Inter-annual variability in surface currents over the California shelf measured by High-Frequency Radar

Douglas George and John Largier

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Talking Currents and RADAR

- Radio Detection and Ranging
- Use radiowaves to determine the movement of surface waters by bouncing off waves
Three regional ocean observing networks (NANOOS, CeNCOOS and SCCOOS)

72 coastal stations, including 5 inside San Francisco Bay
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- 72 coastal stations, including 5 inside San Francisco Bay
- Largest geographic coverage in last 10 years
US West Coast Regional Climate and Events

- **Climate**
  - Upwelling Season (March-August)
  - Relaxation Season (Sept-Jan)

- **Events**
  - 2009-10 El Niño
  - 2011 La Niña
  - 2014-2015 Warm Blob (Marine Heatwave)
  - 2015-16 El Niño
A Decade of Data (2008-2018)

Seasonal mean flow  Headland jets  Offshore flow  Seasonal eddies

Seasonal averages for 2006-2015
A Decade of Data (2008-2018)

Seasonal mean flow  Headland jets  Offshore flow  Seasonal eddies

Winter  Spring  Summer  Fall
1. Seasonal variability
   - Search for latitudinal upwelling signals
2. Inter-annual variability
   - Search for changes associated with ocean climate events
3. Cross-shelf variability
   - Search for structure and dependence on shoreline for current steering
Flow-Shoreline Orientation Analysis

- Relationship of flow to shoreline orientation
  - Simple coast broken into ~10 km segments and orientation extracted
  - Weekly U, V 6-km current data extracted from 20-km wide bands at 10, 20, 50, and 100 km from shore
  - Current data rotated to be alongshore and cross-shore
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Cross-shelf Transects (Alongshore Currents)
Cross-shelf Transects
(Cross-shore Currents)
1. Seasonal variability
   - Upwelling and relaxation signals very strong from Oregon to San Francisco Bay zone

2. Inter-annual variability
   - Ocean climate events suppressed the normal southerly flows in 2015-2016

3. Cross-shelf variability
   - Eddies and jets identifiable using the 20- and 50-km offshore regions
What’s Next

- Correlation Analysis
- Forcings Analysis
  (shoreline steering, meteorology)
- Anomalies Analysis

### Inter-annual correlation of alongshore currents

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North-South Flows
Offshore (green), nearshore (blue)

- Cape Blanco
- Crescent City
- Trinidad Head
- Cape Mendocino
- Fort Bragg
- Pt. Arena

Diagram showing North-South flows with offshore (green) and nearshore (blue) lines for Cape Blanco, Crescent City, Trinidad Head, Cape Mendocino, Fort Bragg, and Pt. Arena from 2011 to 2017.
Thank you!

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