Operational Oceanography in support of the search for MH370

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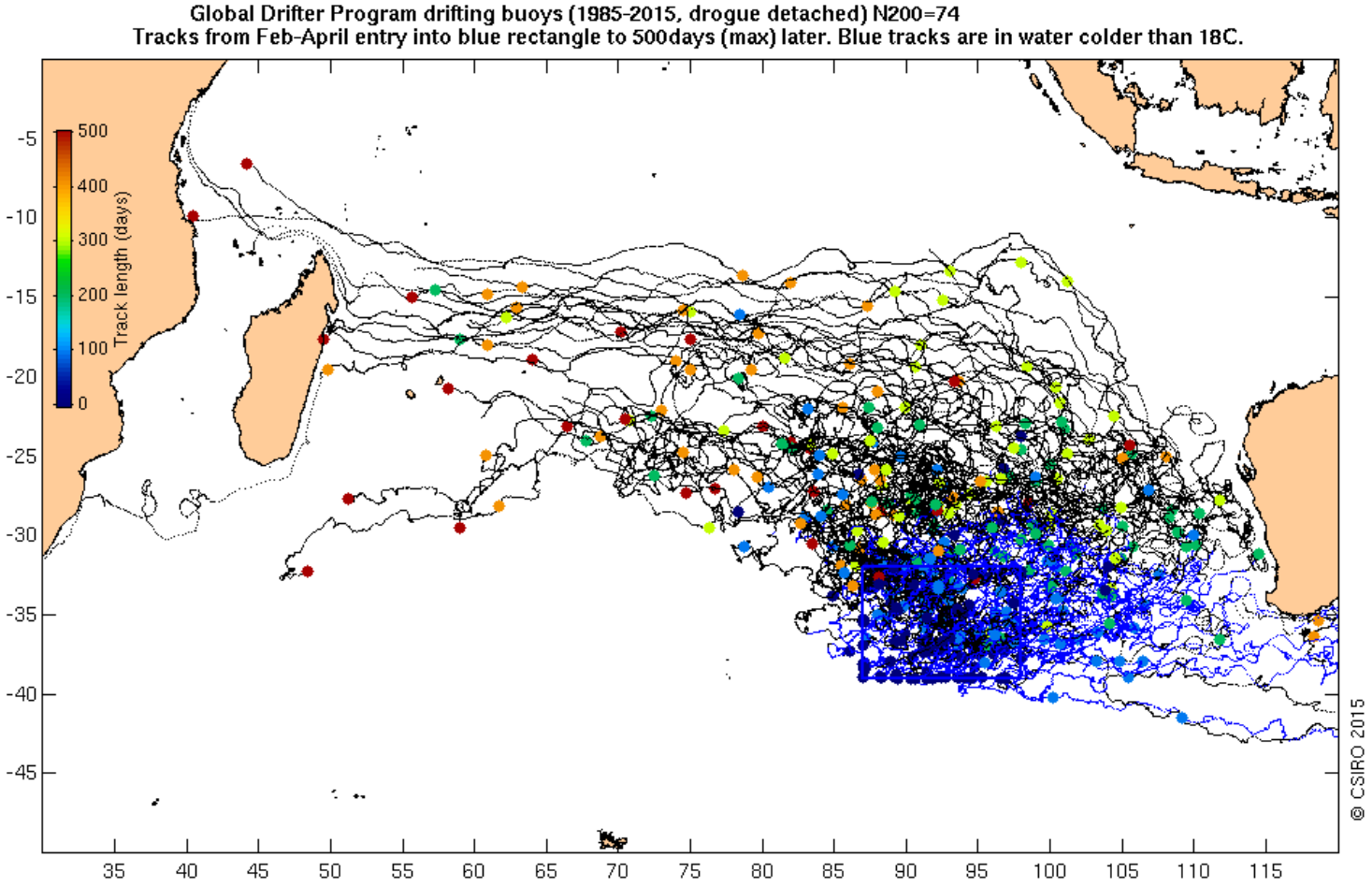
One of the most tragic and mysterious aviation disasters of all time

- 8 March 2014: MH370 disappeared
- 18 March 2014: Australia leads surface search near 45S, 90E.
- 28 April 2014: Surface search ended. Nothing found.
- 2014-2015: sea-floor search along Inmarsat 7th arc, 39S-32S.
- 29 July 2015: Flaperon found on Ile de La Reunion.
- August 2015-now: ongoing speculation that the flaperon finding implies that the crash was in the northern Indian Ocean.
- This talk: flaperon finding on RI is consistent with 39S-32S search area. Not the 'most likely' origin, but certainly within error bounds.
- Tangents: Stokes drift, global ocean models, undrogued drifters.

