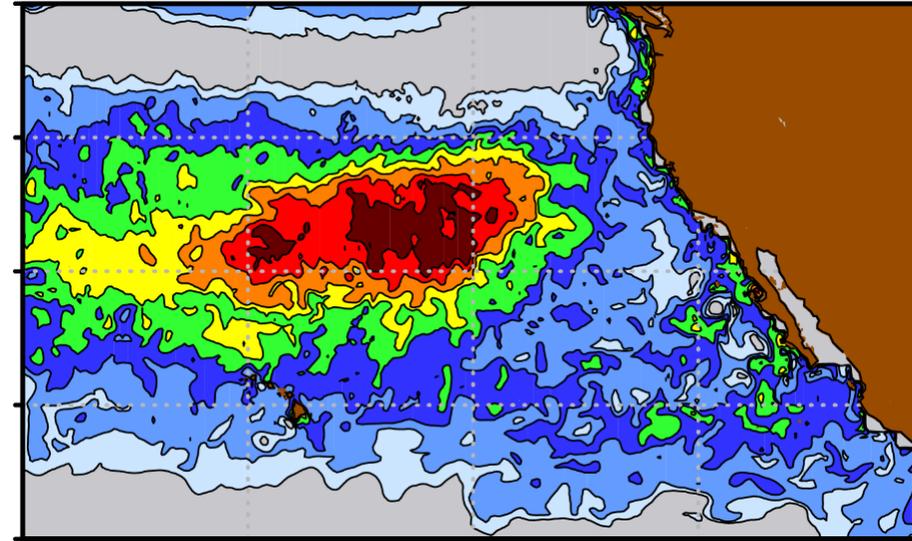


One Integrated Marine Debris
Observing System for a Clean Ocean

Satellite Activity of Ocean Decade Laboratory :
A Clean Ocean



> Online Poster Session & Live Event
> 17 to 19 Nov 2021



Linking marine debris observations and its modeling

Nikolai Maximenko, University of Hawaii
with help and contributions from many partners

Roles of observations:

- Discovery
- Monitoring
- Ground-truthing

Roles of models:

- Interpretation and understanding
- Synthesis, big picture
- Applications (end-user support, optimization of observing system, etc.)
- Forecast

Fundamental, long-standing task -- static balance of marine debris: thanks to the models, we at least know that balance is not closed.

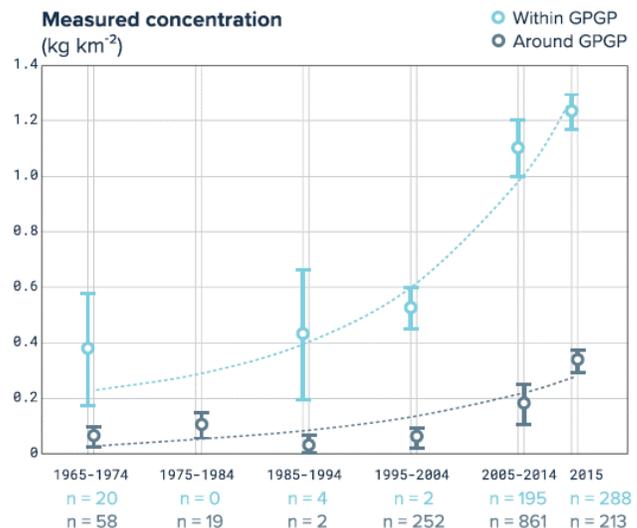
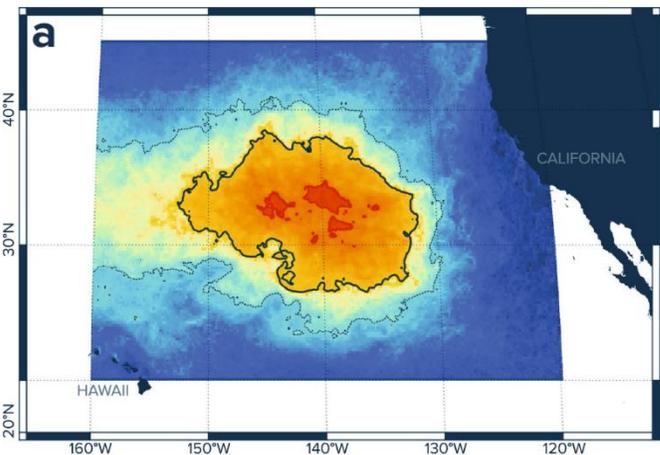
Source → Residence/transport → Sinks

A new, urgent task – monitoring of trends.

