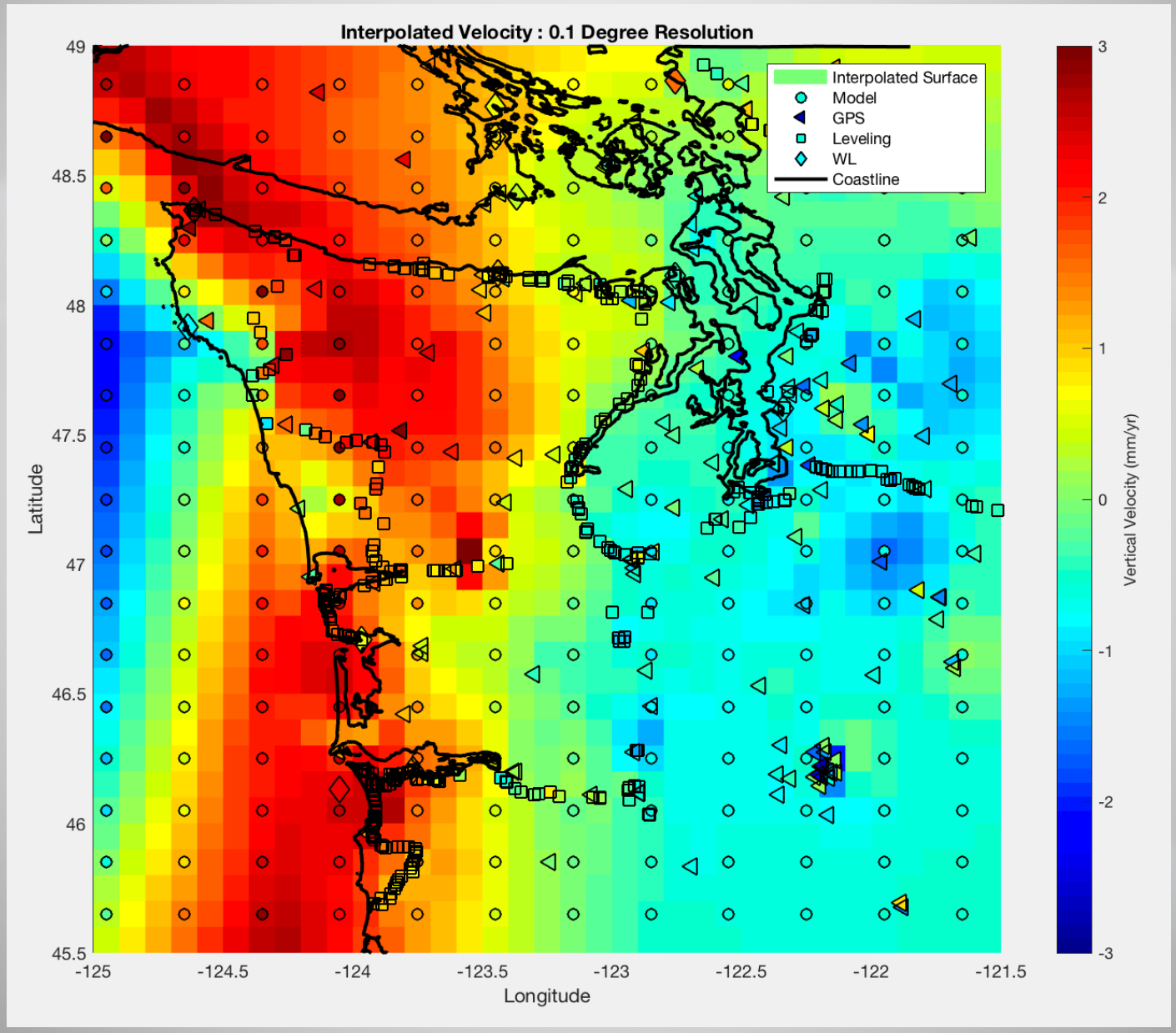



Geometry modified from McCrory et al. (2004)