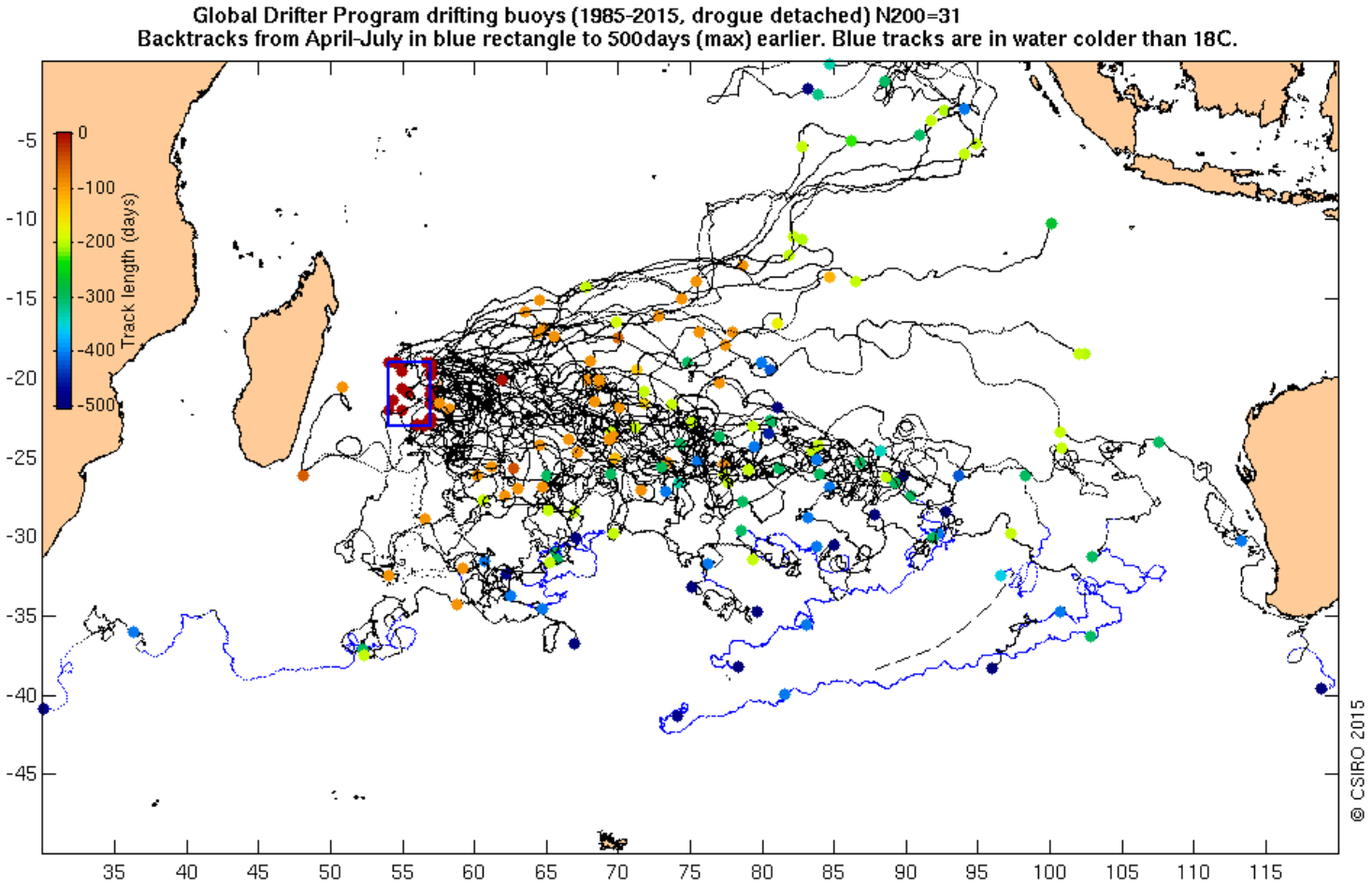
Early post-flaperon model-based simulation showing why it was not a surprise.

- (movie deleted. It is archived at http://www.marine.csiro.au/~griffin/MH370/)

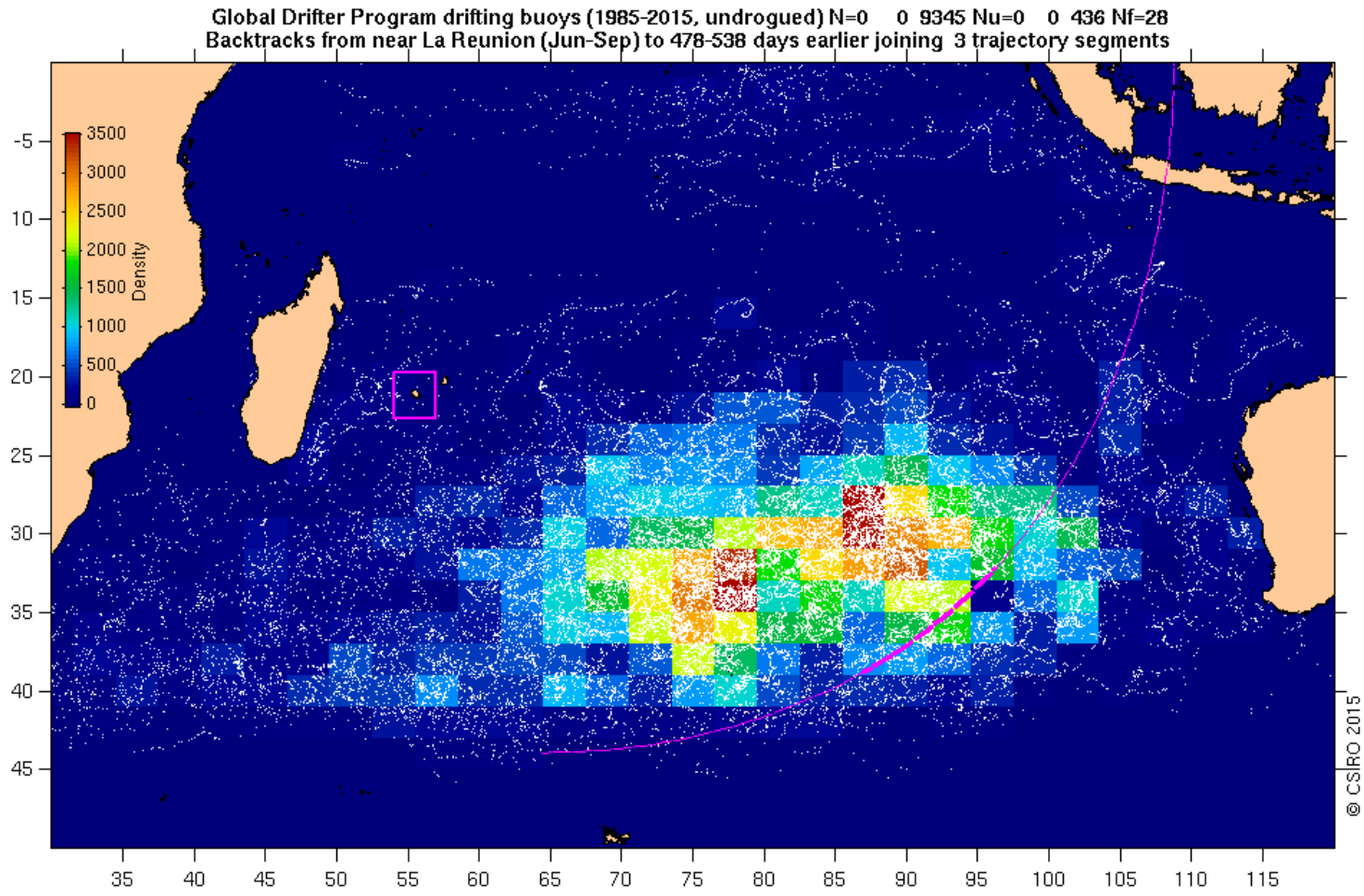
Un-drogued drifters: quite a few 500d-long trajectories going near La Reunion.