UN Sustainable Development Goal 14.1: by 2025, prevent and significantly reduce marine pollution of all kinds, particularly from land-based activities, including marine debris and nutrient pollution

This presentation is to illustrate the growing importance of synthesis of observations and models for correct interpretation of signals.

Early warnings!!!



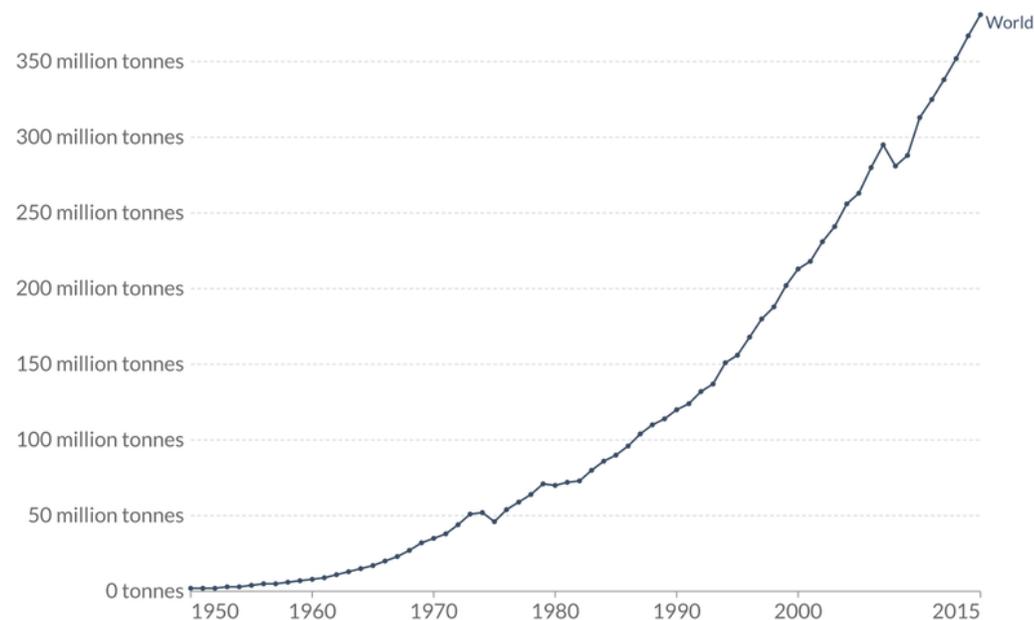
Moore, 2008: *Synthetic Polymers in the Marine Environment: A Rapidly Increasing, Long Term Threat.*

Lebreton et al., 2018: Evidence that the Great Pacific Garbage Patch is rapidly accumulating plastic.

Consistent with the global plastic production!!!

Global plastics production, 1950 to 2015

Annual global polymer resin and fiber production (plastic production), measured in metric tonnes per year.