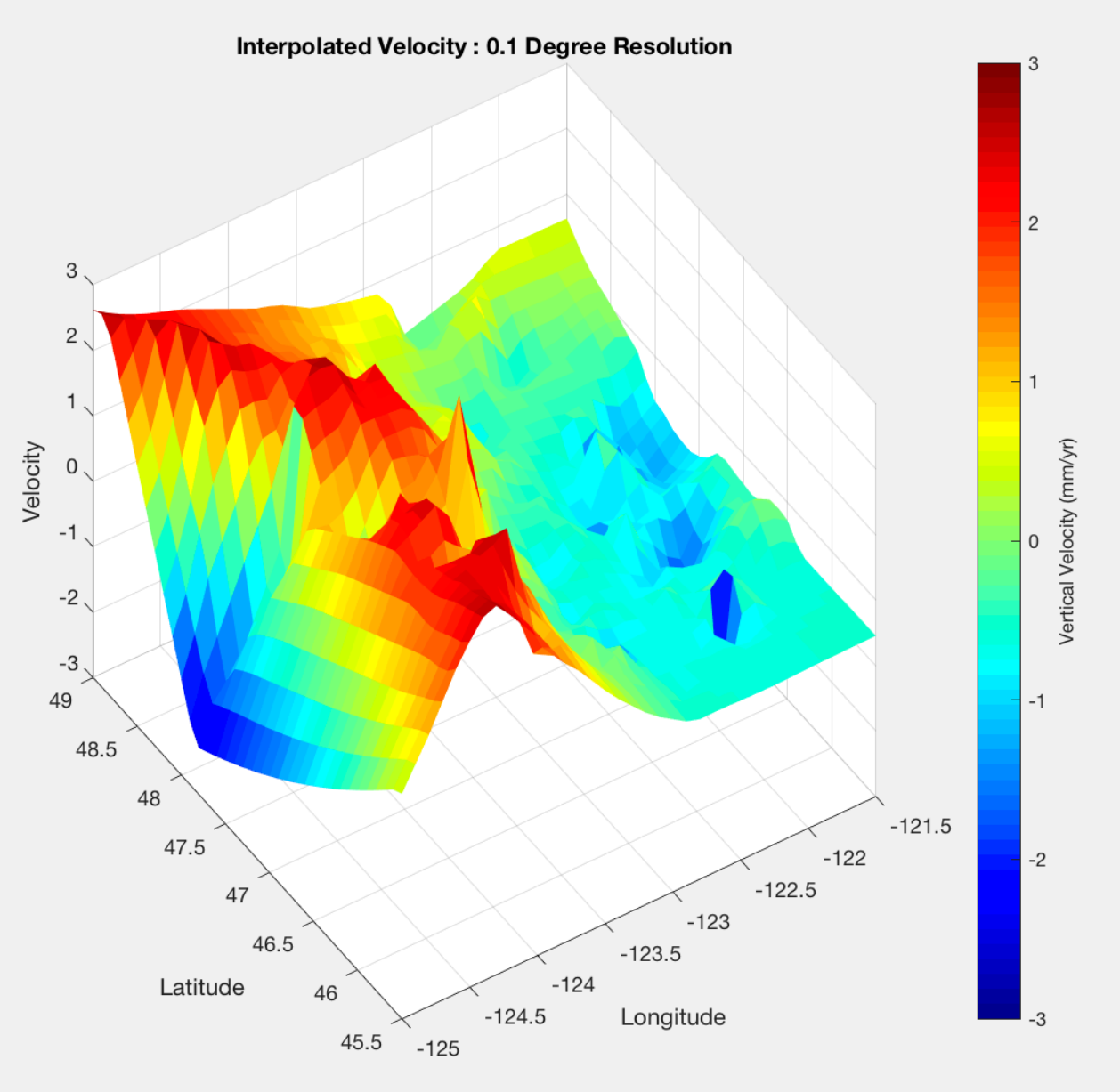
# Inputs


Data Used for Interpolation
Model
GPS
Leveling
WL
Coastline
Latitude
Longitude
Vertical Velocity (mm/yr)
49
48.5
48
47.5
47
46.5
46
45.5
-125
-124.5
-124
-123.5
-123
-122.5
-122
-121.5
3
2
1
0
-1
-2
-3