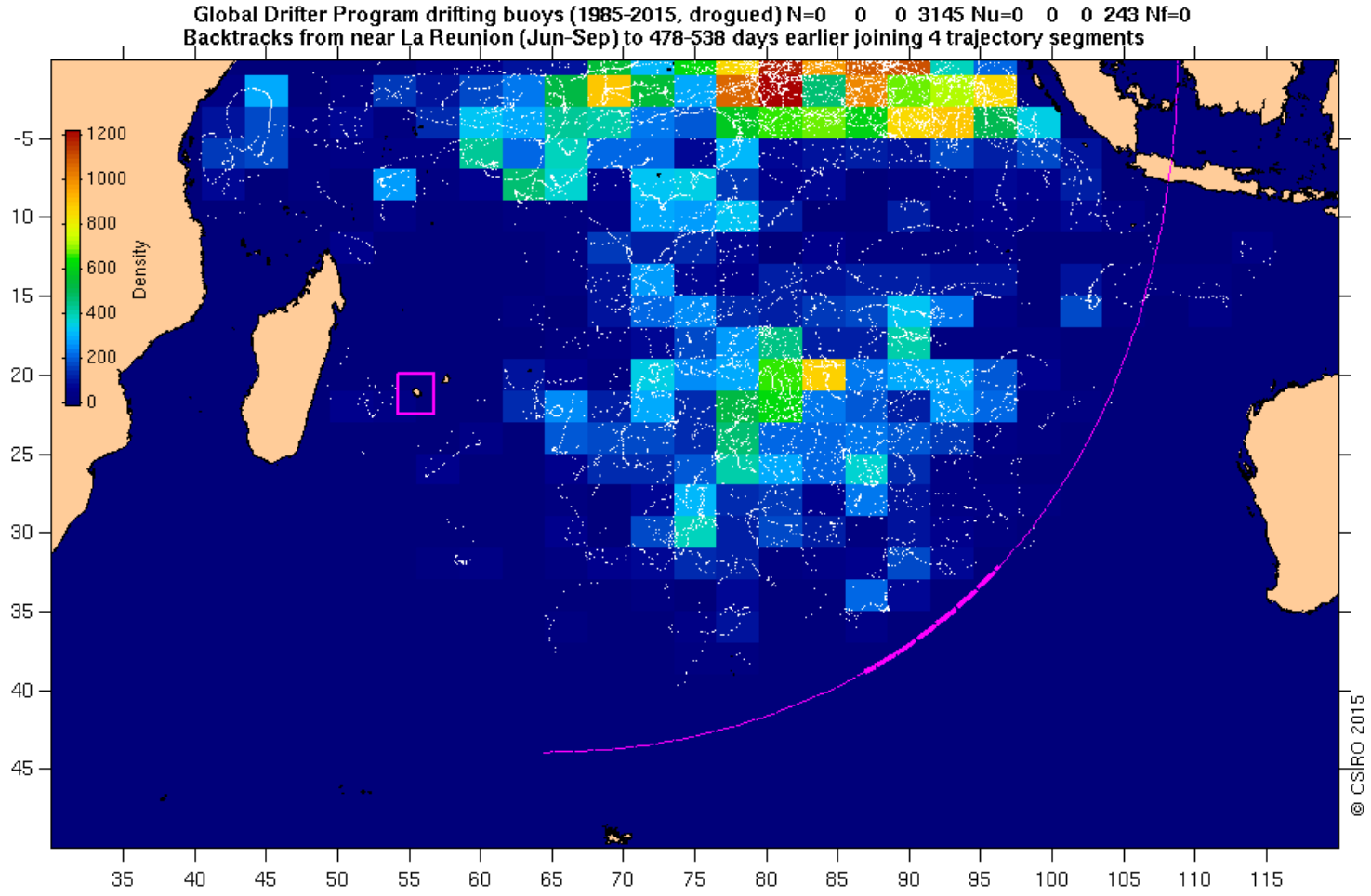
Tracks leading to La Reunion: mostly from ESE, few are 500d long.



