Recirculation in the Kuroshio Extension

Steven Jayne[1], Nelson Hogg[2], Stephanie Waterman[1], Luc Rainville[3], Kathy Donohue[4], Randy Watts[4], Julie McClean[5], Matt Maltrud[6], Bo Qiu[7], Shuiming Chen[7], & Peter Hacker[7]

[1] Woods Hole Oceanographic Institution

[2] Cornell University

[3] Applied Physics Lab / University of Washington

[4] University of Rhode Island

[5] Scripps Institution of Oceaongraphy

[6] Los Alamos National Laboratory

[7] University of Hawaii

Recirculation in the Kuroshio Extension?

Are there recirculation gyres to the north and south of the Kuroshio Extension?

- Altimetry, hydrography and drifters clearly suggest that there is recirculation south of the Kuroshio
- North of the Kuroshio there is less decisive observational evidence for recirculation
- To answer this question we utilize KESS observations and output from a high-resolution ocean general circulation model

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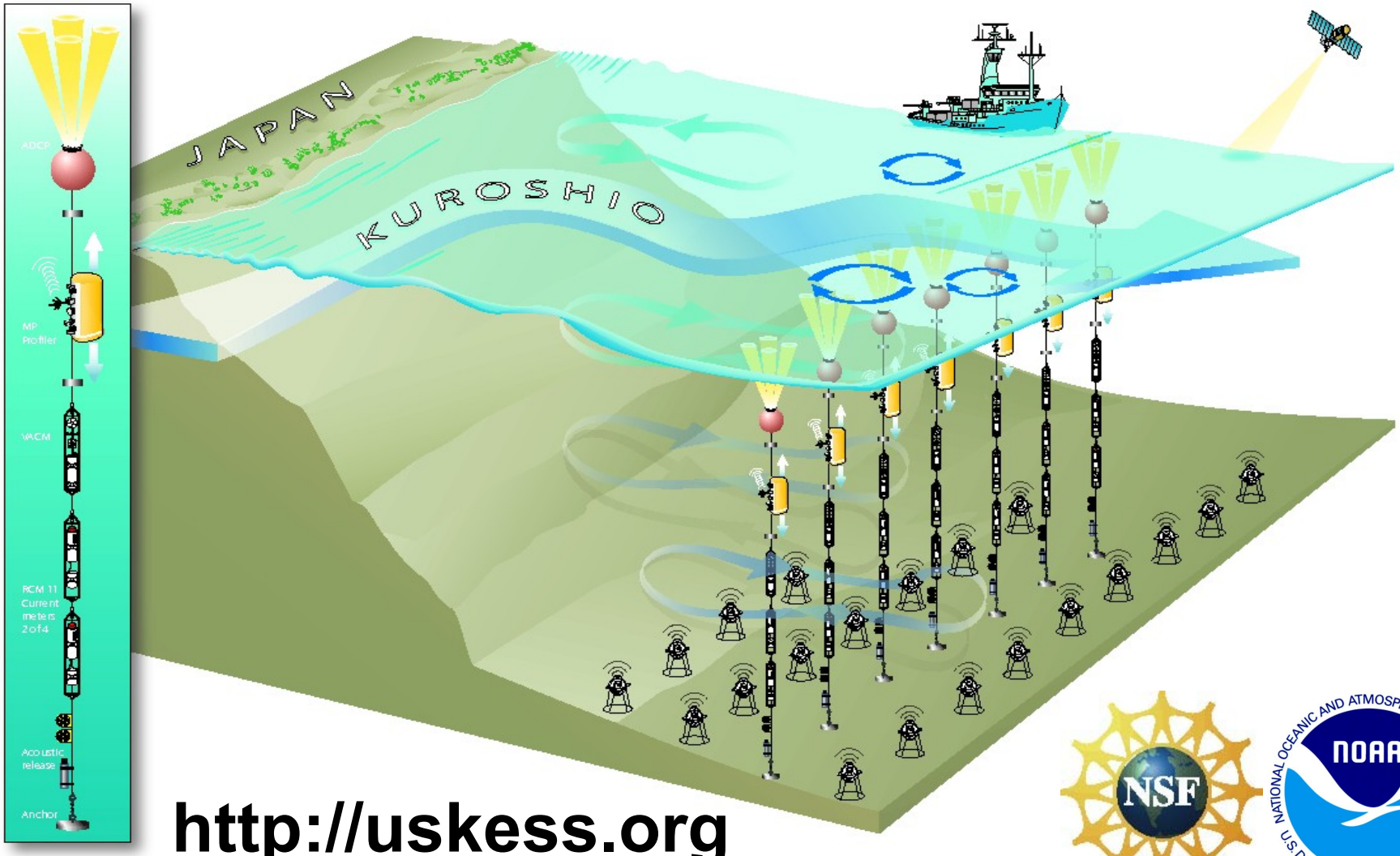
Kuroshio Extension System Study (KESS)



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KESS Objectives

The overall goal of KESS is to identify and quantify the dynamic and thermodynamic processes governing the variability of and the interaction between the Kuroshio Extension and the recirculation gyre(s).

- To understand processes coupling the baroclinic and barotropic circulation and variability.
- To determine and quantify cross-frontal exchange processes in the Kuroshio Extension.
- ✔ To determine the processes that govern the strength and structure of the recirculation gyre(s) – its position, elongation, stratification, and subtropical mode water formation within the gyre(s).