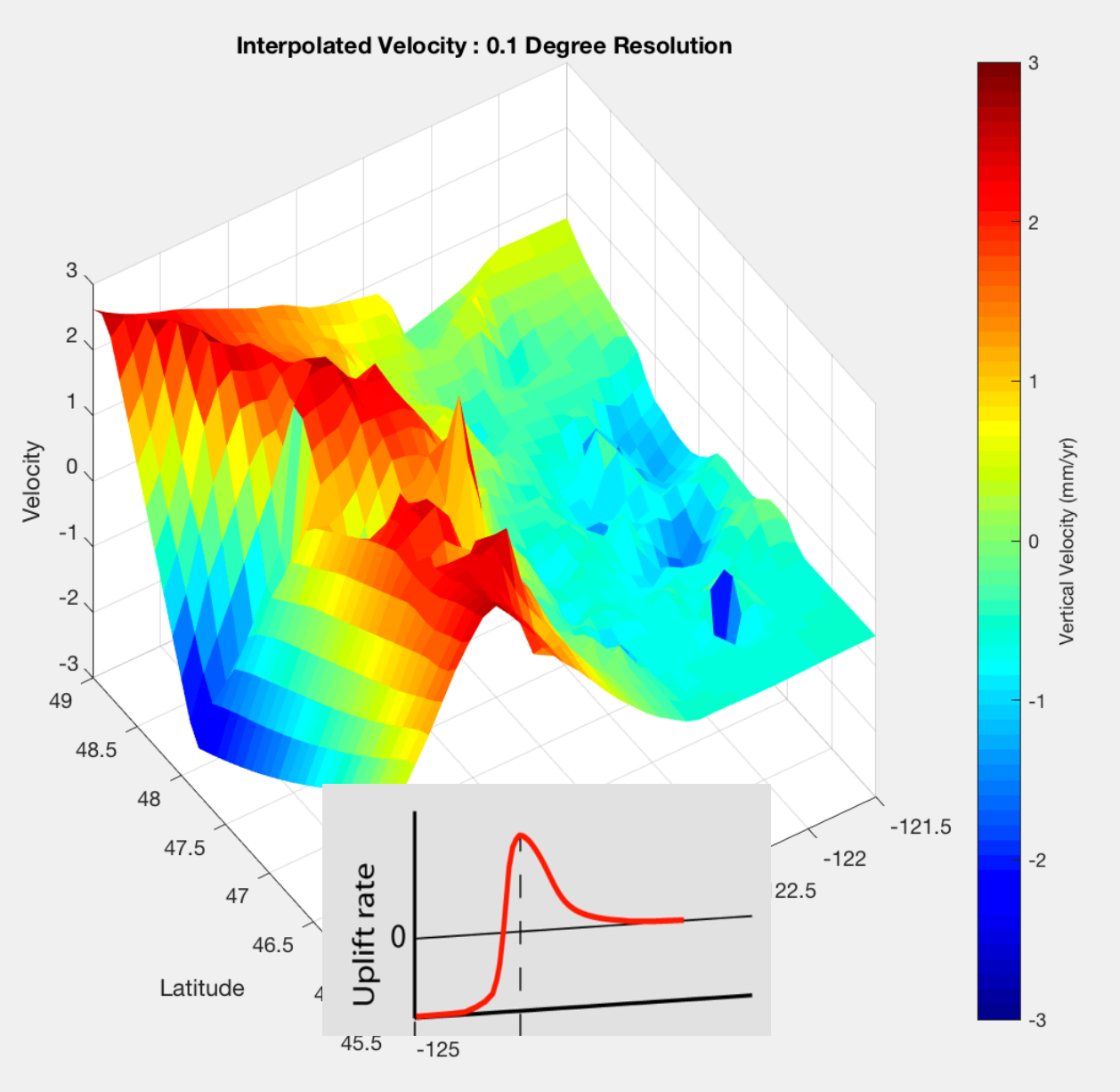
# Interpolated Surface



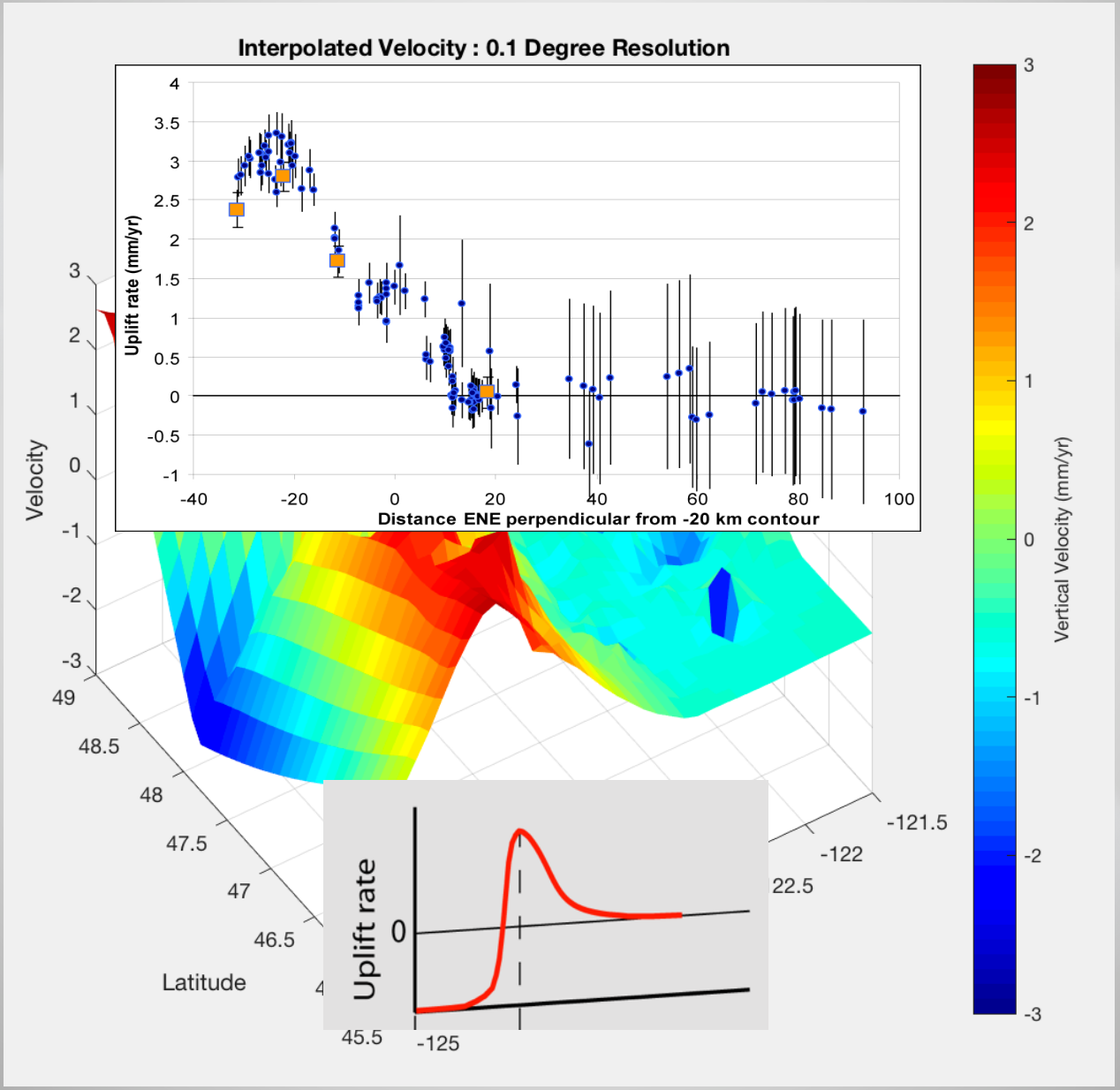
# Interpolated Surface



