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How to obtain ocean turbulent dynamics at super resolution from optimal multiresolution analysis and multiplicative cascade?

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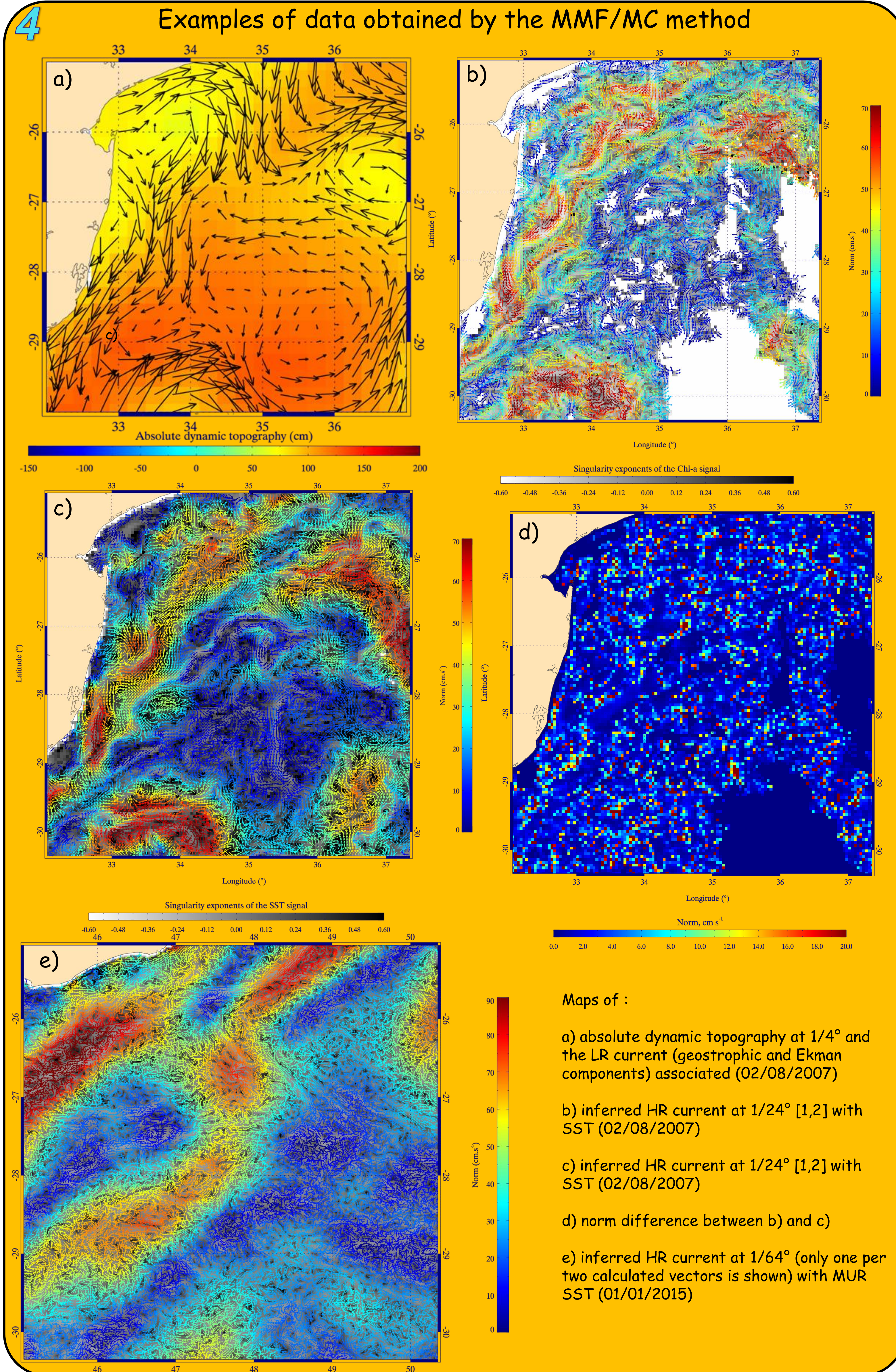
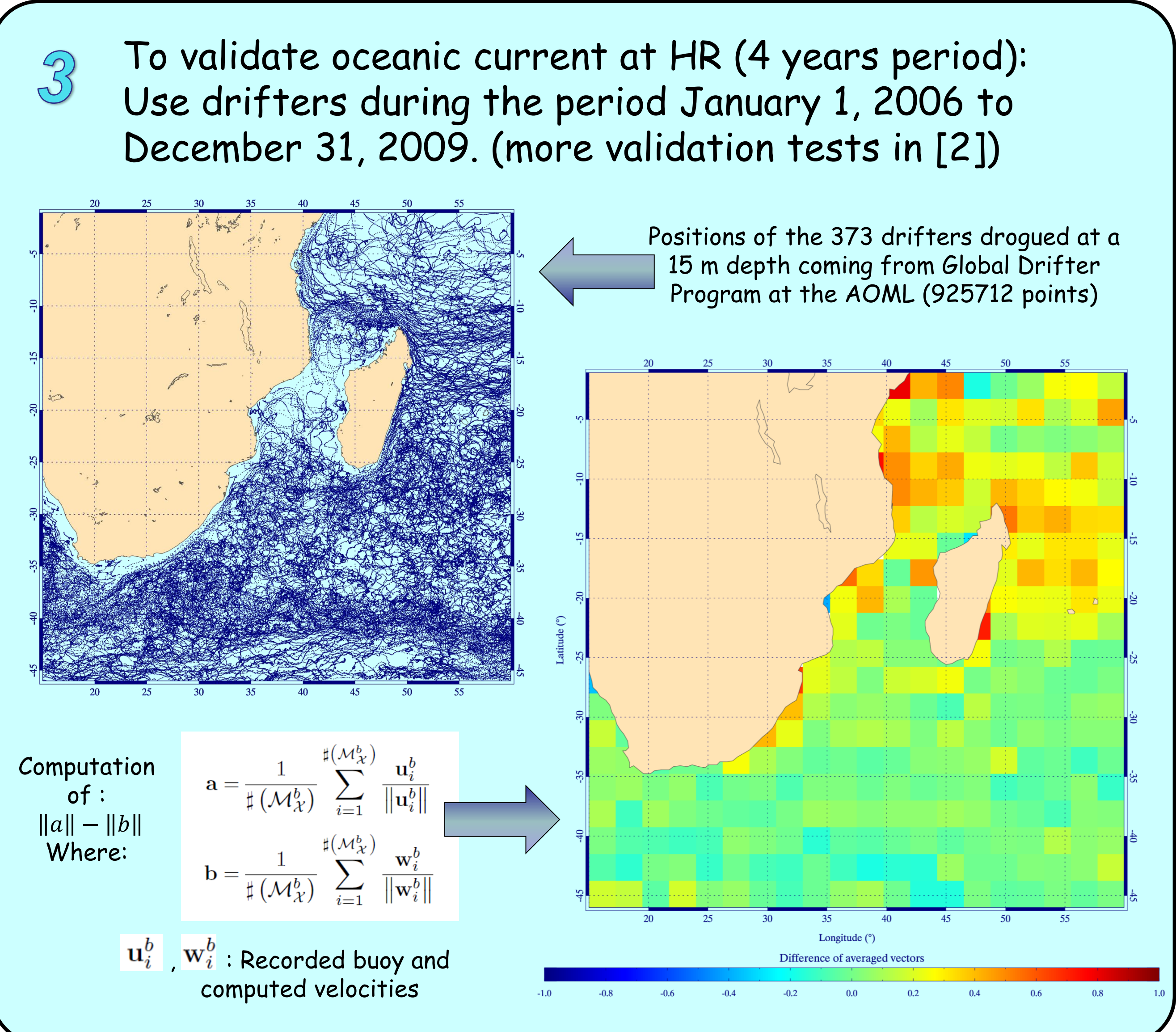