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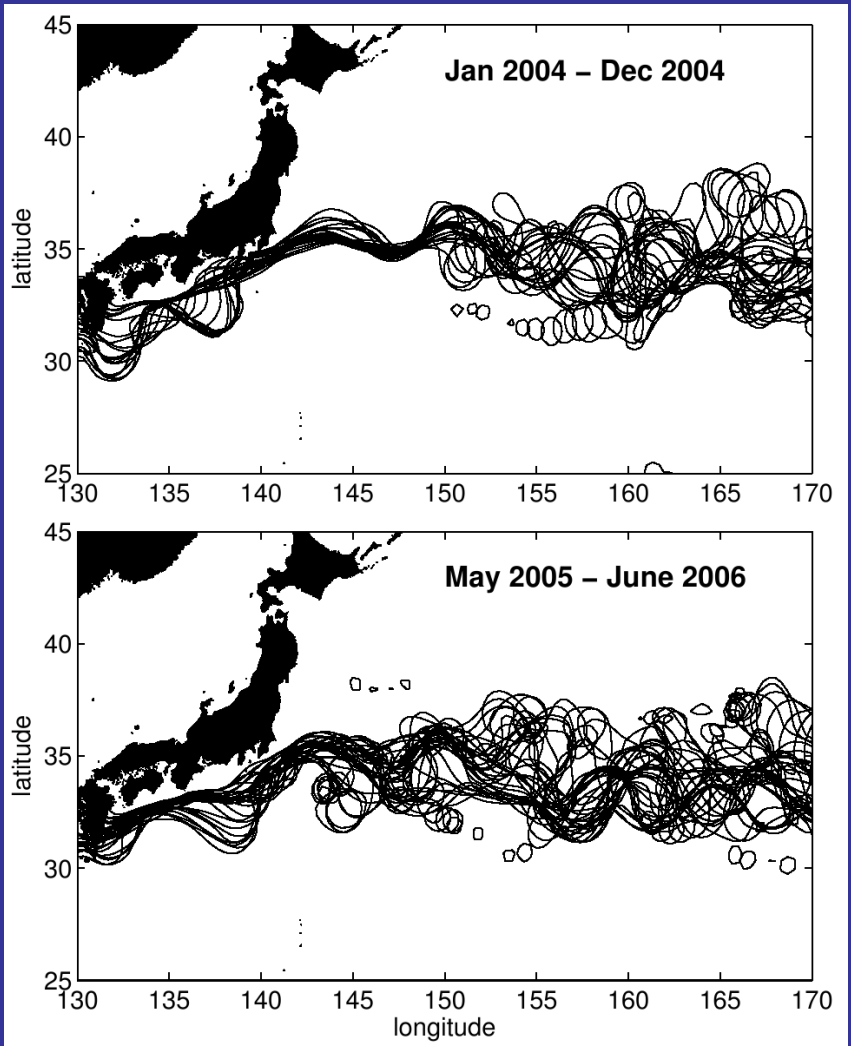
KESS Observations



- KESS field program May '04 – June '06
  - Inverted echo sounders (CPIES)
  - Subsurface current meter moorings
  - Surface Met buoy
  - Profiling floats
  - Hydrography

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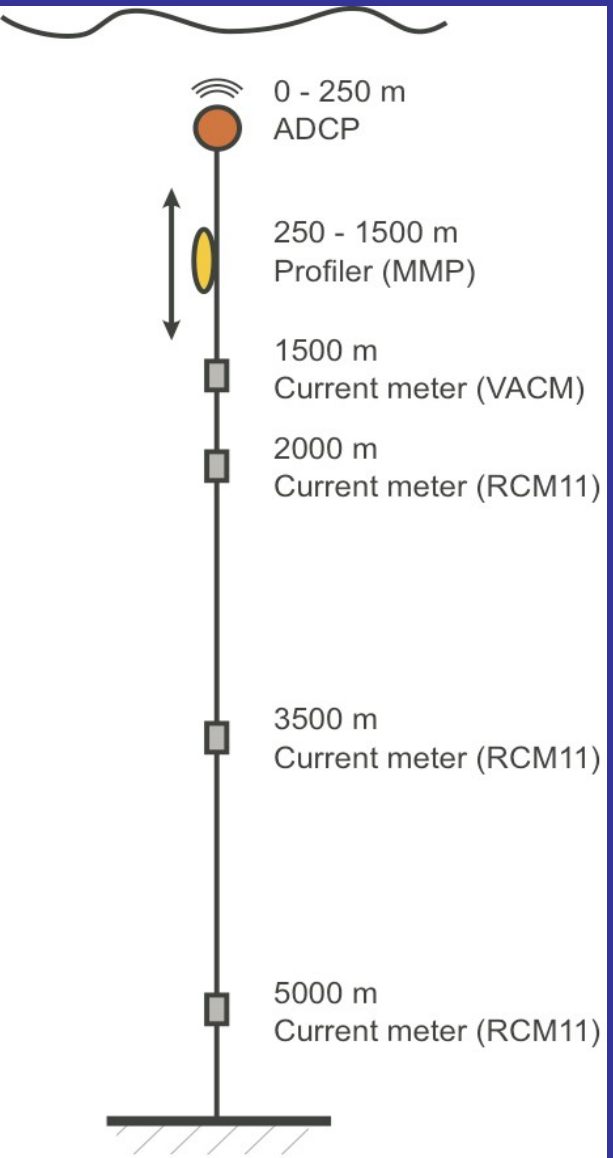
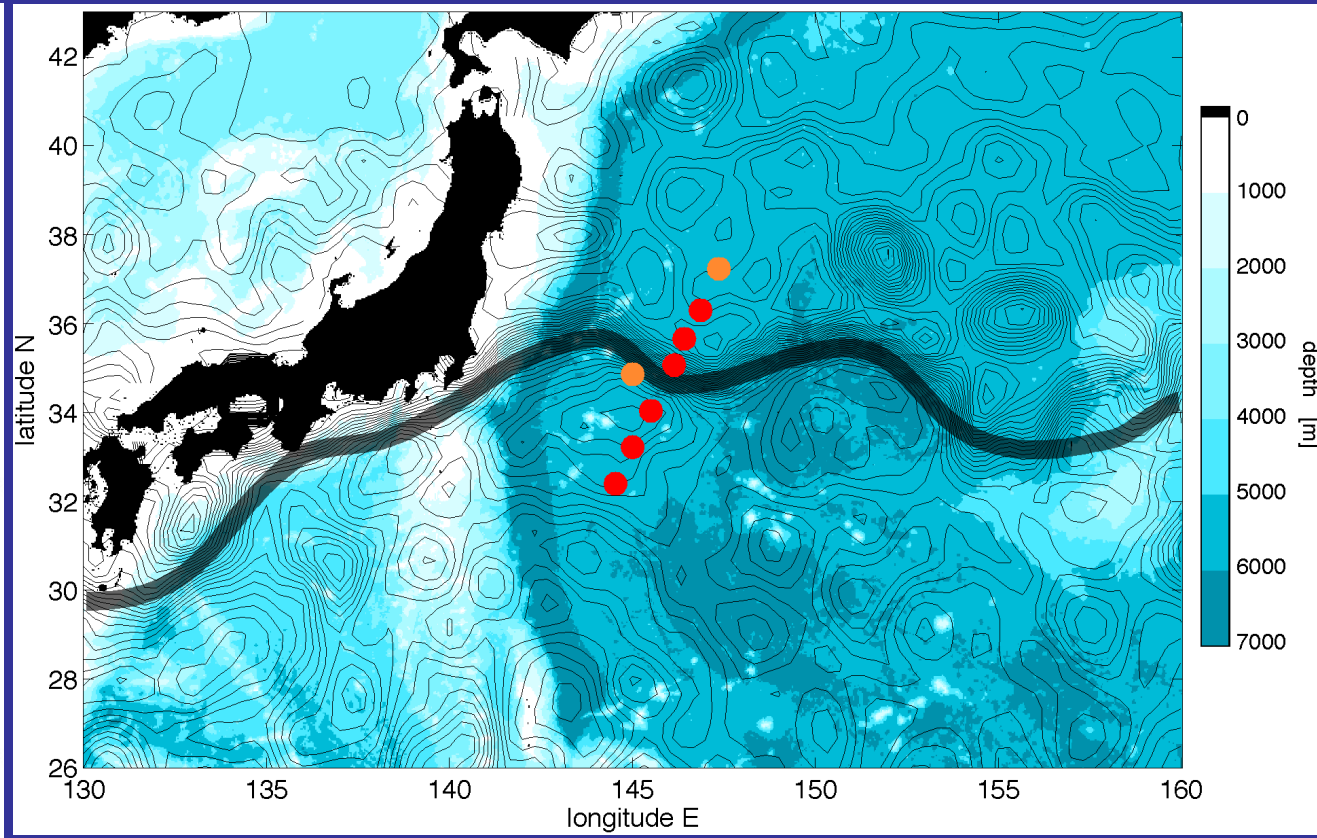
KESS Subsurface mooring component