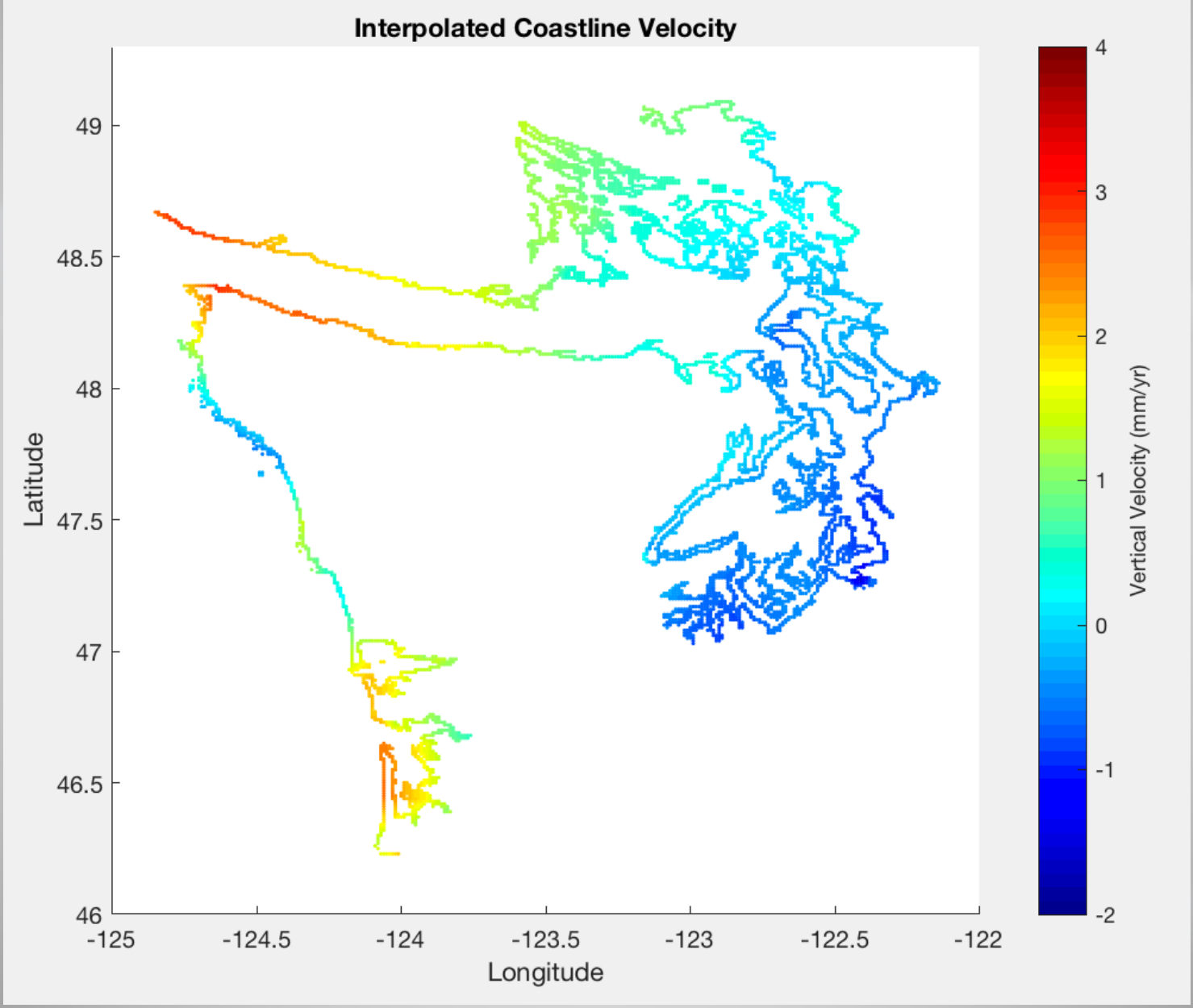
# Interpolated Surface



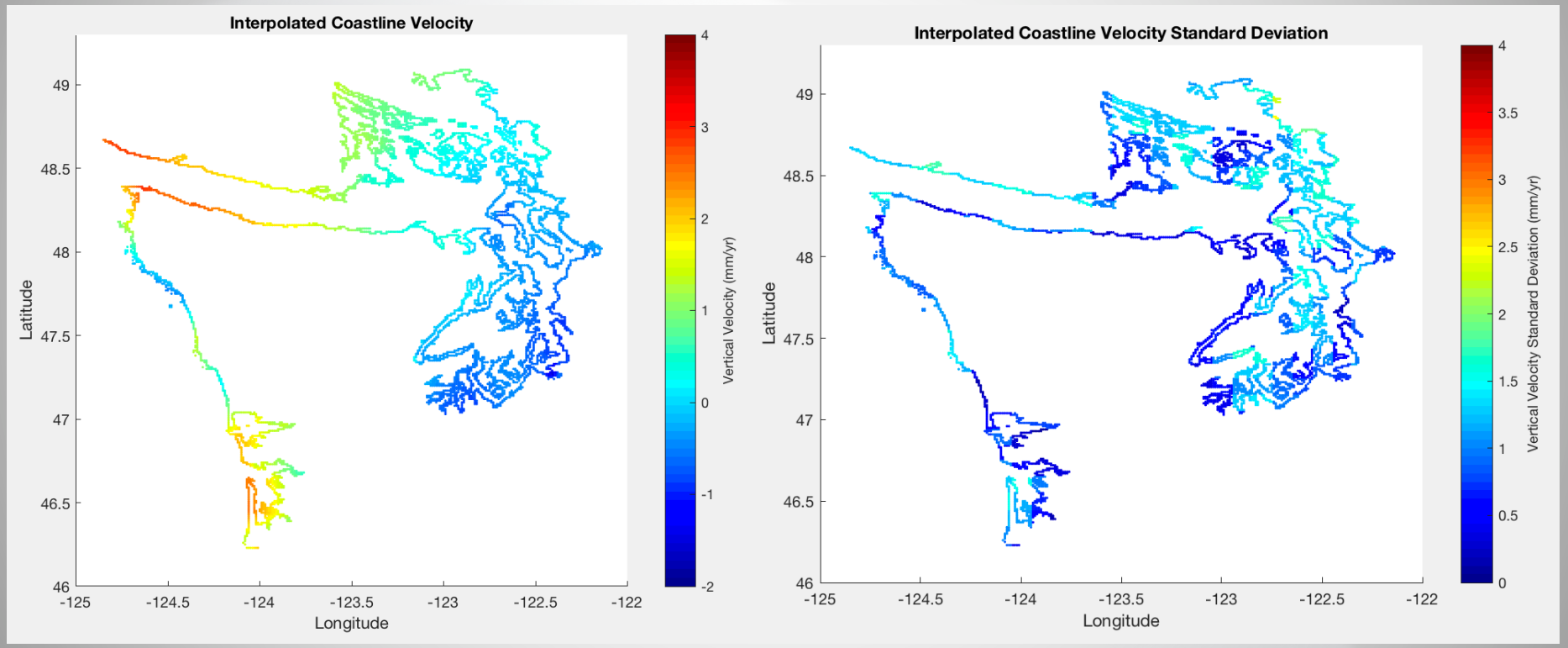
# Interpolated Surface



# Interpolated Coastline