

GOES-R Ocean Dynamics: Ocean Surface Currents From SST Kinematic and Dynamic Approaches

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*GOES-R Science Week:
2011 Risk Reduction Annual Meeting*

Ocean Surface Currents from SST

Kinematic Approach

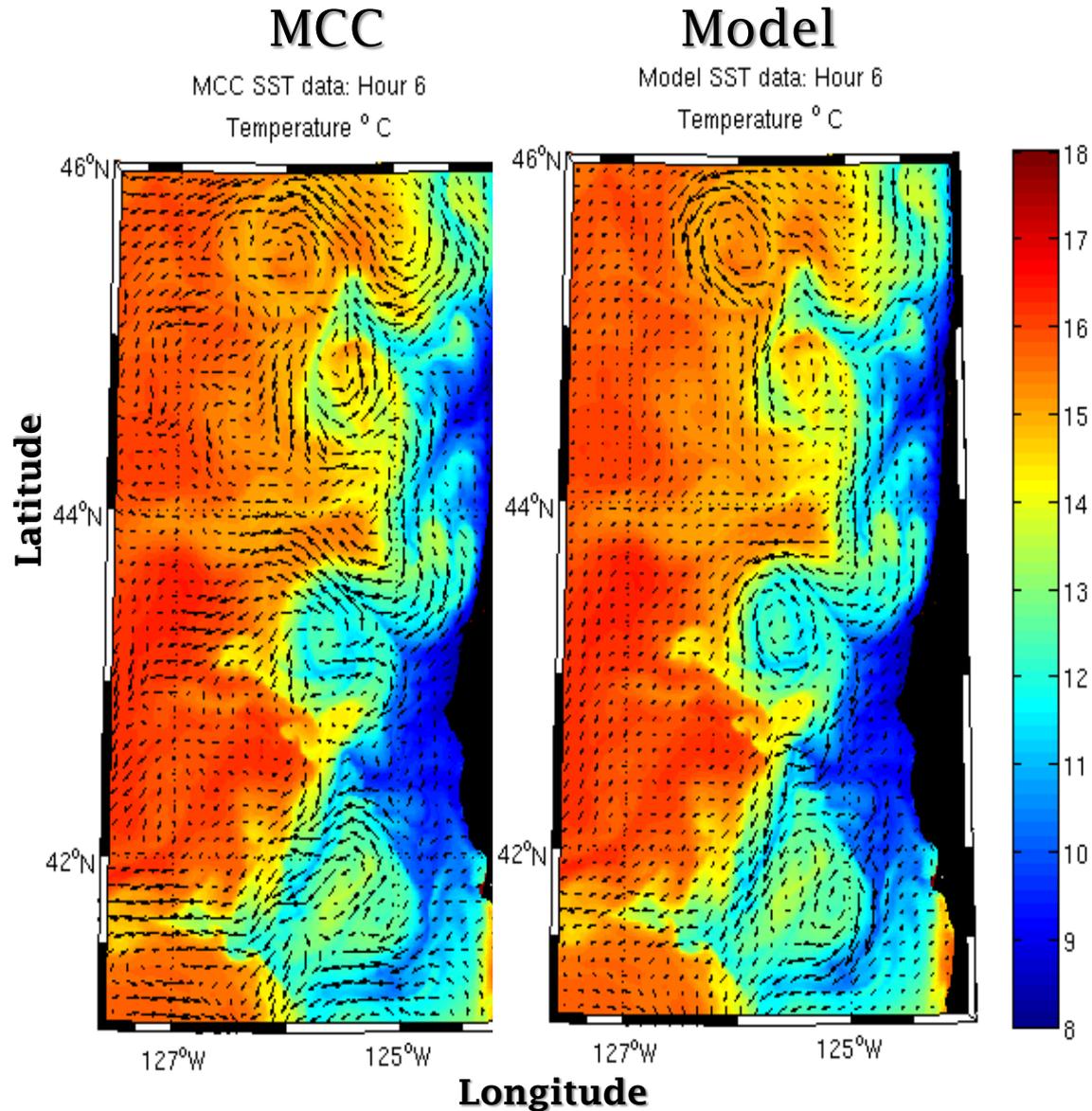
“Derived Motion”

Dynamic Approach

Model Data Assimilation

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|---|--|
| <ul style="list-style-type: none">• <u>Quick</u> application wherever sequential images are available.• No dynamics – Derived from GOES cloud-motion wind procedures (Emery et al., 1986).• <u>Can be fooled</u> by “non-advective” propagation.• <u>Clouds obscure SST > 50%</u>.• AVHRR (2-4 images per day).• GOES: more images to “see between clouds”; coarse spatial resolution and noisy SST• GOES-R: Improved resolution and SST accuracy.• Error estimates using model SST fields for proxy GOES-R data. | <ul style="list-style-type: none">• <u>Dynamically consistent</u> surface velocity, SST.• Plus <u>deeper currents</u>, temperature and salinity (oxygen, bio-optics, ecosystem parameters).• <u>Requires time</u> to set up a new model domain;• DA can substitute for poor IC, BC, forcing.• Besides the velocity fields, the model supplies <u>diffusivities, error estimates</u> used in trajectory models for spills.• <u>Producing 2-day forecasts</u> off Oregon using NWP surface forcing, expanding to entire West Coast.• NOAA Office of Response and Restoration (Seattle) is testing use of the fields in the <u>operational GNOME trajectory model</u> (used in Gulf DWH spill). |
|---|--|