Contours are SSH from altimetry - 4/28/2004

2004 - 2005 6 moorings

2005 - 2006 8 moorings

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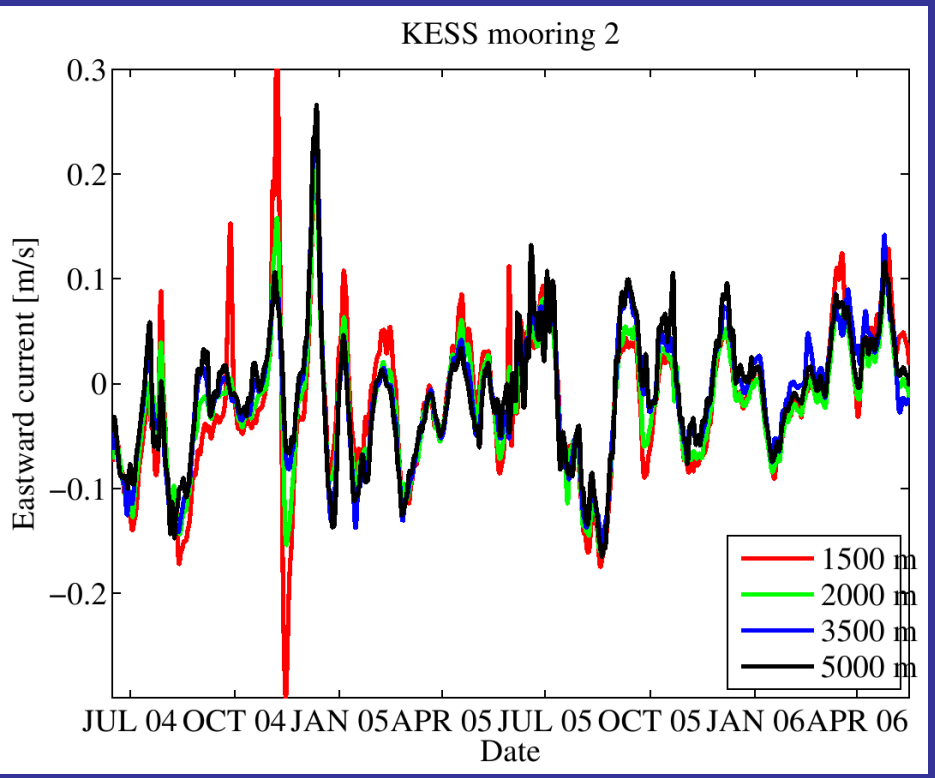
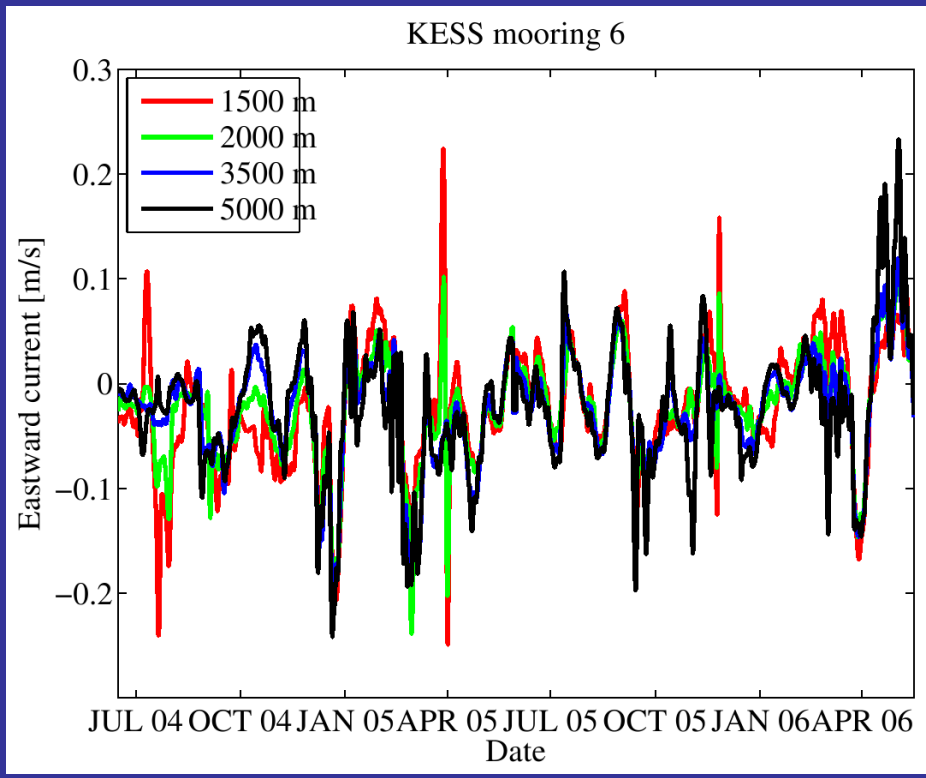
Current Variability





- Currents below the thermocline are only weakly depth dependent, implying the circulation is largely barotropic