Vertical Velocity



# Interpolated Coastline Vertical Velocity Uncertainty



# Inputs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**GPS**


**Tide Gauges**

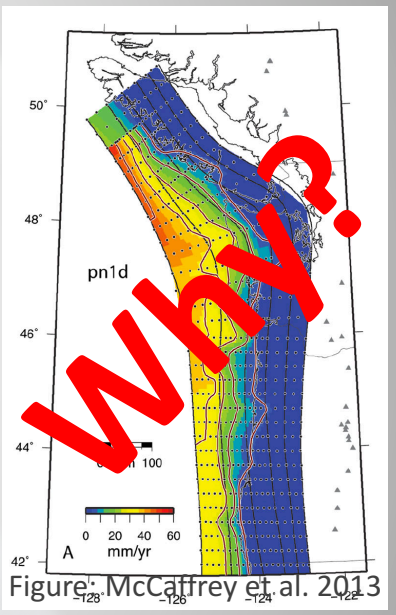
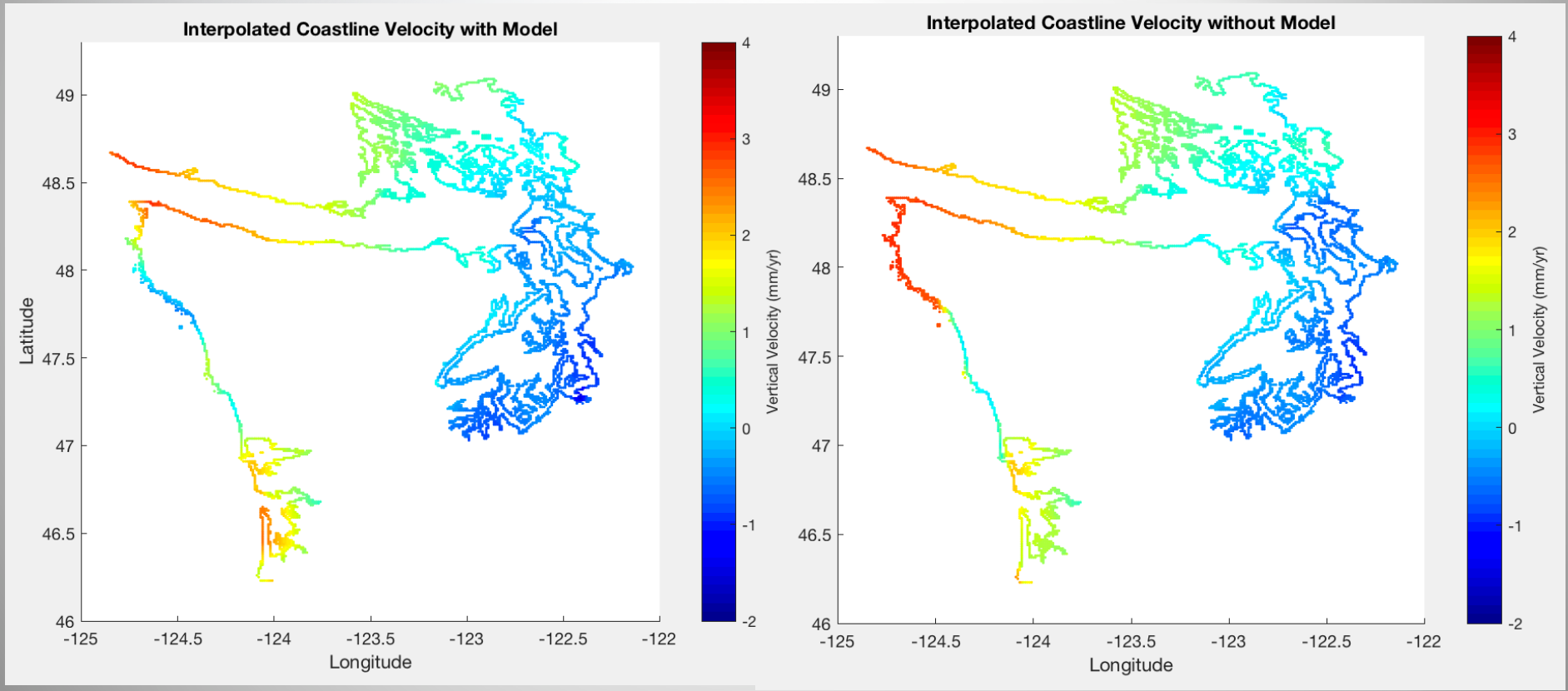
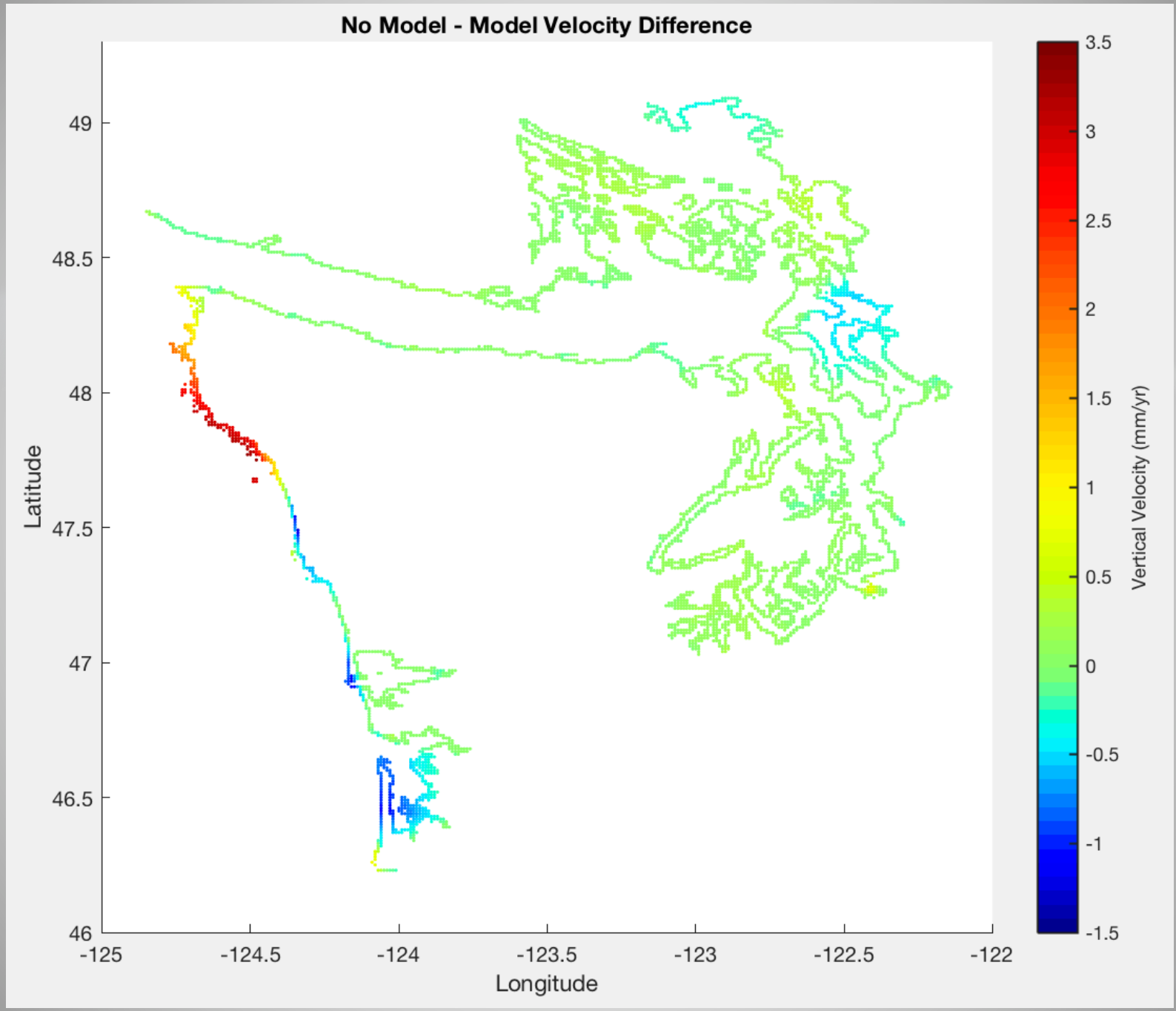



