

**Remote sensing detection of storm and waste water plumes to assess
public health and water quality in Los Angeles and Orange Counties**
by

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SHOT - PPT SLIDE #1

PPT of Title. Southern California Water Resources

MICHAEL (VOICE OVER)

Hello, this is Michael Fong and Ryan Boarman here at the NASA Jet Propulsion Laboratory in Pasadena, CA, presenting our Fall 2012 NASA Develop project titled, "Remote sensing detection of storm and waste water plumes to assess public health and water quality in Los Angeles and Orange Counties."

RYAN (VOICE OVER)

We would like to thank our science advisor Benjamin Holt at JPL for guidance throughout this project.

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SHOT - PPT SLIDE #2

PPT of Title. Study Sites

MICHAEL (VOICE OVER)

Our project arose from a need for a remote sensing decision support tool to monitor coastal pollution and identify potentially hazardous conditions. The water quality of the coastal ocean and the safety of beaches for public use is potentially threatened by pollution from urban runoff and wastewater effluent. In our study area, the Southern California Bight, 95% of the annual runoff volume and pollutant load come from episodic storm events, typically in the fall and spring, and stormwater runoff rates in Los Angeles are increasing due to the increasing population and proliferation of impervious surfaces. This project is in two parts. First, we will use thermal infrared imagery to monitor, in real-time, a wastewater plume offshore the SA River during Sept-Oct 2012. This plume is from the repair of a 5 km outfall pipe at 50-60 m depth and diversion of wastewater effluent to the 1 km pipe in 20 m deep water. The Orange County Sanitation District is concerned about the transport of effluence offshore during the repair of the 5 km outfall pipe at 50-60 m depth and diversion of effluent to the 1 km pipe in 20 m deep water. In the second part of the study, we will examine stormwater runoff from 2006-2011 in the Ballona Creek, LA Harbor, and Santa Ana Rivers and their relationship to hazardous beach conditions. The second part of the study is the real-time monitoring of

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SHOT - PPT SLIDE #3

PPT of Title. Study Sites

MICHAEL (VOICE OVER)

Our results will aid in decision support, and for the wastewater project, the satellite imagery that we provide will aid in in-situ monitoring of the plume. Our partners for this project are the Southern California Coastal Water Research Project, the Southern California Coastal Ocean Observing System, the Orange County Sanitation District, and Heal the Bay.

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SHOT - PPT SLIDE #4

PPT of Title. Plume Structure from SST map

RYAN (VOICE OVER)

We used ASTER thermal red infrared imagery from the Terra satellite to derive sea surface temperature from at-sensor radiance, after atmospheric correction and emissivity normalization. A wastewater plume signature should be slightly colder than surrounding areas.

From the ASTER sea surface temperature imagery, we were able to see a clear plume signal during the diversion event. The coldest portion of the plume was 20°C, while surrounding waters were 2-3 degrees warmer. A two-lobed plume structure was seen, with one lobe moving alongshore to the SE, and the second lobe moving offshore towards the SW.

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PPT of Title. Plume Detection and Methodology

RYAN (VOICE OVER)

For the stormwater study, we used synthetic aperture radar from ENVISAT, UAVSAR, and the Advanced Land Observation Satellite to detect plumes based on regions of anomalous low backscatter emanating from river mouths.

A similar sized patch in a clean patch of water served as a reference for comparison.

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PPT of Title. Plume distribution and frequency (1995-2011)

RYAN (VOICE OVER)

Overlaying all the plumes from our time series showed the distribution and frequency behavior of the stormwater plumes in Ballona Creek and Los Angeles Harbor. In Ballona Creek, the breakwater had the effect of splitting the flow of plume up and downcoast, with 55% of the plume areas moving north and 44% south.

In Los Angeles Harbor, the breakwater had the effect of trapping plumes within the harbor.

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SHOT - PPT SLIDE #7

PPT of Title. Beach Coliform Distribution- Ballona Creek

MICHAEL (VOICE OVER)

Our partners at Heal the Bay provided us with beach total coliforms data, which we compared with SAR plume data to assess the relationship between beach contamination and stormwater plumes.

Our preliminary results show that the distribution and level of total coliforms on the beach may be related to physical transport processes.... [next slide]

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PPT of Title. Total Coliform vs. Plume Shore Distance

MICHAEL (VOICE OVER)

As well as the distance from the shore to the plume. Future studies should focus on timing beach measurements with SAR missions

to increase the database for comparison of remote sensing and in-situ data.

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PPT of Title. THANKS YOU!

RYAN (VOICE OVER)

We would like to thank our partners at Heal the Bay for providing us with beach data and our partners at the Orange County Sanitation District, Southern California Coastal Ocean Observing System, and Southern California Coastal Water Research Project.

MICHAEL (VOICE OVER)

Also thank you to the NASA Develop program, the Develop team at JPL, and our science advisor Ben Holt.

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