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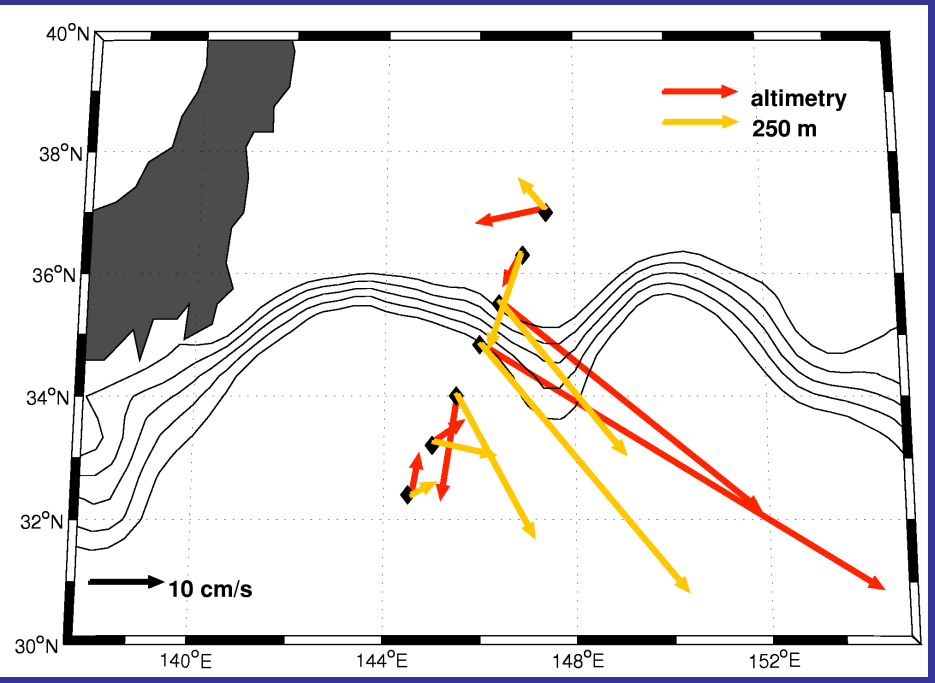
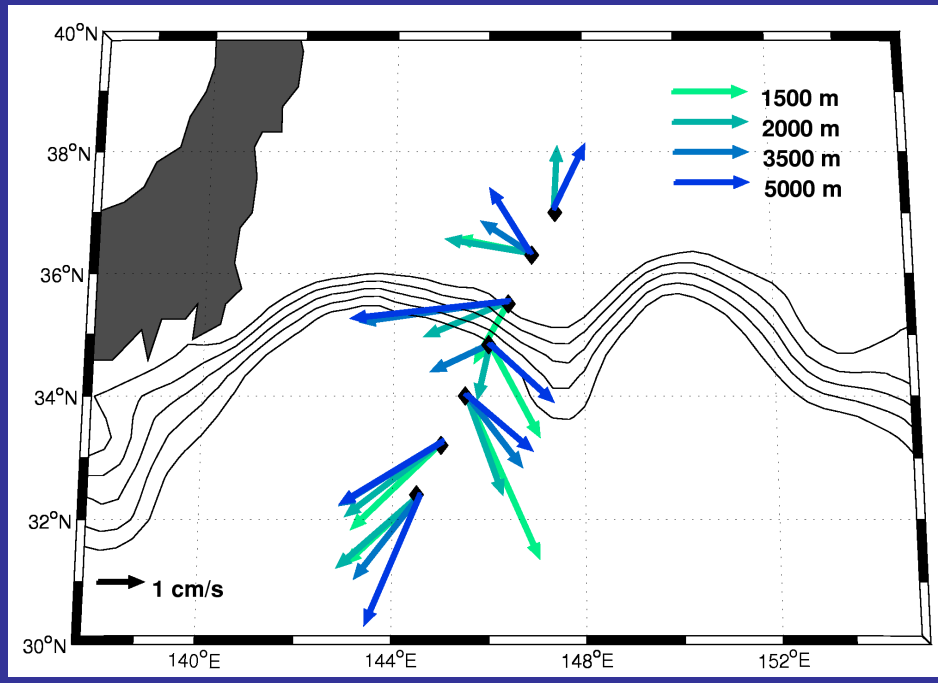
Time-averaged current observations

Upper ocean velocity



Deep ocean velocity



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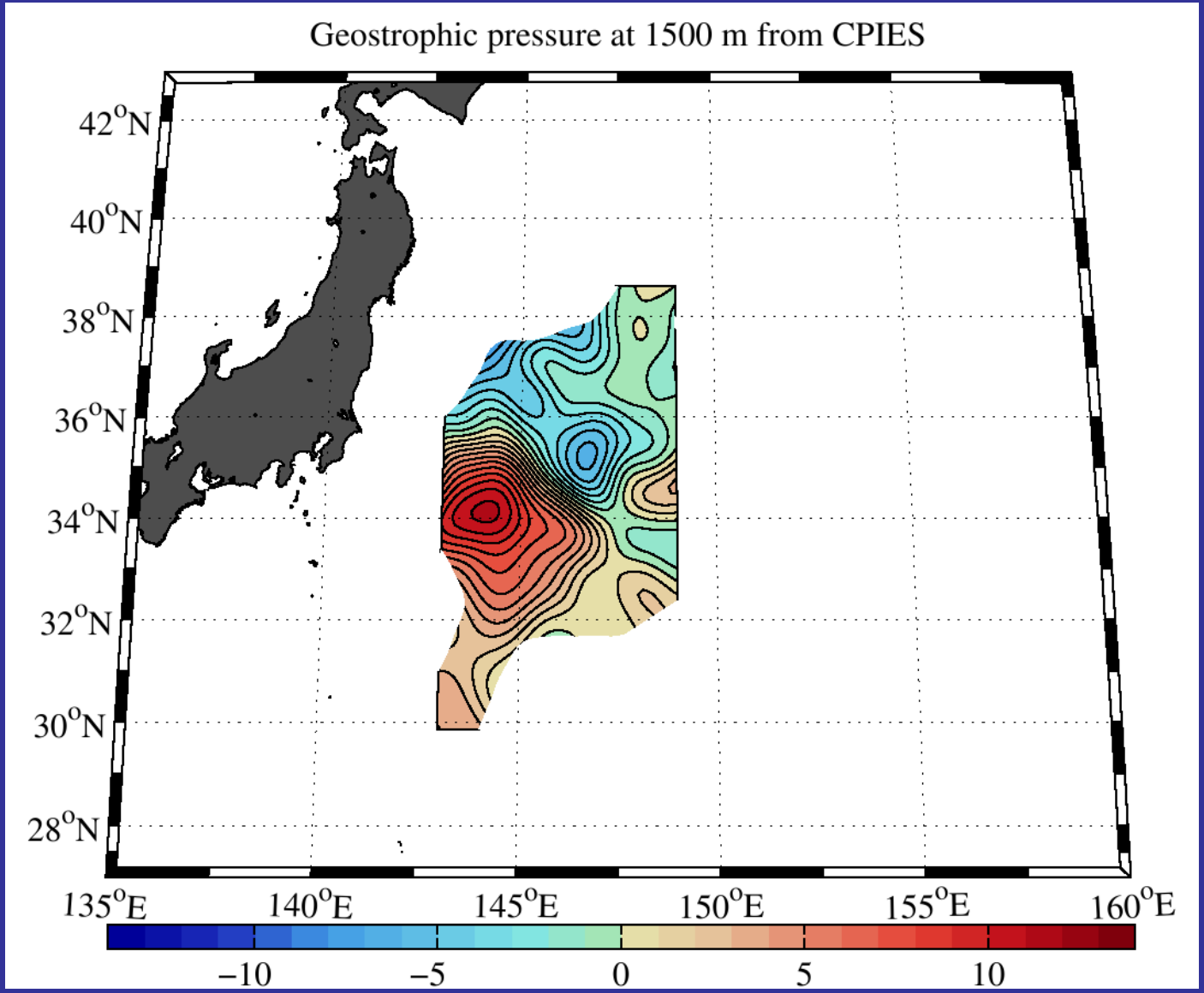
CPIES