Figure: McCaffrey et al. 2013

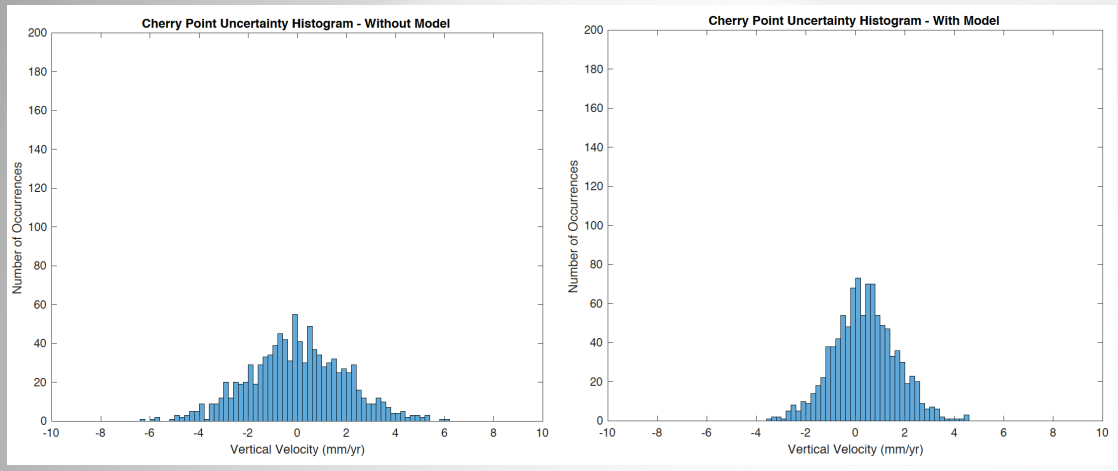
**Locking Model**

# Interpolation with and without Locking Model



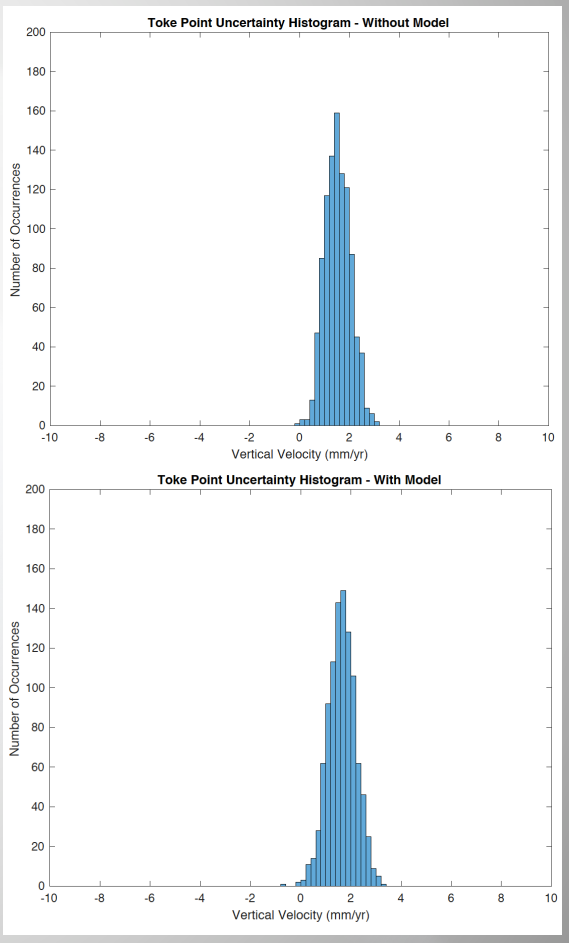

No Model - Model Velocity Difference
Latitude
Longitude
49
48.5
48
47.5
47
46.5
46
-125
-124.5
-124
-123.5
-123
-122.5
-122
Vertical Velocity (mm/yr)
3.5
3
2.5
2
1.5
1
0.5
0
-0.5
-1
-1.5

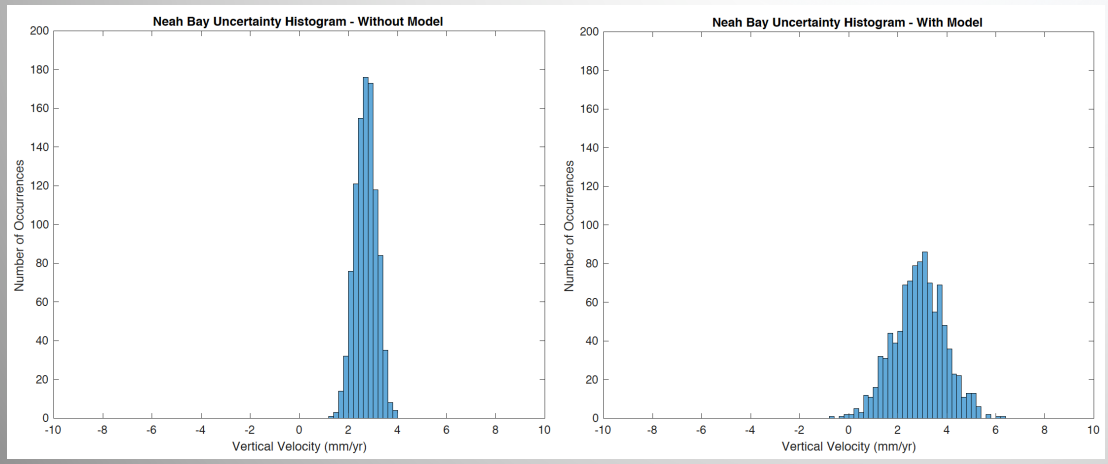
# Interpolated Coastline Vertical Velocity Uncertainty