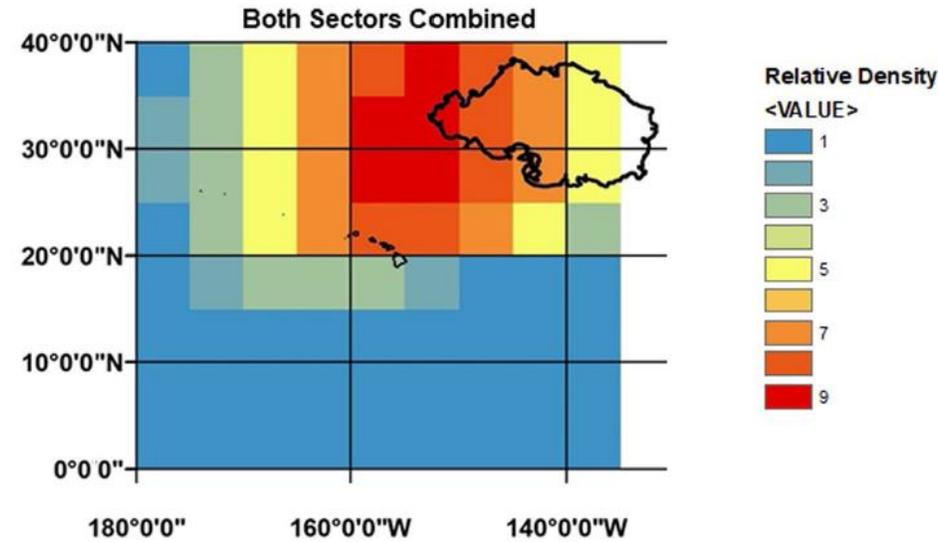
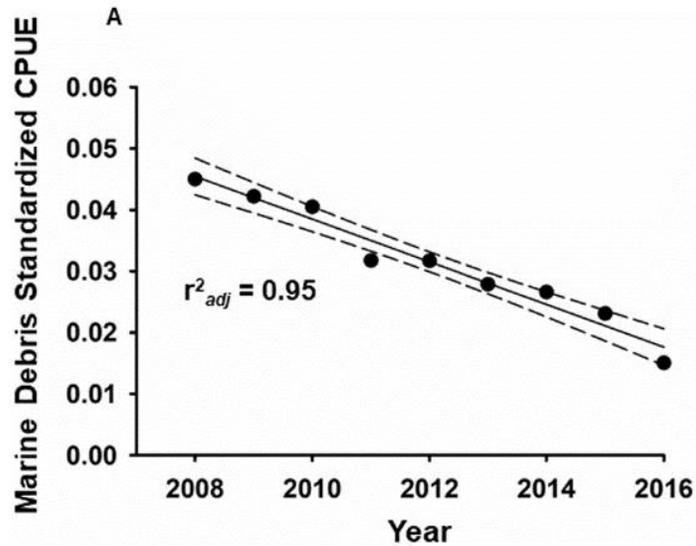


Source: Geyer et al. (2017)

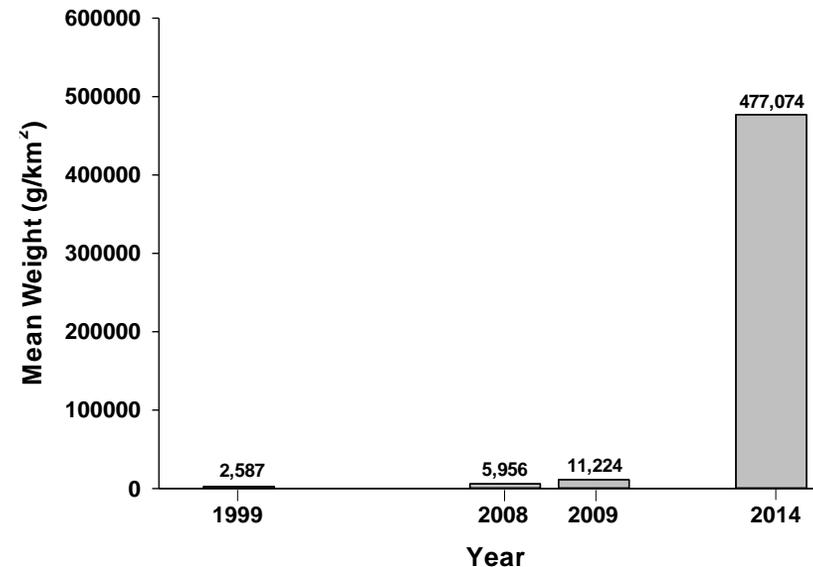
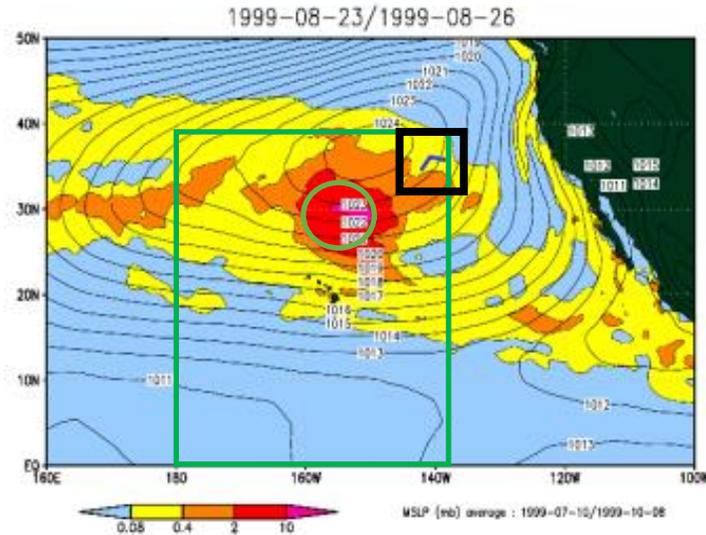
Recent good news???