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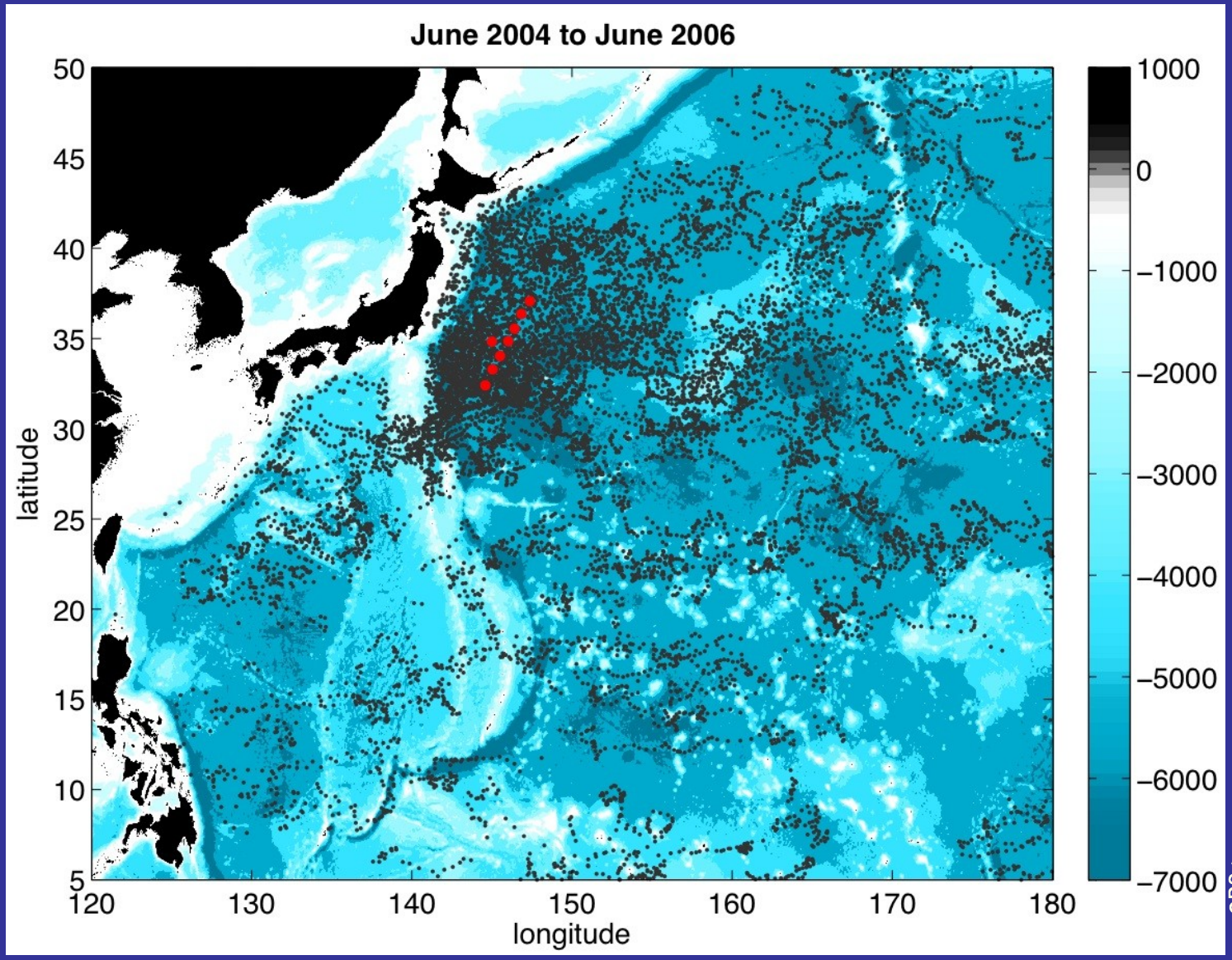
Argo Floats