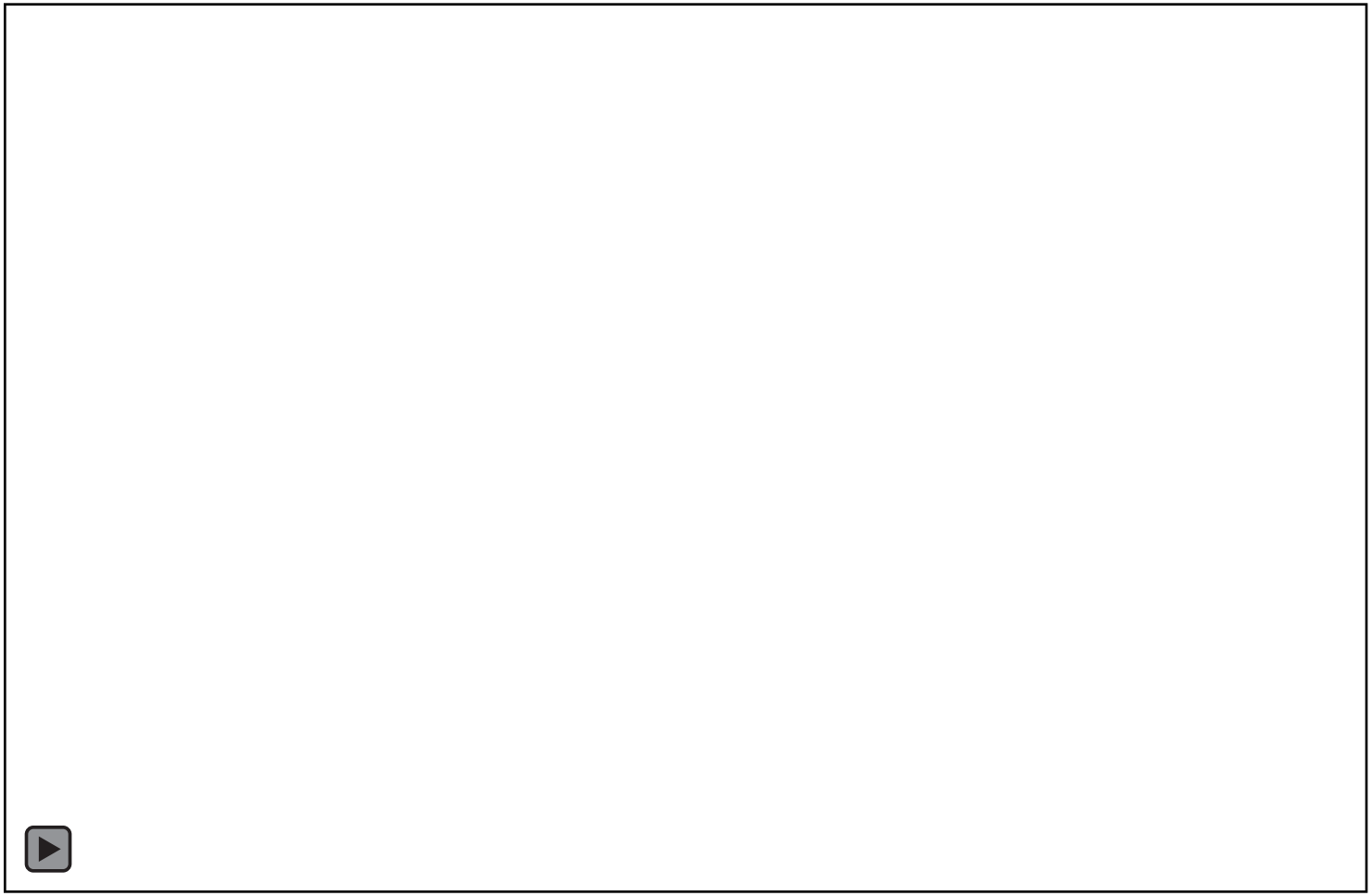
Composite tracks back from RI: 39S-32S search area on shoulder of likelihood function.



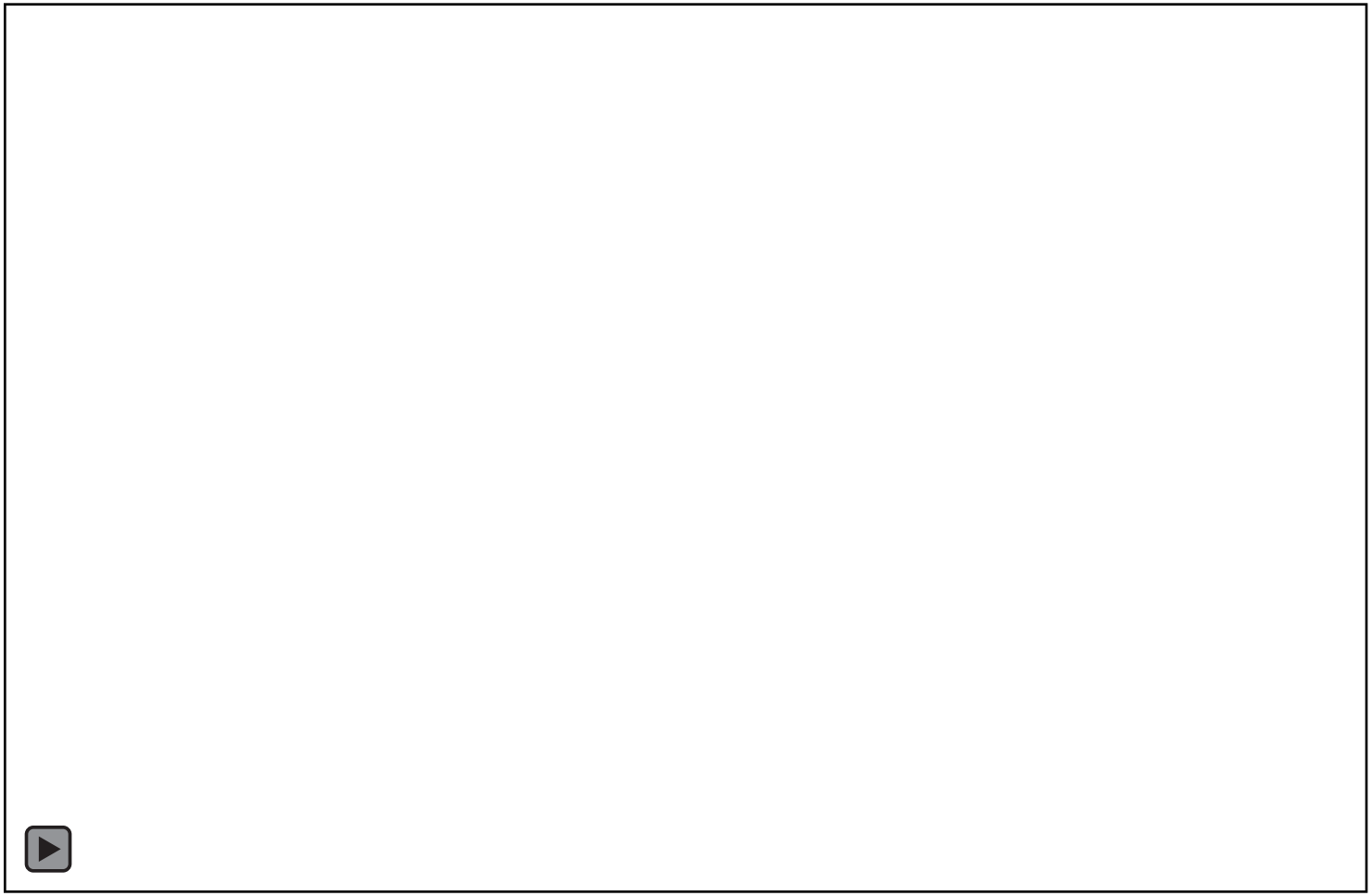
Drogued drifters: support northern hemisphere theory. But the flaperon did not have a drogue!