3-time decrease in derelict fishing gear in the data of Hawaii-based long-line fisheries.
(Uhrin et al., Nature Communication, 2020)

Are we approaching the goal?



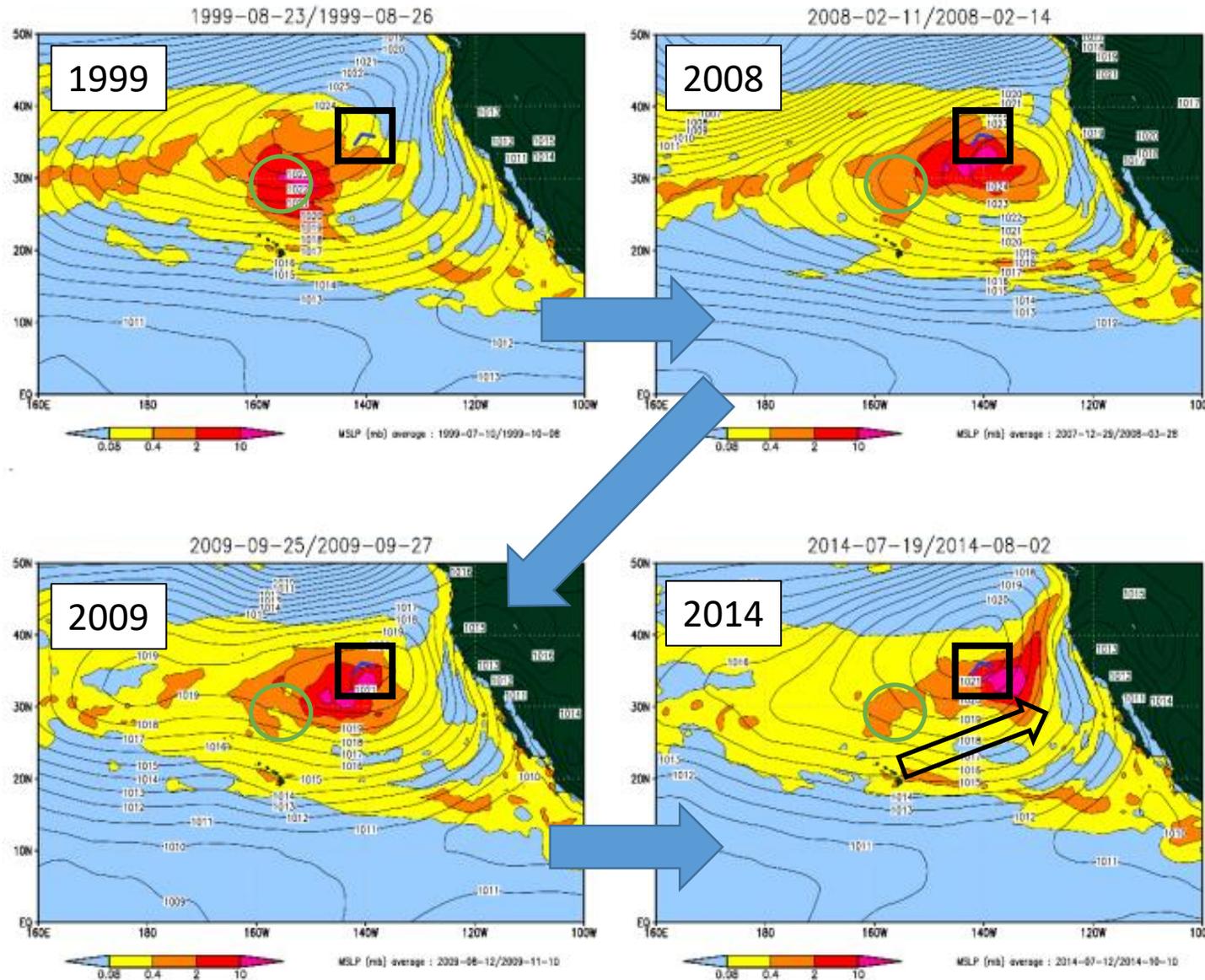
During the same time period fast increase in microplastics was reported in close area.