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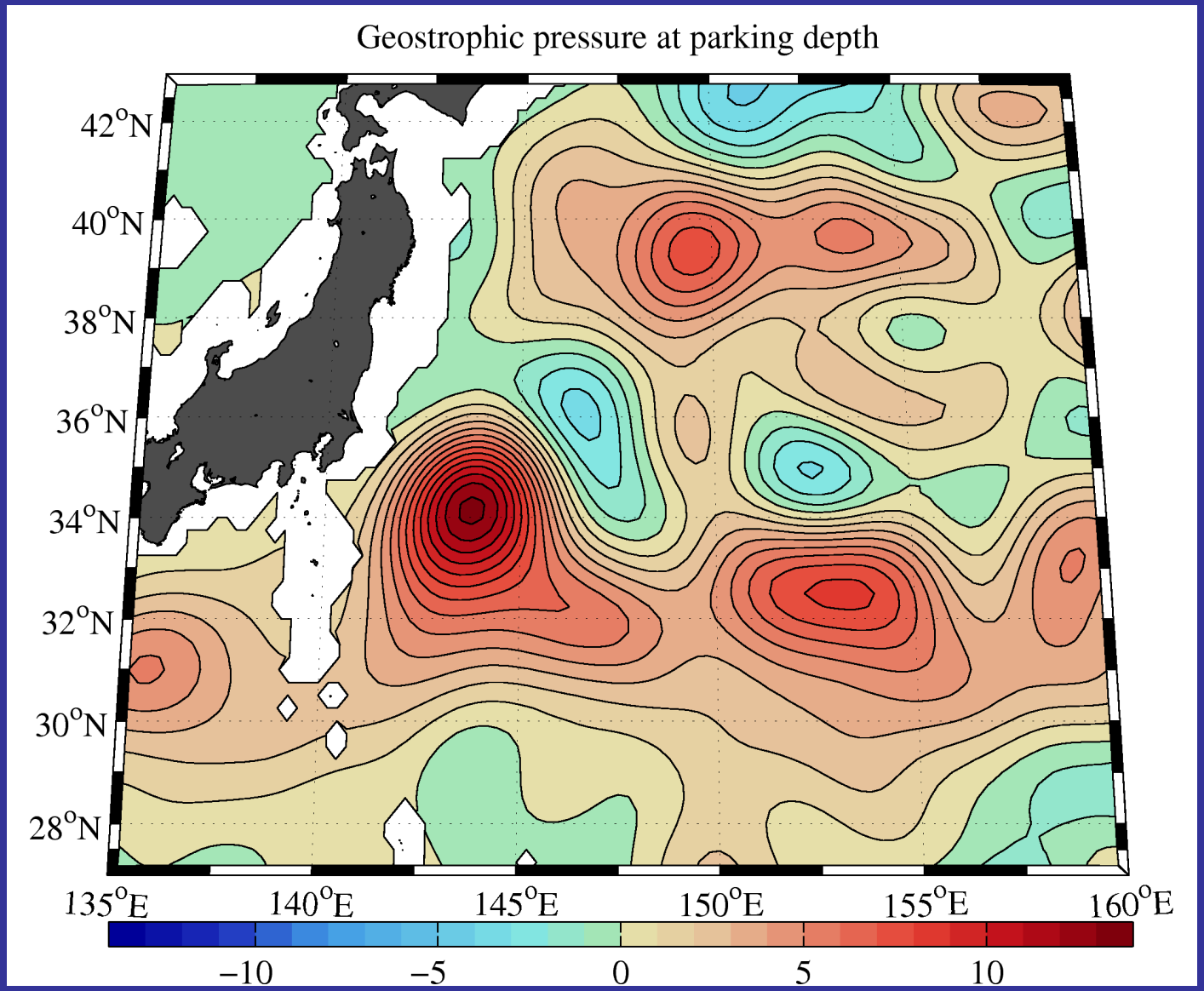
Mapped Flow Field from Floats