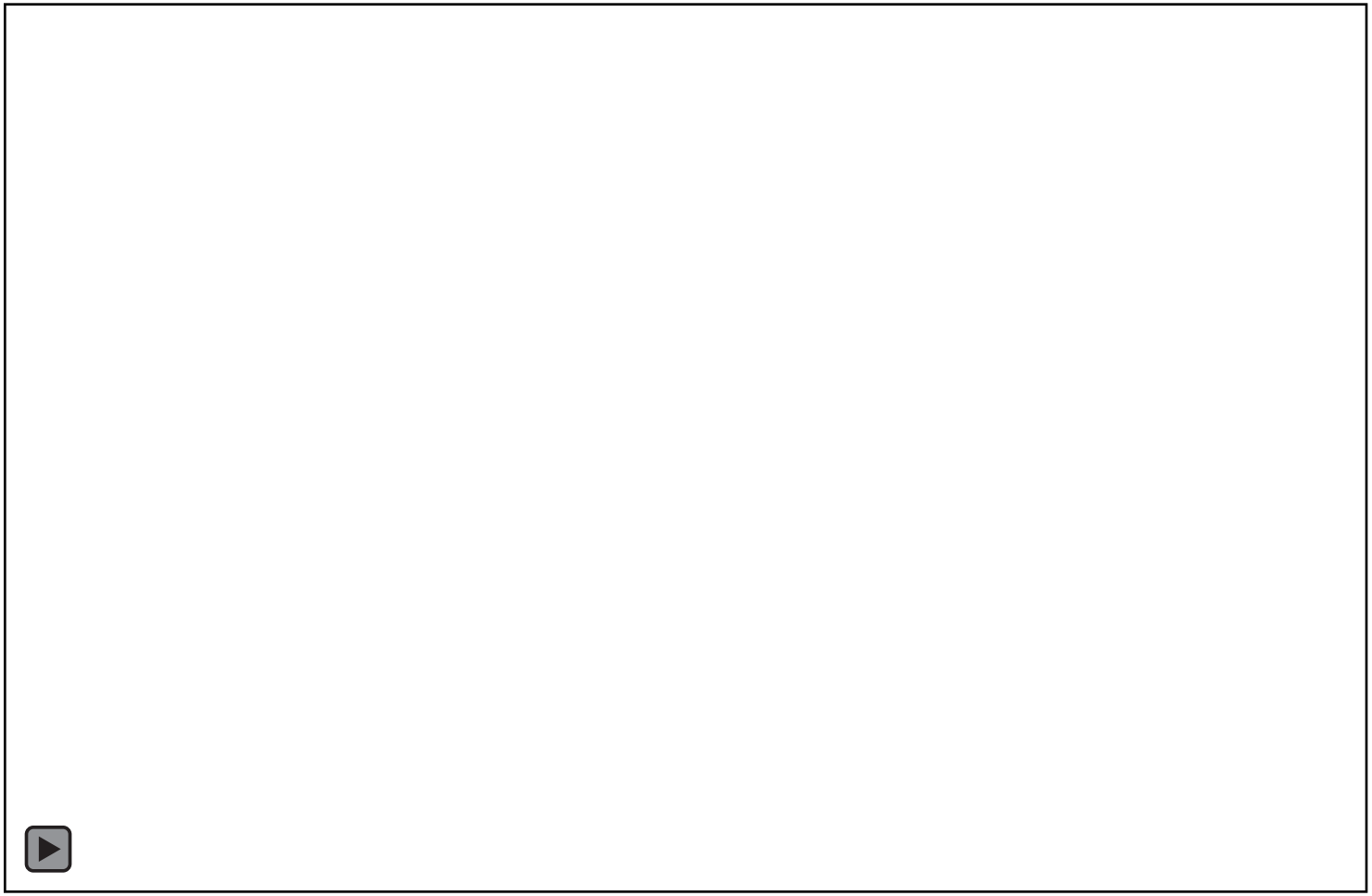
Stokes drift alone does not aggregate debris. (3 years simulation showing cumulative effect)