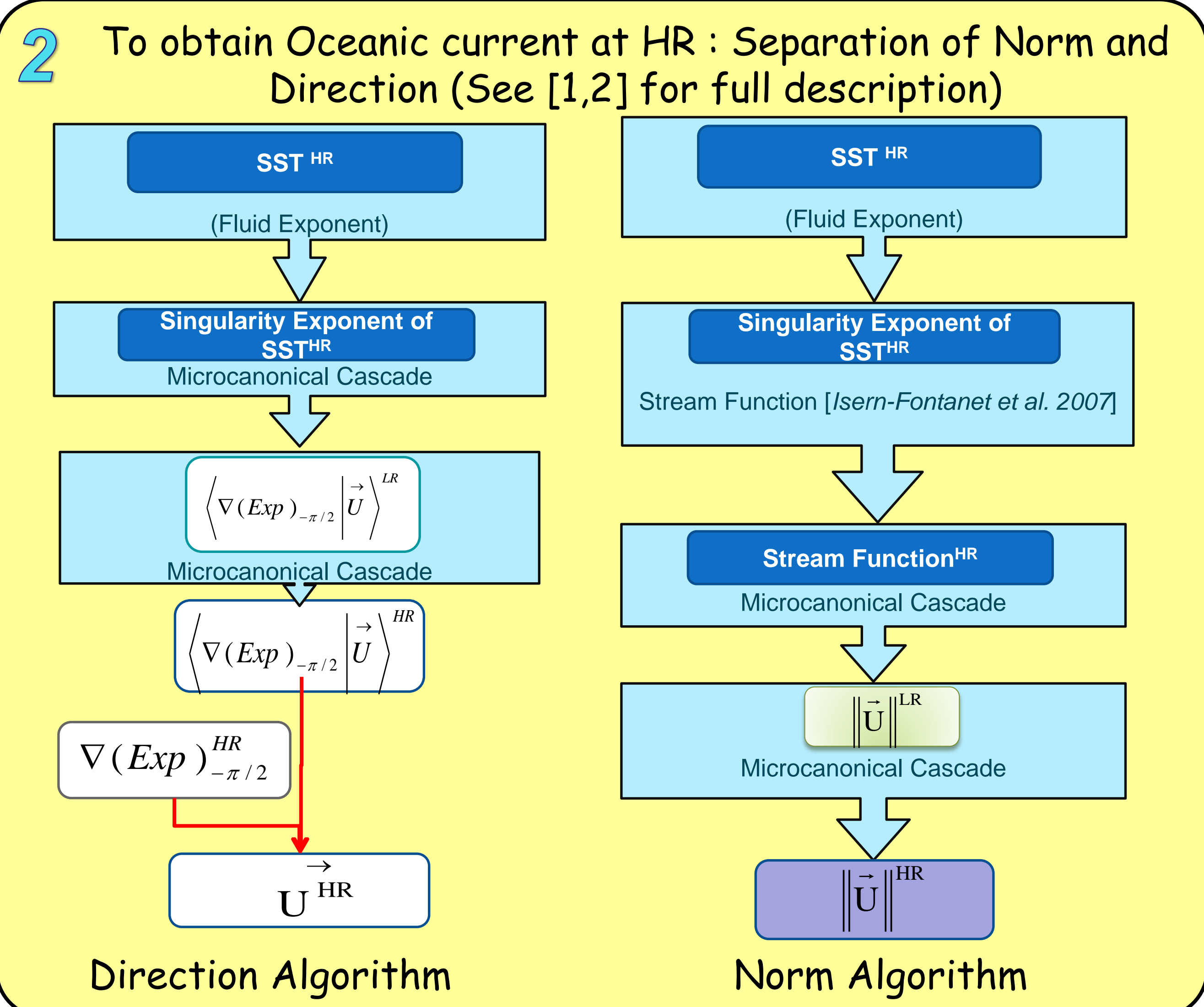
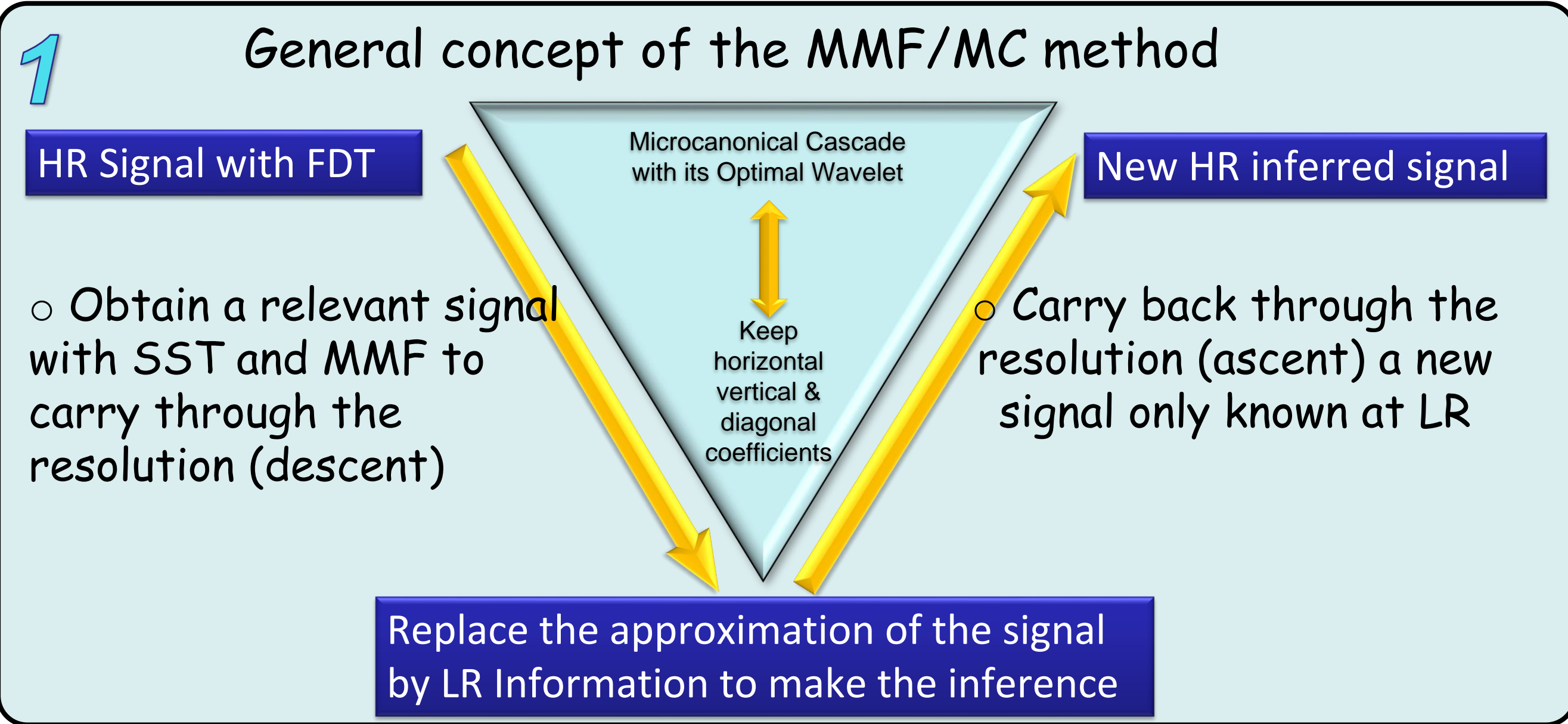
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Abstract