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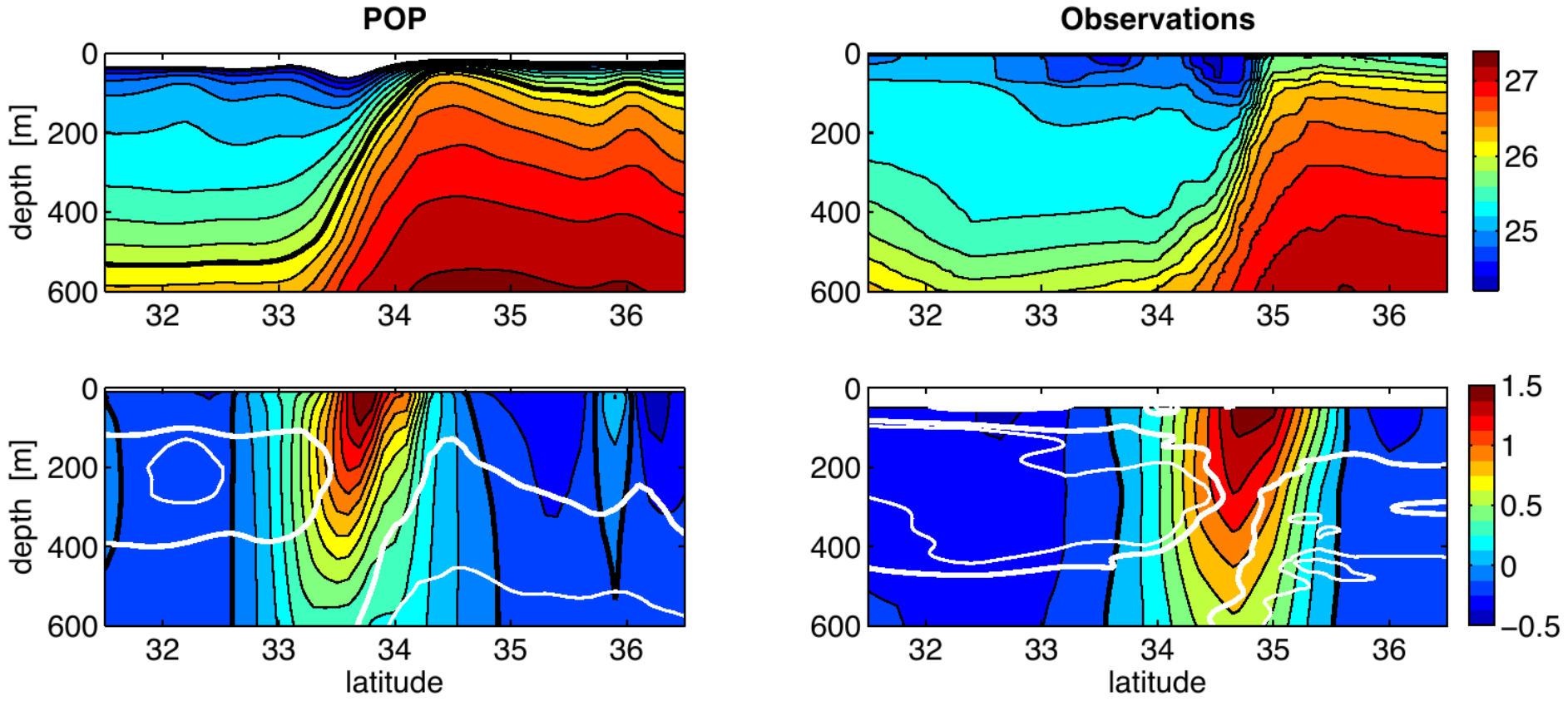
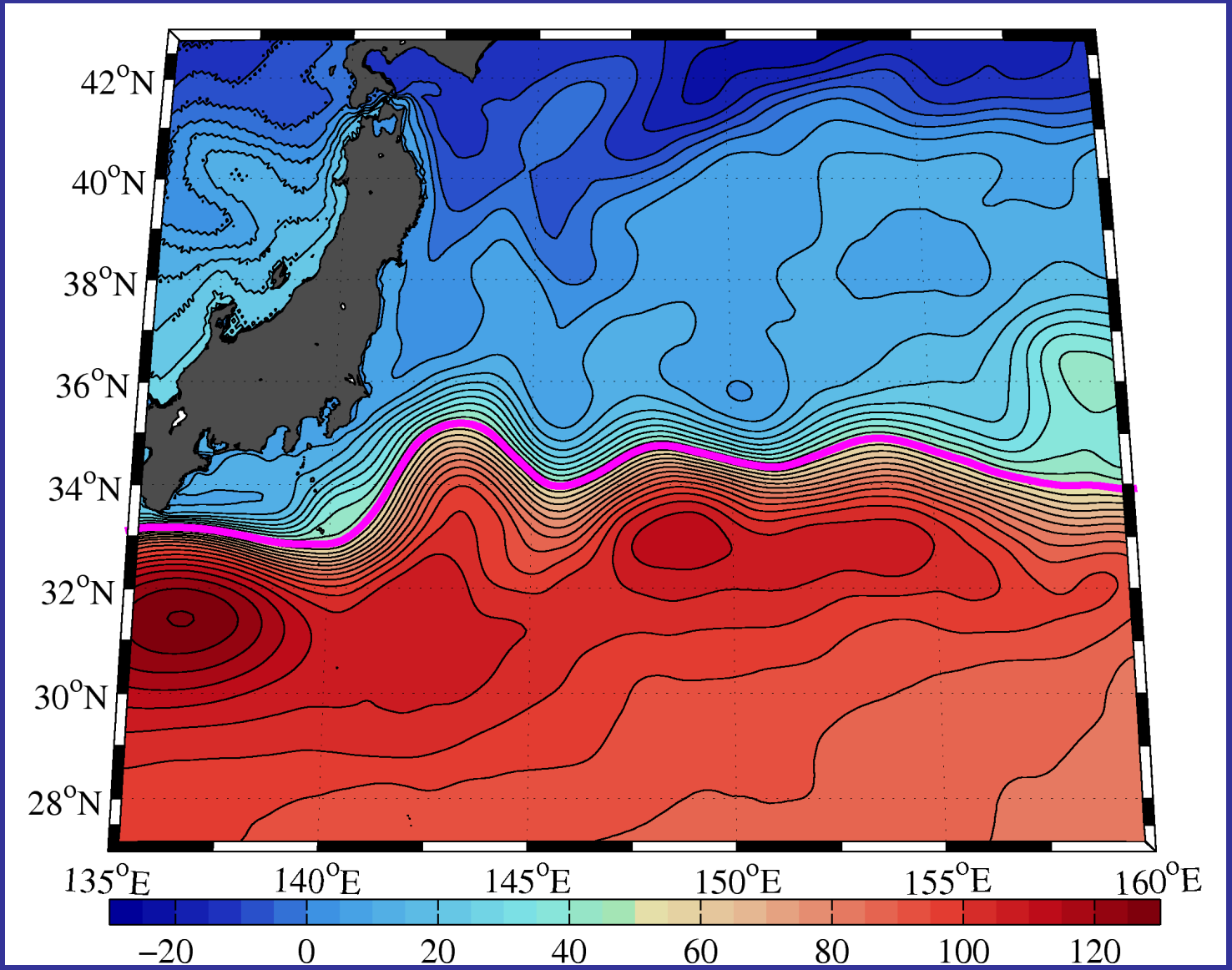
POP - Ocean Circulation Model



Model Surface Flow Field



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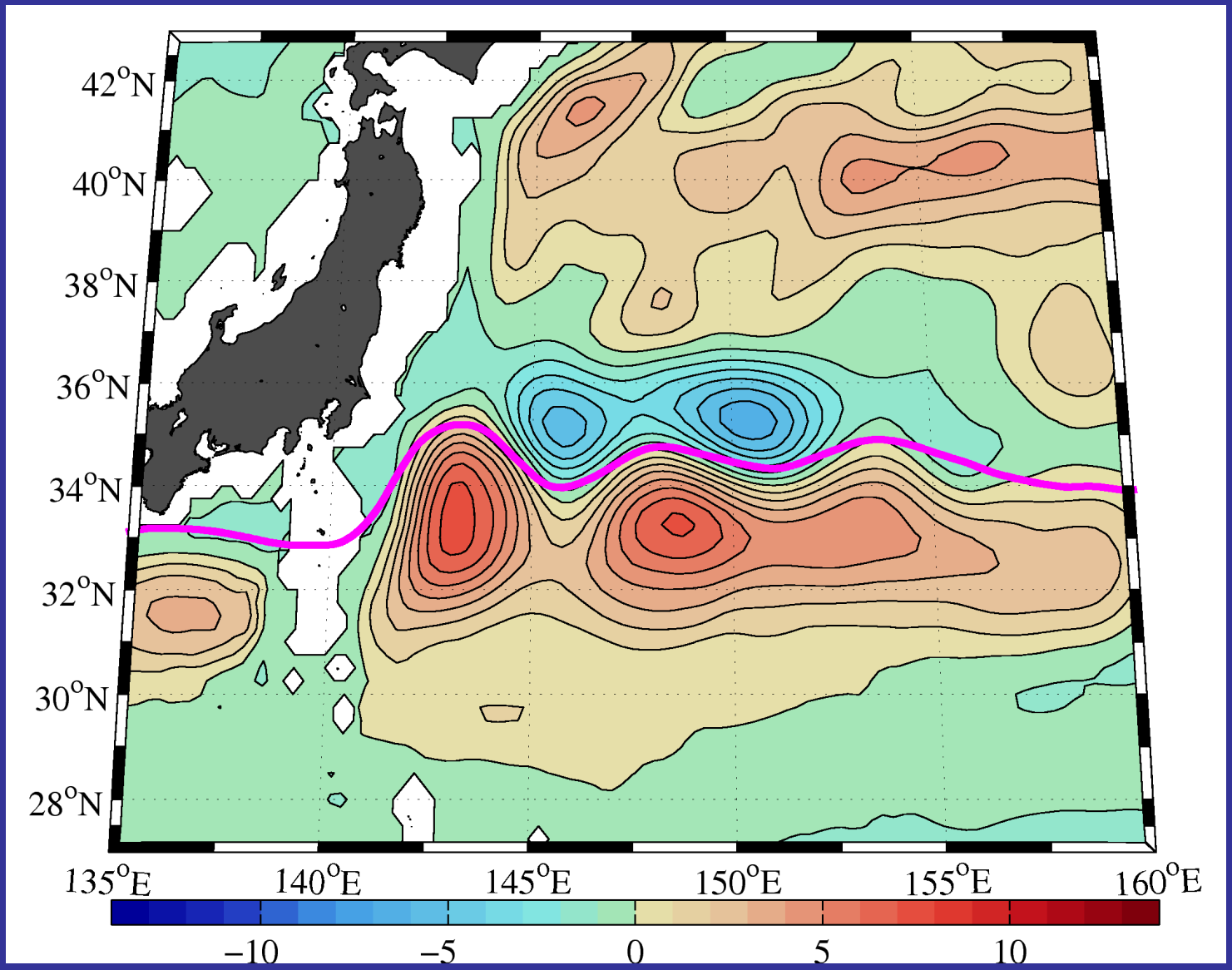
Model 1500 m Flow Field