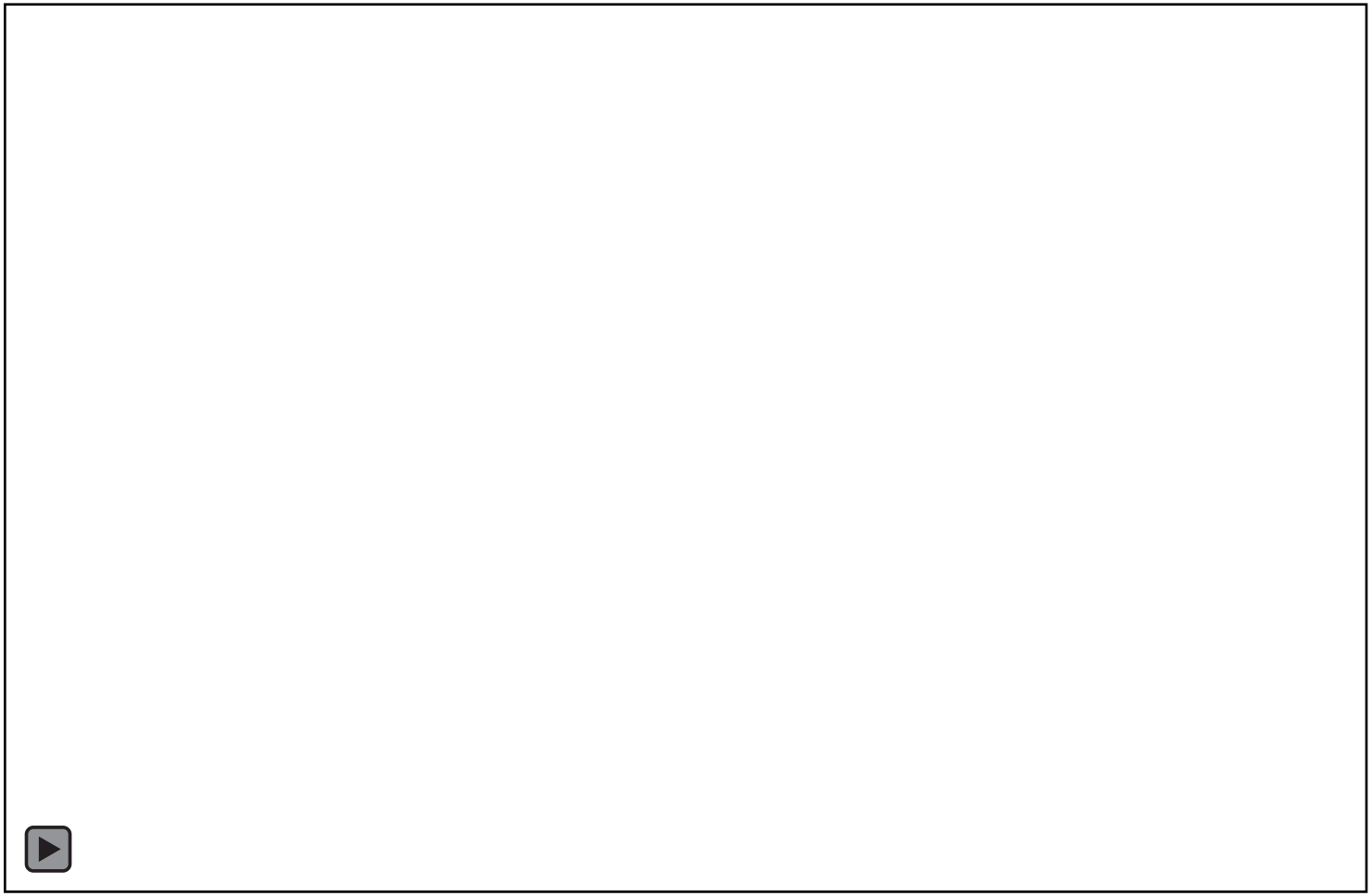
Ekman aggregates debris along 30S



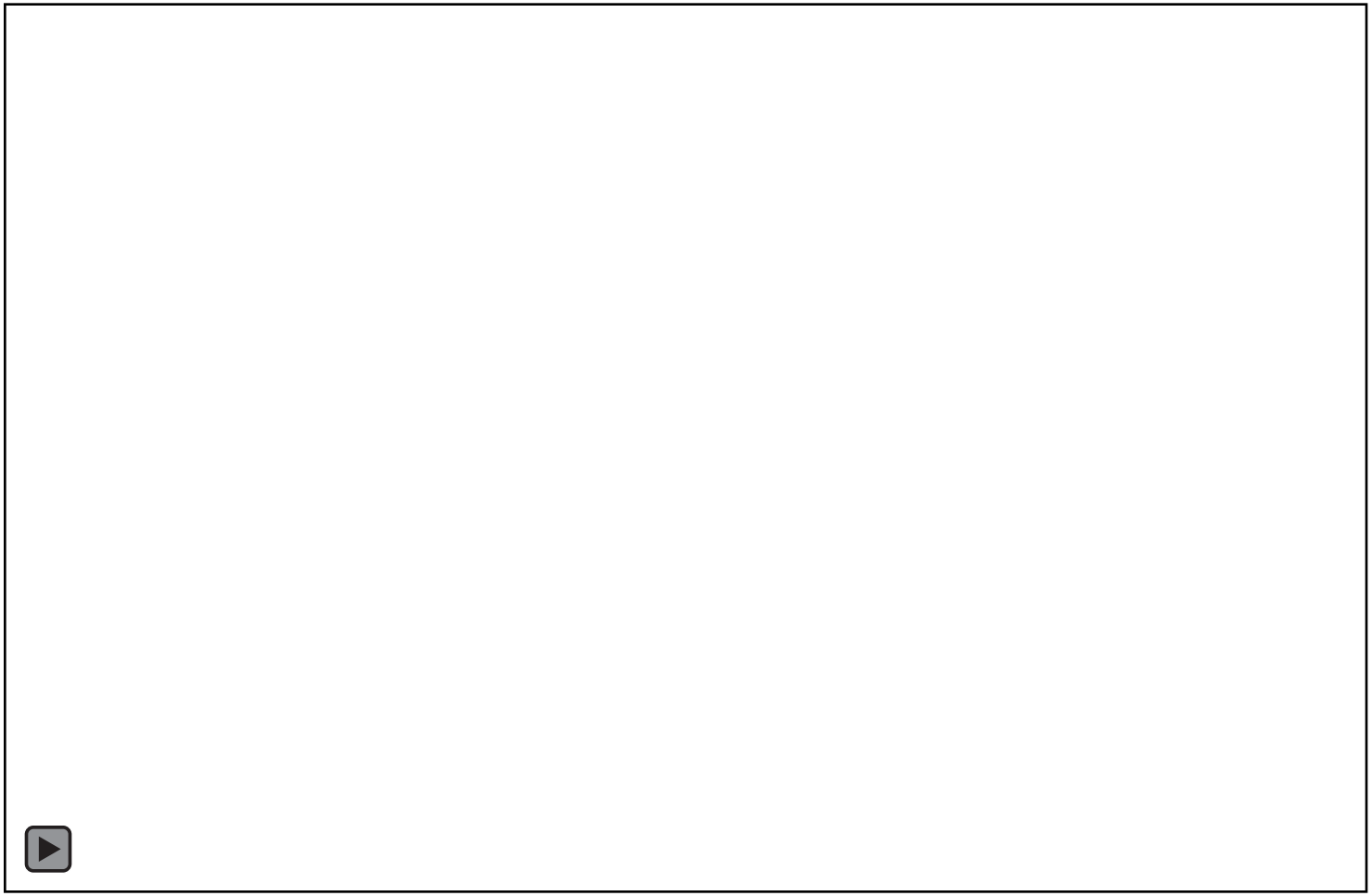
Stokes+Ekman aggregates debris S of RI