Credit:
Capt. Charles Moore
and Algalita Research
and Education
Foundation.

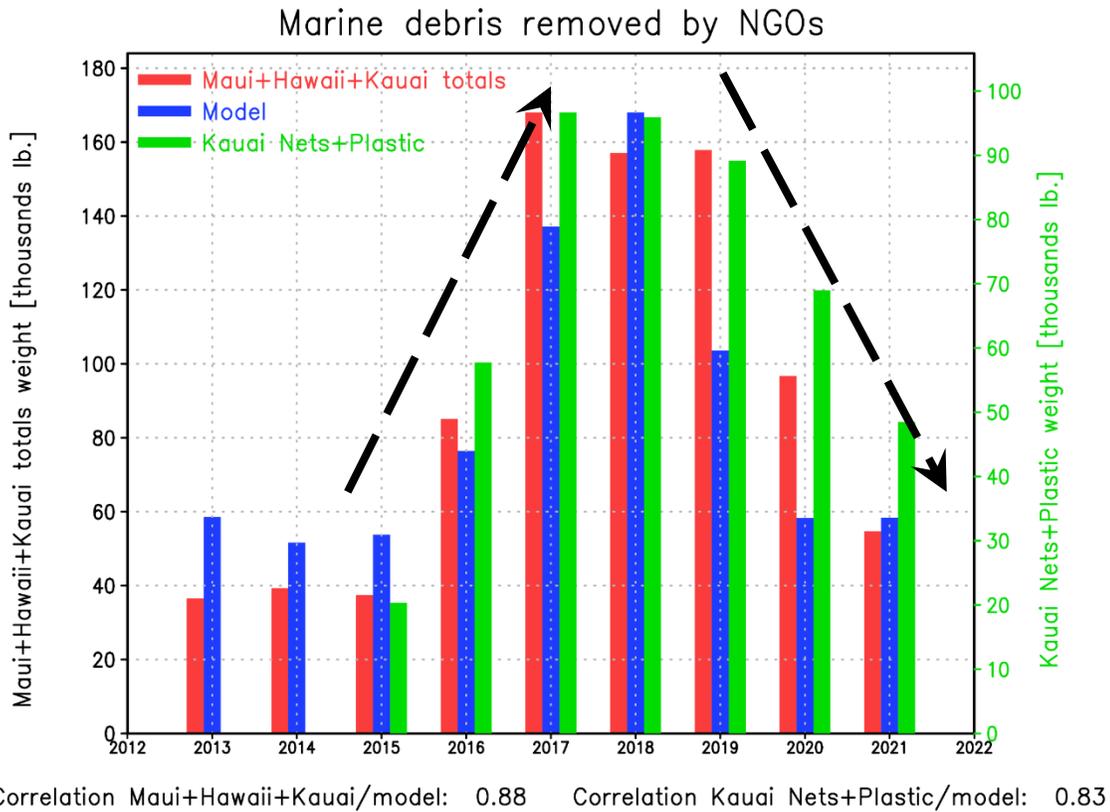
Can the changes be due to the ocean dynamics and not due to changes in marine debris?