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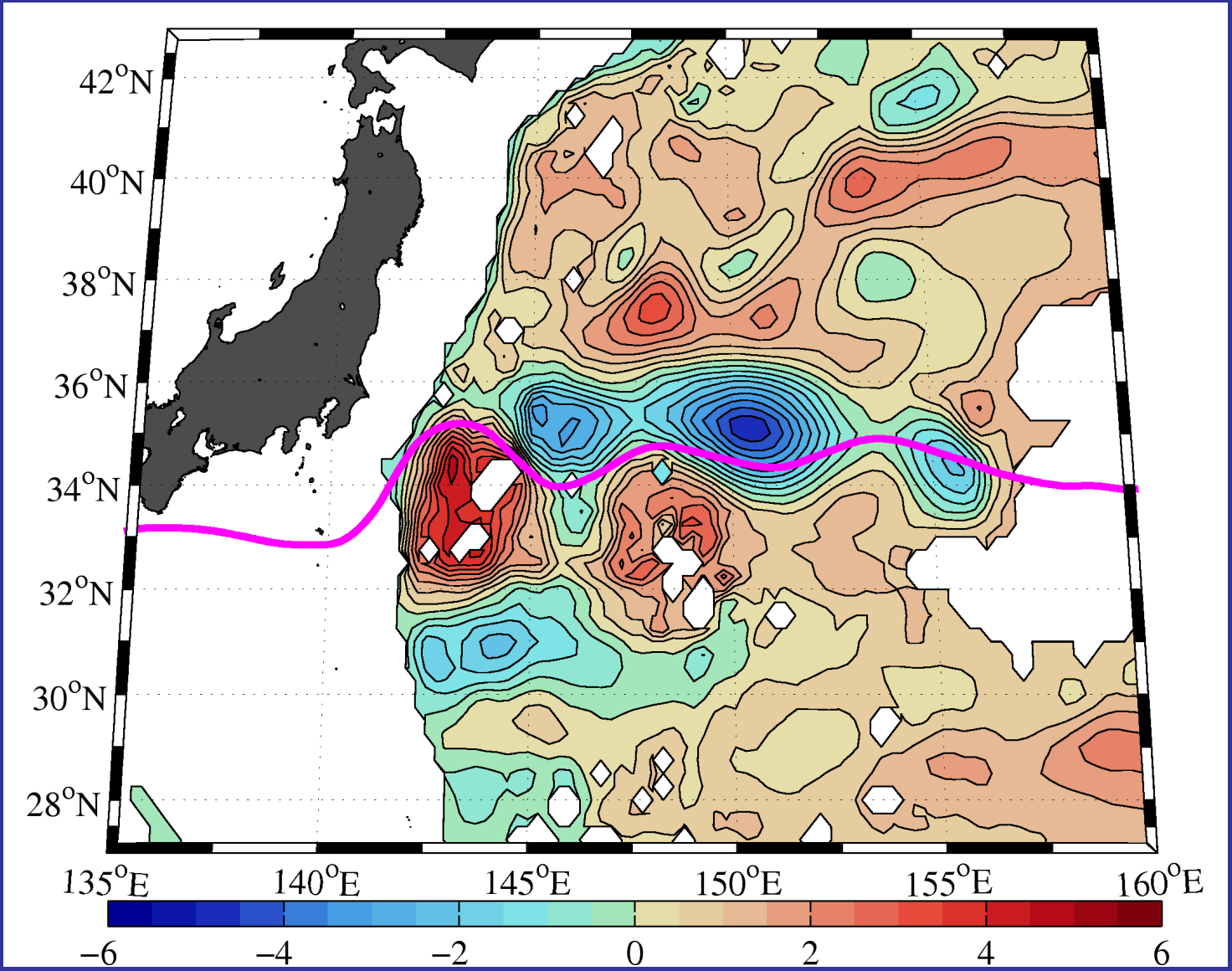
Model 5000 m Flow Field



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Summary

- Recirculation gyres are observed to exist to both the north and south of the Kuroshio
  - **Northern recirculation gyre has not been previously described from observations**
- The recirculation gyres can be clearly seen in the ocean general circulation model
- The direct observational evidence from the current meters and floats confirms the presence of the recirculation gyres
- Forcing mechanism...?

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KESS at Ocean Sciences

- Waterman, Jayne & Hogg: Eddy-mean flow interactions in western boundary current jets. Talk - next
- Chen, Qiu & Hacker: The Kuroshio Extension northern recirculation gyre: Profiling float measurements and forcing mechanism. Poster - this afternoon
- Qiu, Chen & Hacker: New insights into the subtropical mode water interannual variability from the KESS profiling float program. Talk – Thursday 4:30
- Rainville & Jayne: Evolution of the North Pacific subtropical mode water during KESS. Talk – Thursday 4:45
- Howe, Donohue & Watts: Mean stream-coordinate structure of the Kuroshio Extension first meander trough. Talk – Thursday 5:00
- Park, Watts, Donohue, Fearing, Greene & Tracey: Sea surface height variability observed by pressure-recording inverted echo sounders and satellite altimetry in the Kuroshio Extension. Talk – Friday 5:00

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