#### Subduction, Collision and the Long-term Tectonic Deformation of the Aleutian arc and Southwest Alaska Jeff Freymueller, Kimberly deGrandpre, and Shanshan Li





# Outline

- Block Models and Microplates
  - A plate tectonics-like description of diffuse continental deformation
  - Alaska: Yakutat, Southern Alaska, Bering
  - Problems with the model
- New data and corrections
  - New data from western Alaska (PBO + Other)
  - Correction for 1964 postseismic deformation
- Peninsula block
- Plausible alternative plate configurations

#### **Block Model and Microplates**



#### **Evidence for Bering Plate**



#### Earlier Alaska Block Model



Cross and Freymueller (2008)

Freymueller et al. (2008)









### Peninsula Block (PENN)



Li et al. (in prep)

#### Viscoelastic + GIA Corrections



#### Velocities Relative to North America





### Velocities With Model Removed



#### **Different Plate Model Predictions**



# Velocities Relative to Chukotka-Arctic-Bering



# Fit of "Chukotka-Arctic" Plate

- Angular velocity fit using 29 stations
  - Reduced  $chi^2 = 3.4$ 
    - Reduced chi2 of 1.0 would be fit to data noise level
- Chukotka-Arctic-Bering pole location
  - 56.0875° N, 165.8675° E, 8.0169 °/Myr

– (East of the neck of Kamchatka)

• Misfit is dominated by a few probable outliers

#### **Residual Velocities**



#### **Conclusions/Tectonic Interpretation**

- New velocities are more consistent with a division of Bering Sea crust into two regions
  - Chukotka-Arctic region rotating clockwise
  - Southern Bering Sea and Aleutian arc escaping to west, but probably not a single rigid block
- Chukotka-Arctic plate model a good fit to data
  - May help explain thrust earthquakes in Koryak
    Highlands
  - May help explain tsunami-related earthquakes north of Aleutian cusp
  - Still large data gaps in western Alaska

## **Slip Partitioning and Microplates**



120°E 125°E 150°W 145°W 140°W 115°E 130°E University of Nebraska Omaha

#### Noda (2013)

#### Bering Plate Measured vs. Modeled Velocities



Cross and Freymueller (2008)