A fundamental challenge in oceanography is the **synoptic determination of ocean circulation** using the data acquired from space, with a **coherent depiction of its turbulent characteristics**. This determination has the potential of revealing all aspects of the ocean dynamic variability on a wide range of spatio-temporal scales and will enhance our understanding of ocean-atmosphere exchanges at super resolution, as required in the present context of climate change.

- New method based on an **approximation of the energy of Microcanonical Cascade (MC)**, expressed in a **Multiscale Microcanonical Formulation (MMF)**, associated to turbulent signals provided by different Sea Surface Temperature (SST) or Ocean Color (Chl-a) products.
- **The approach** offers the opportunity to infer different oceanic turbulent signals from Low Resolution (LR) to HR. Basic idea:
 - **optimal cascading** to decrease the spatial resolution of the HR signal (adimensional critical transition informations of SST),
 - use the signal available at LR (GEKCO product at 1/4° [1]), **transmit that information along the scales back to higher spatial resolution** using the cascade to obtain a new HR signal.
- The process has been successfully used to **obtain oceanic currents** at 1/24° [2] and 1/64°.



Conclusion and Future Work

- Evidencing multiscale geometric structures in synthetic ROMS data and satellite data data through the Multiscale Microcanonical Formalism
- Validation of algorithms on synthetic ROMS data
- Application of the algorithms on satellite data
- Validation of the new HR satellite data with *in-situ* data
- Future Work: - Analyze the difference between SST and Chl-a inferred HR currents for the 4 years period
- Process and validate SST HR currents at 1/64° on global area

References

- [1] H. Yahia, J. Sudre, C. Pottier and V. Garçon, 2010, Motion analysis in oceanographic satellite images using multiscale methods and the energy cascade, Pattern Recognition, DOI: 10.1016/j.patcog.2010.04.011
- [2] J. Sudre, H. Yahia, O. Pont, and V. Garçon, 2015, Ocean turbulent dynamics at superresolution from optimal multiresolution analysis and multiplicative cascade, IEEE TGRS, DOI: 10.1109/TGRS.2015.2436431

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