Model tracer concentration in numerical experiment with constant source



Ocean signal is dominated by the eastward shift of the “garbage patch” !!!

Marine debris on Hawaiian shoreline

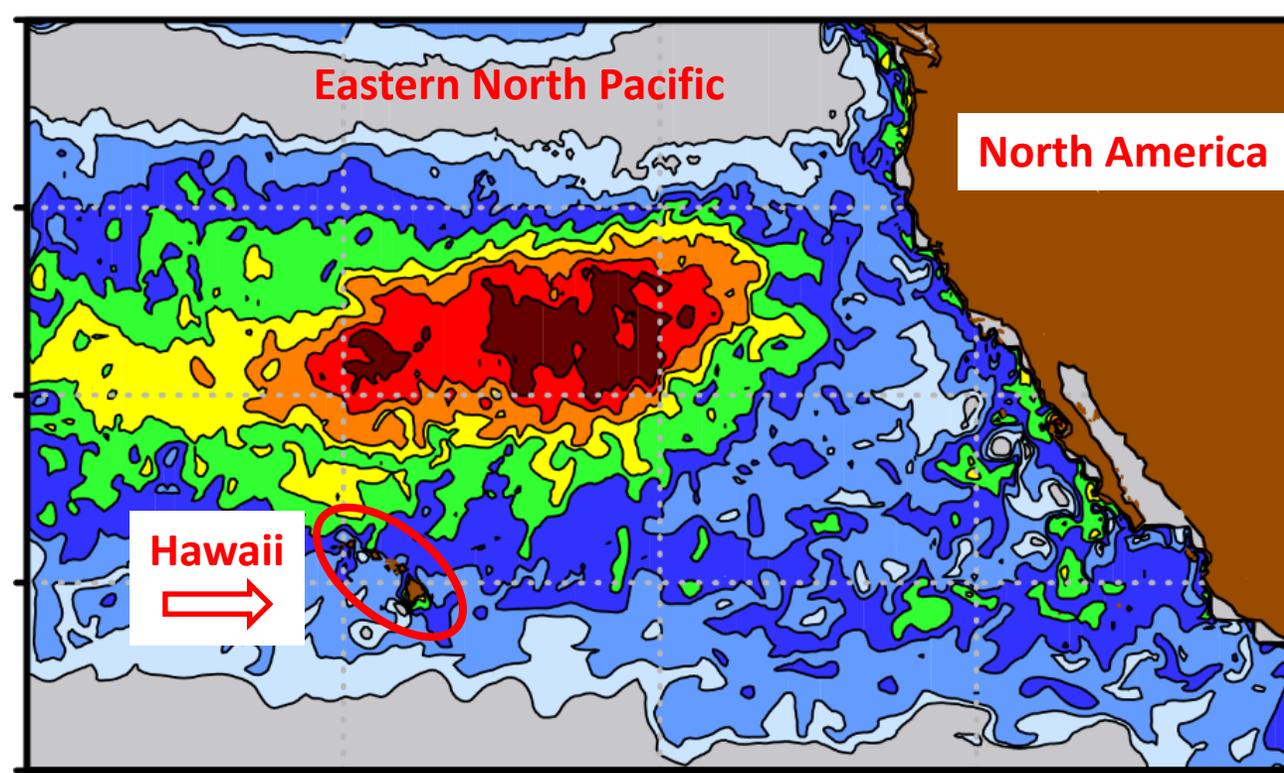


Data source:

Megan Lamson and Hawai'i Wildlife Fund

Carl Berg and Surfrider Foundation, Kauai Chapter

High correlation (>0.8) with the constant-source model suggests that majority of debris in Hawai'i is from distant sources and influx is largely controlled by the ocean-atmosphere dynamics.



Conclusions

- Correct interpretation of observations of trends in marine debris requires synthesis with numerical models capable to reproduce important factors not covered by observations.
- Models consistent with the actual debris dynamics, origin, and lifecycle need to be developed and validated with observations.