Seasonal Changes in Sand Level and Wave Energy on Southern California Beaches

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Introduction

- Investigate seasonal variability of sand levels in Southern California
- Sand levels LIDAR and in-situ surveys at two focus sites
- Waves: regional network and numerical model

GPS Sand Level Observations

- Back beach to waterline
- Vertical accuracy ~10 cm

Wave Observations

- Wave observations combined with numerical model
- Hourly estimates every 100 m alongshore
- Alongshore variability in wave field due to offshore islands

Southern California Wave Field: Dec. 21, 2004

Finding the Waterline:

Goal:
- Diverse LIDAR returns from ocean surface
- Retain LIDAR returns from sand surface

Tests:
- Compare LIDAR processing to regions where ATV data is available
  - ATV-LIDAR divergence is most offshore
  - Acceptable LIDAR data point
  - Using LIDAR tide level, and wave height to define waterline

Results

Focus Sites

San Onofre Beach
3km

Torrey Pines Beach
7 km

Elevation Change
Volume Change
Spatial EOF

Spatial Amplitude of First EOF

San Onofre

Torrey Pines

San Onofre

Torrey Pines

San Onofre

Torrey Pines

Conclusions

- Primarily seasonal cycle in sand level fluctuations: summer accretion when south swell is predominant and winter erosion when north swell is predominant
- Considerable alongshore variability, with three times as much elevation change at Torrey Pines than at San Onofre
- Seasonal volume change and wave energy correlated at the focus sites, but not over the 79 km section
- In general, more variability in seasonal volume changes than seasonal wave field
- Larger sand grain size at San Onofre and elsewhere could contribute to difference
- Future work investigating the influence of grain size (and cobbles), beach width, and wave obliquity

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