AN EVALUATION OF OIL POLLUTION PROBABILITY IN THE LEVANTINE BASIN OFF ISRAEL

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Contamination probability

• The probability of pollution at point \((x, y)\):

\[
P(x, y) = \sum_{\omega} P(x, y|\omega) \cdot P(\omega)
\]

• Where

\(P(\omega)\) is the probability of oil spill event \(\omega\).

\(P(x, y|\omega)\) the conditional probability of pollution at \((x, y)\) given that event \(\omega\) occurred.

• In this study we estimate conditional probability numerically and use spill probabilities from RAOP-MED Project.
Probability of oil spill

• Oil Spill probability was produced during RAOP MED project

• Scenarios: Ship-ship collision; Ship-rig collision; Ship spills unrelated to collision; Rig spills unrelated to collision; Spill during unloading from oil rig to ship; Maritime connectors

• Collision probabilities estimated using Macduff model (1974)
Spill probability and Maximal spill size

- Traffic at the mouth of the Suez canal poses high risk of oil spill
Conditional Probability – Sample Space

• Synoptic state sampled every 36h for one year Sep 2012-Aug 2013 (253 dates per release point)
  • Separated to 3-month seasons
• Release points taken from high ship collision probability map (0.1° resolution) within model grid.
• Oil density - API 31.1
• Instantaneous 45KT released (10,000 oil parcels)
Conditional Probability - Estimation

• The fate of spill events is determined by simulation of MEDSLIK v5.3.1 (Lardner 2009)
  • Wind input – SKIRON
  • Current and SST input – SELIPS

• Medslik output set for
  • every 3h for 15 days
  • Gridded on 100m – regraded to 1km grid

• Probability is estimated as percentage of contaminated events
SELIPS 2012-2013

- SELIPS produces daily forecast
  - Pom2k
  - 1km resolution
  - SKIRON Atm. forcing
  - ALERMO BC & IC
  - SST nudging
- Circulation at slope and shelf depends on along-slope Cyclonic current
  - Strongest during Summer and Winter
  - Direction may change due to wind and Eddies
Winter

- Core of high probability area is away from the coast
- Along shore current is wider
- Coastal boundary layer acts as insulator
- Bardawill Lagoon blocks some spills
Spring

• Most Spills do not pass Bardawill
• Events of Easterly and Northern wind due to Red Sea Trough
• Current Reversal events
Summer

- Strong beaching in the Southern coast
- Persian Trough (Monsoon circulation) causes North-Westerlies
Fall

- Highest probability of contamination
- Narrow along shore current in Israel does not isolate the coast
- Westerlies in storm events
Annual spill pollution probability
Future expansions

• Improve oil spill probability estimate (better ship density data)
• Extent time period
• Expand model domain (avoid domain boundary issues)
• Include other scenarios (oil rig-ship collision)
• Improve analysis – beaching statistics
Concluding remarks

• Probability of pollution in Israeli coast from spills near Suez Canal: ~1-3 events per century
• Probability exhibit seasonal variability – highest probability during fall
• Spill probability increases with ship traffic by a factor of 2 to 8
Questions

Thank you for your attention