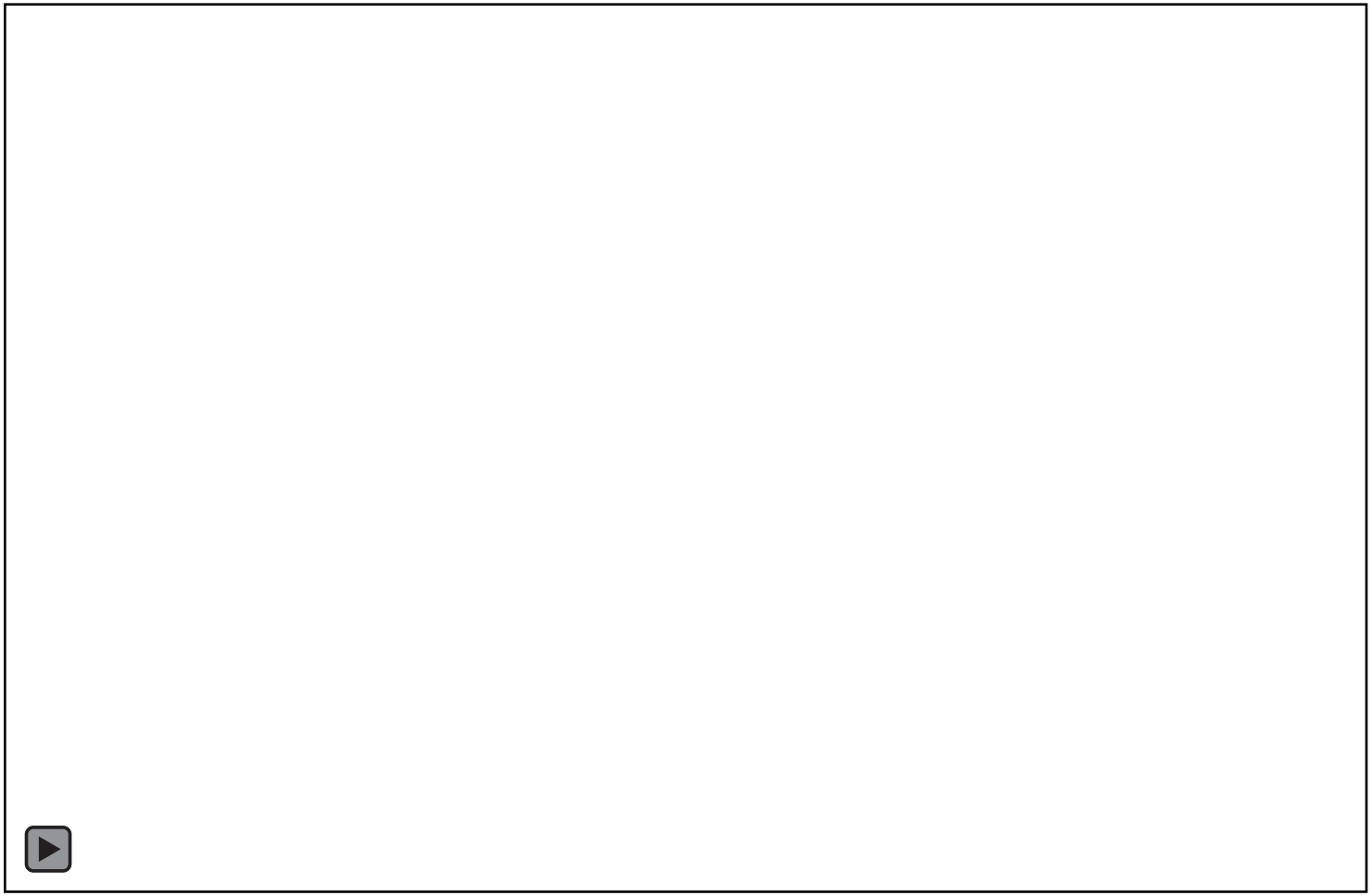
Undrogued drifters agree (3-year video) (trajectories->monthly velocity->trajectories)