MCC and Model-derived surface velocity fields for 6 hour separations, no clouds



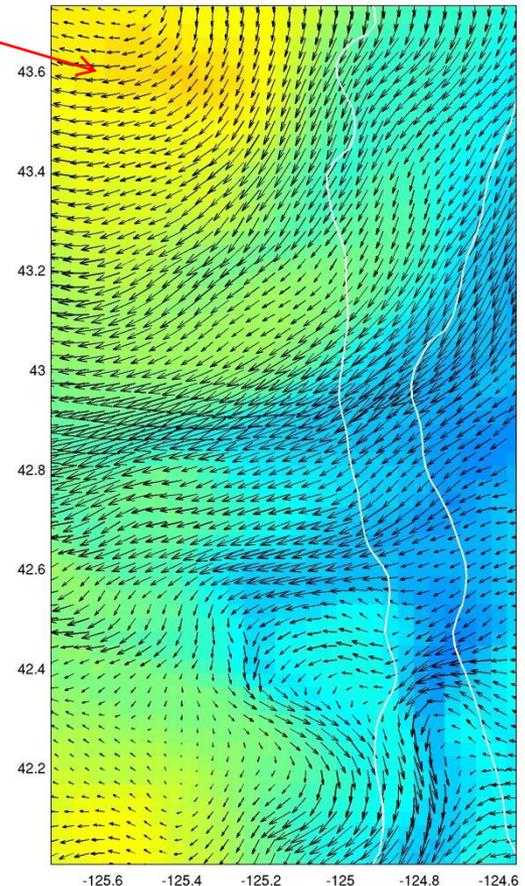
Assimilation of GOES-R SST into Coastal Ocean Circulation NOWCAST/FORECAST Models

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 NOAA collaborators: E. Maturi, A. Harris, L. Miller (NOAA/NESDIS/STAR),
 D. Foley (NESDIS/CoastWatch), A. MacFadyen (NOS/ORR), F. Aikman (NOS/OCS/MMAP)

SST and surface velocities are dynamically coupled

Assimilation of GOES SST in a high-resolution coastal ocean model => improved forecasts of SST fronts, surface currents
 [users: fisheries, search&rescue, environmental hazard response, navigation, etc.]

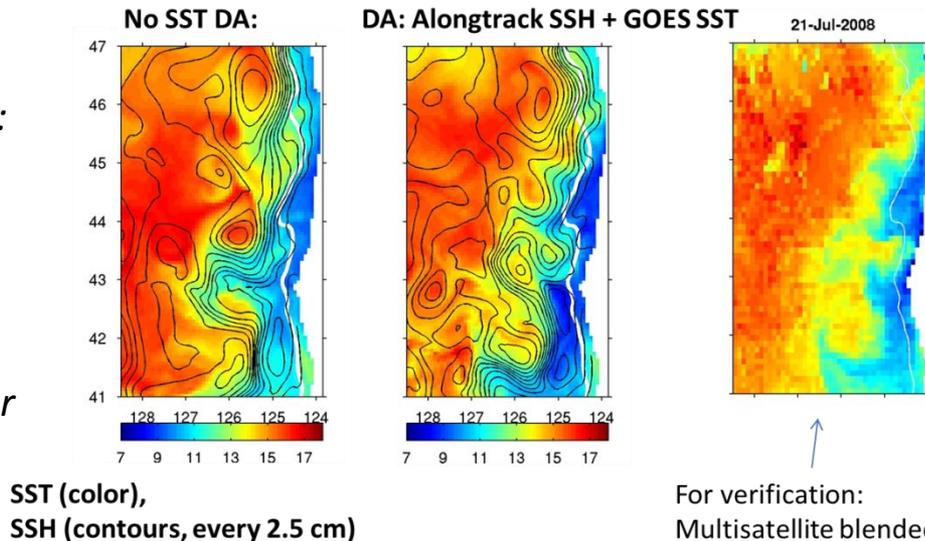
Model SST and surface currents:



SST and SSH model fields:

(left) before GOES SST assim.

(center) after assim.



For verification:
 Multisatellite blended SST
 (D. Foley, CoastWatch)

Ocean Surface Currents

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 - AVHRR (2-4 images per day).
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 - Error estimates using model SST fields for proxy GOES-R data.
- Dynamically consistent surface velocity, SST.
 - Plus deeper currents, temperature and salinity (oxygen, bio-optics, ecosystem parameters).
 - Requires time to set up a new model domain;
 - DA can substitute for poor IC, BC, forcing.
 - Besides the velocity fields, the model supplies diffusivities, error estimates used in trajectory models for spills.
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“Optical Flow Techniques” may offer improved error characteristics and alternate constraints

