1 Abstract
Understanding and predicting coastal ocean water quality has bene-
fits for reducing human health risks, protecting the environment, and
improving local economies which depend on clean beaches. Con-
tinuous observations of coastal physical oceanography increase
the understanding of the processes which control the fate and transport
of a marine plume which potentially contains high levels of contaminants
from the upstream watershed.

A data-driven model of the fate and transport of river plume water from the
Tijuana River has been developed using surface current observa-
tions provided by a network of HF radar operated as part of a local coastal
observing system that has been in place since 2003. The model outputs
are compared with water quality sampling of shoreline bacte-
ria indicator, and the coliform and E. coli alarm for an expected
value using the receiver (or relative) operating characteristics (ROC) analysis.

2 Observations
The South Bay region has been influenced by the contaminated wa-
ter from several resources: Tijuana River, San Diego Bay, and Los
Buenos Creek, and other non-point source storm water runoff [1].

17.27 17.24 17.21 17.18 17.15 17.12
32.53
32.56
32.59
32.62
32.65
32.68
Longitude (W)
Latitude ... 14 12 10 8 6 4 2 0 2 4
0
5
10
(North)−−−−−−−−−−−−− distance from TJ river mouth (km) −−−−−−−−−−−−−−−− (South)
\%
0 0.2 0.4 0.6 0.8 1
0
0.2
0.4
0.6
0.8
1
AOC = 73.98 %
FP (1−specificity)
TP (sensitivity)
(c)

Figure 5: The positive and negative are considered as the signal
and noise events. True-Positive (TP) and False-Negative (FN) occur
when the diagnosis and the event agree, and False-Positive (FP) and
True-Negative (TN) occur when the diagnosis disagrees with the event.

3 Theoretical background
3.1 Statistical trajectory model
The number of the particles (1) arriving within the sampling bin of the
model is a function of several parameters:

\[ \lambda = \frac{\alpha x_{i} + \beta}{\gamma} \] (1)

where \( \alpha \), \( \beta \), and \( \gamma \) are water quality control criteria. \( \alpha \), \( \beta \), and \( \gamma \) are
inferred from the simulations. The water quality sampling stations
along the coastline (C0, C1, C2, C13, and C15) are indicated.

The water quality indicator \( q \) is binary value for the contamination
of the sampling area \( c \) (clean) or \( c \) (contaminated), and is defined as
based on the observations:

\[ q = \begin{cases} 1 & \text{if } c = \text{contaminated}, \\ 0 & \text{otherwise}. \end{cases} \] (2)

The water quality sampling data provide a classification of potential
contaminants present within the river plume.

The number of particle at the near sampling station and the water
quality sampling data (c) is shown in Figure 3. A contingency table for four cases is shown in

4 Results
The ROC analysis is applied to several rain events during wet season.
The number of particle at the near sampling station and the water
quality indicator are sorted, then the TP and TN are calculated as a function of the threshold \( x \).

The particle concentration profile in time, the rainfall flux, and the ROC
curve are shown as an example in Figure 7. The area below the ROC
curve is about 0.74. Using four years water quality sampling and the RMW
during several wet seasons (rain events), the average accuracy of the
alarm model is about 0.70, which is a reasonable classification.

Acknowledgement
We would like to acknowledge the generous sponsors of this work.
SYK is supported through a graduate student fellowship provided by
the California Institute of Telecommunication and Information Technol-
ology (CALIT2). EJT is partially supported through funding provided by
the Office of Naval Research (ONR), NOAA, the State of California,
Coastal Ocean Currents Monitoring Program (COOMP), BDC is sup-
ported by both NOAA and COOMP.

References