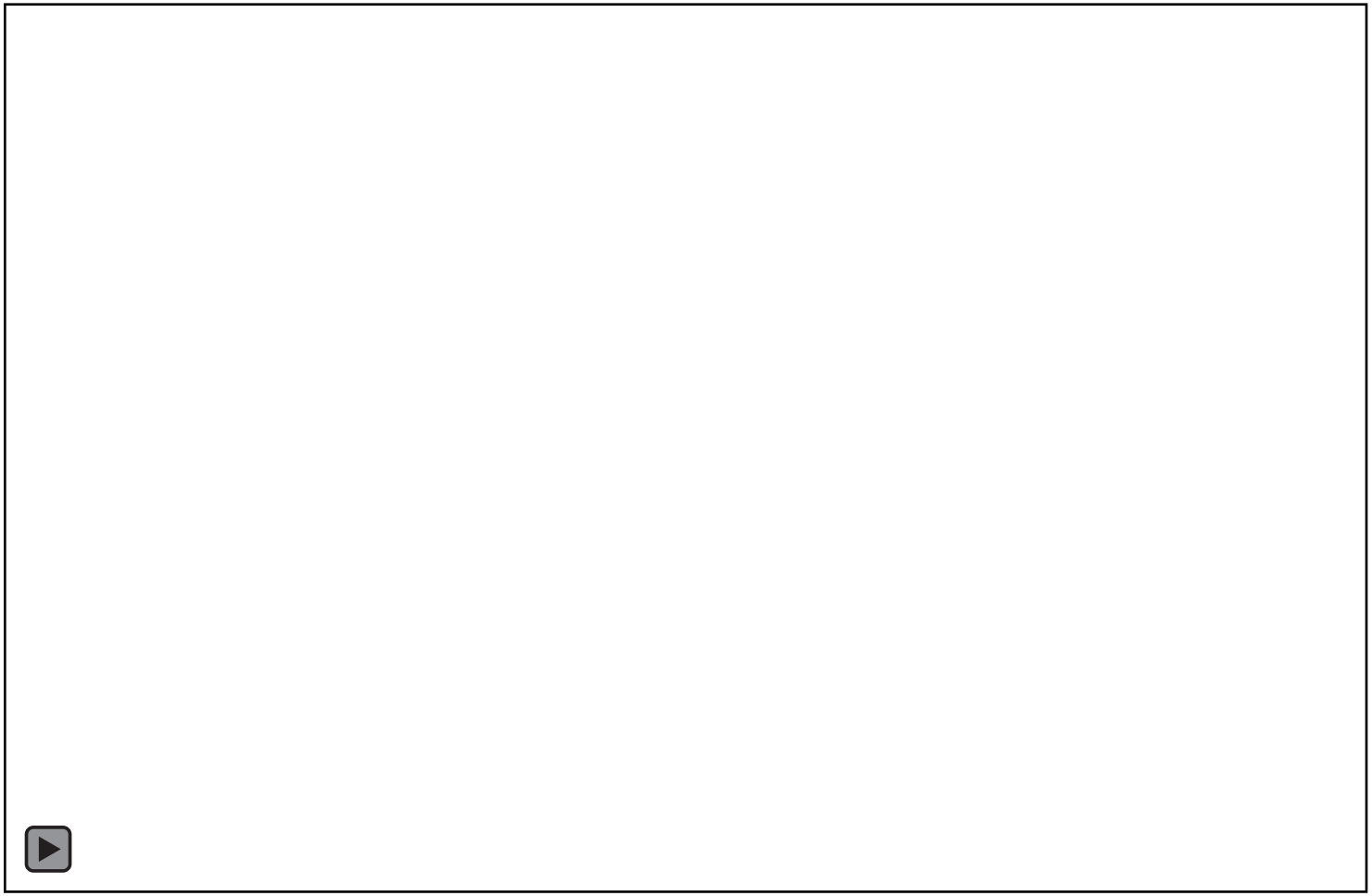
Drogued drifters avoid Stokes, by design and evidently.



Back to MH370: Stokes+Ekman climatology only half the story (eddies etc could explain the rest).



Back-track from RI: again, climatology incompletely explains the trip (expected).



Summary

- During March-April 2014, altimetry played a pivotal role in guiding the surface search. Drift modelling was validated using drifters (last year's OSTST poster).
- In 2015 our task was to check that the flaperon finding was not inconsistent with the sea floor search based on Inmarsat handshakes.
- Modelling and drifters **do not cast doubt** on the 7th arc 39-32S search area.

Conclusion

- MH370 tested our understanding of Indian Ocean surface drift.
- Global ocean models are not designed for this application.
- Most (all?) omit the Stokes-Coriolis term in the momentum equation. Standalone Stokes drift not always used operationally.
- Question: how much of the sea level anomaly measured by altimeters is affected by Stokes-Coriolis set-up?
- Do we need a correction term (like IB) for Stokes-Coriolis for dynamical consistency? May account for model-data misfit, with consequences for assimilation.

Thank you

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