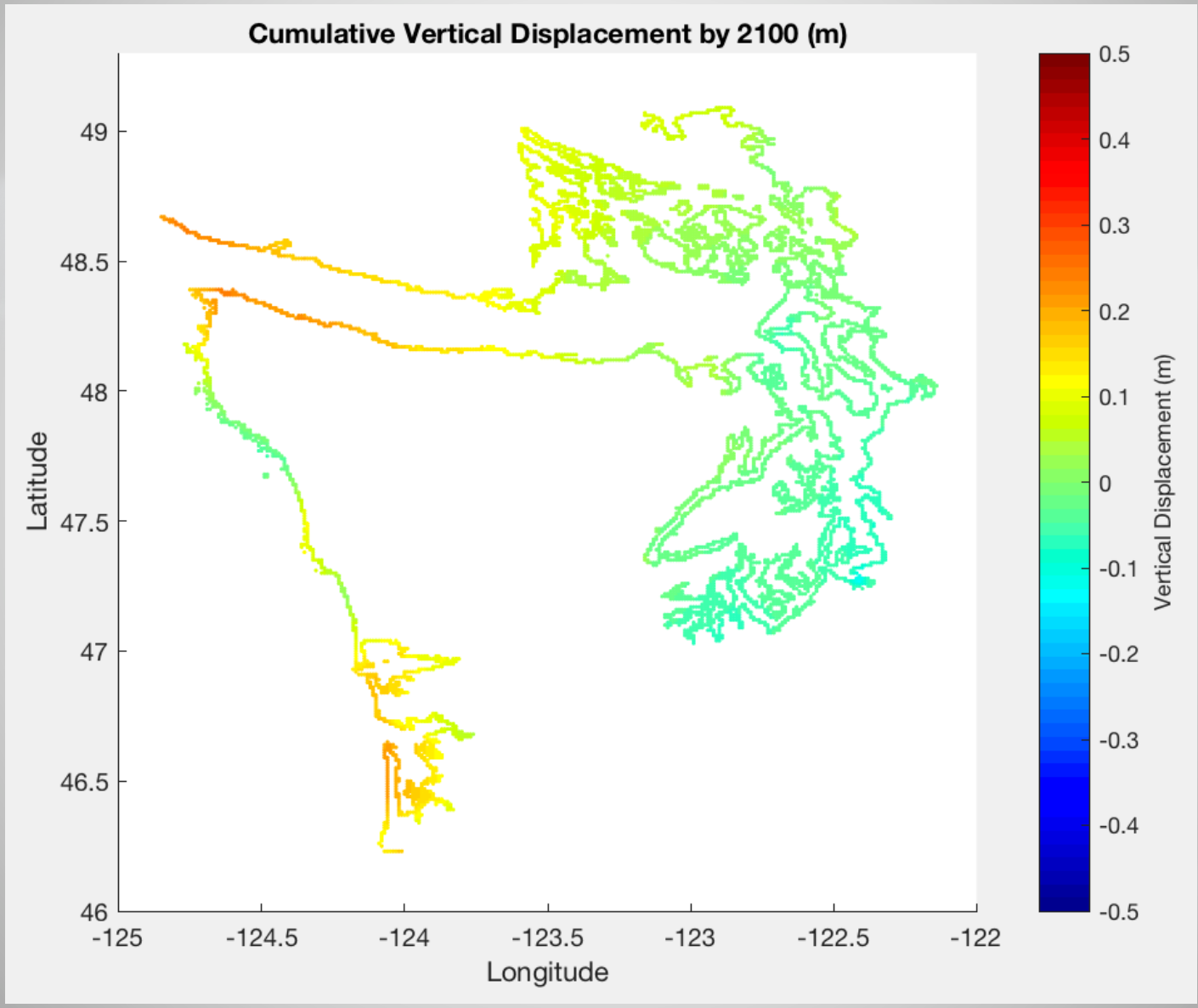




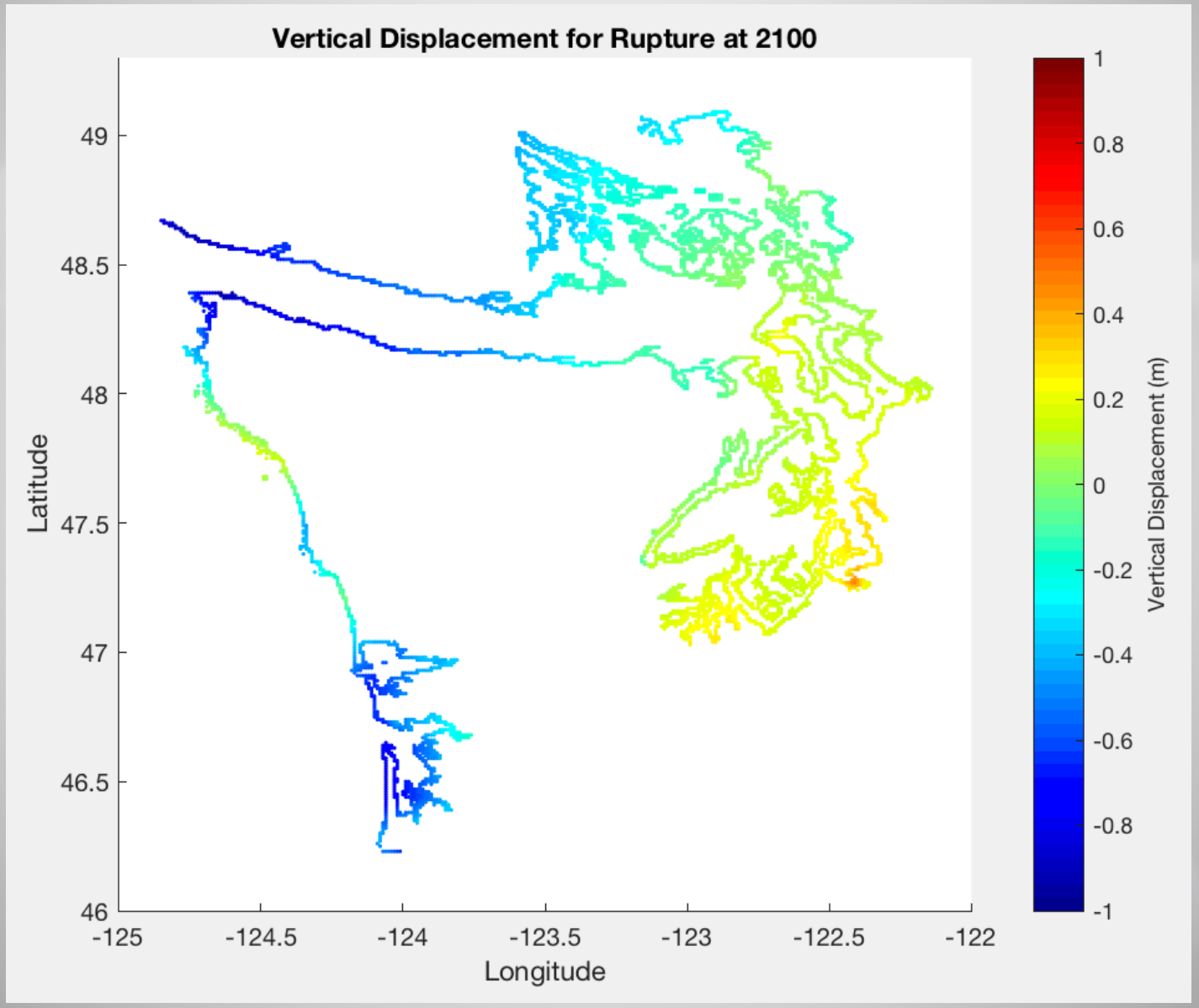


# Extrapolation to 2100



# Hypothetical Rupture in 2100



# Future Work

- More complex interpolation methods, incorporating data weighting
- Comprehensive incorporation of GIA into analysis

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## Special thanks to:

Ray Weldon, Ian Miller, David Schmidt,
and our numerous collaborators.