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DISPERSION ANALYSIS PREDICTION

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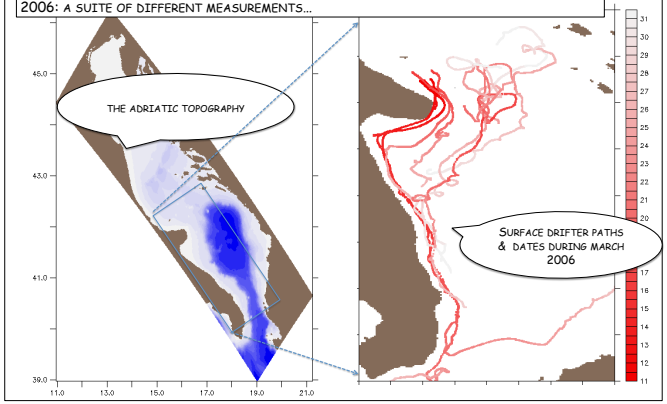
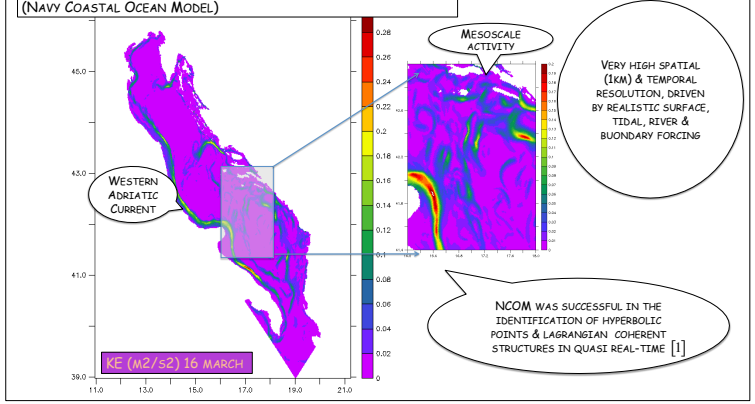
The Dynamics of the Adriatic in Real-Time (DART) observational program in 2006: a suite of different measurements...



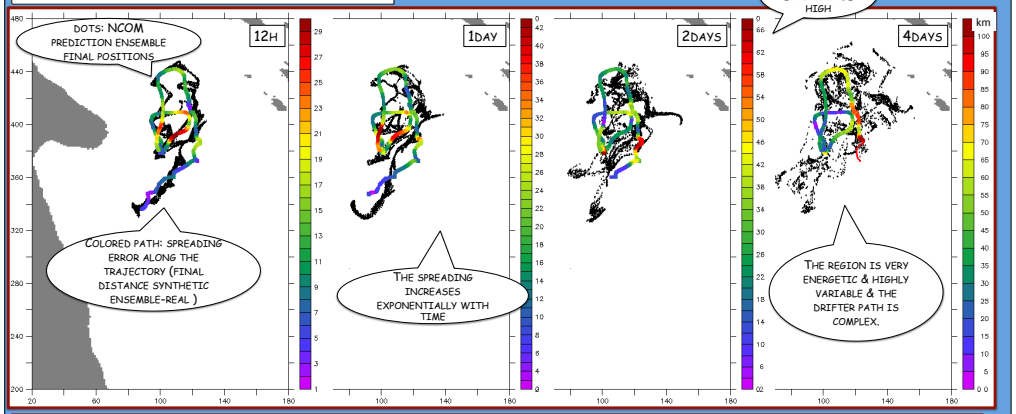
...in conjonction with a real-time modeling effort, NCOM (Navy Coastal Ocean Model)

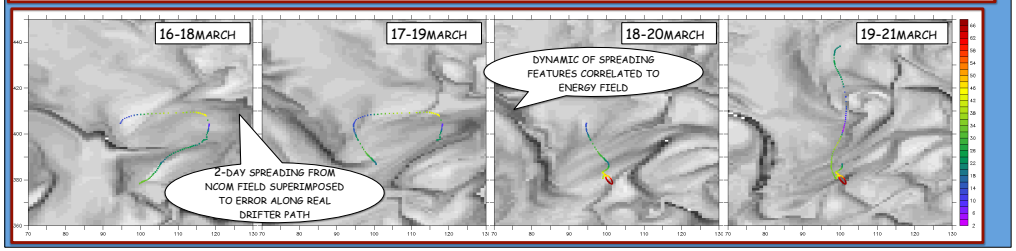


VERY HIGH SPATIAL (1KM) & TEMPORAL RESOLUTION, DRIVEN BY REALISTIC SURFACE, TIDAL, RIVER & BUONDARY FORCING

NCOM WAS SUCCESSFUL IN THE IDENTIFICATION OF HYPERBOLIC POINTS & LAGRANGIAN COHERENT STRUCTURES IN QUASI REAL-TIME [1]

NCOM performance in terms of dispersion prediction: spreading error of one drifter





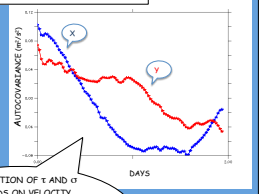
The Inserting Missing Component: the velocity is corrected by a sub-grid scale component such that the prediction of tracer spreading is improved (in terms of pdf) [2]

DRIFT — FLUCTUATION — MISSING COMPONENT

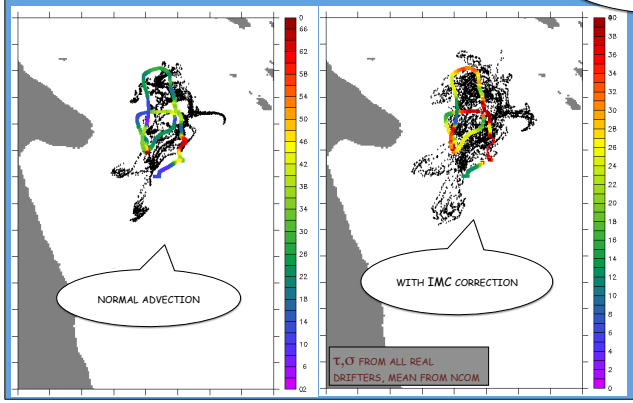
$$\frac{dx_c(t)}{dt} = U + u_m'(t,r_m(t)) + \eta(t)\ , \quad \frac{d\eta(t)}{dt} = a\frac{du_m'(t,r_m(t))}{dt} + bu_m'(t,r_m(t)) + c\eta(t)$$

$$a = \frac{\sigma_c}{\sigma_m}\sqrt{\frac{\tau_m}{\tau_r}} - 1, \quad b = \frac{\sigma_r}{\sigma_m\sqrt{\tau_m\tau_r}} - \frac{1}{\tau_r}, \quad c = -\frac{1}{\tau_r}$$

RMS OF FLUCTUATIONS — CORRELATION TIME



ESTIMATION OF τ AND σ DEPENDS ON VELOCITY AUTOCOVARIANCE FUNCTION WHICH DEPENDS ON THE MEAN, THE ADVECTION TIME, THE DATA ENSEMBLE, THE INITIAL TIME, ...



IN TERMS OF FINAL DISTANCE, PATH AND SINGLE TRAJECTORY, THE IMC CORRECTION IS ADDING NOISE, AND INCREASES THE ERROR.

IN TERMS OF « ENVELOPE » RESULTS ARE PROMISING.

THE ON-LINE COMPUTATION OF THE STATISTICAL PARAMETERS ALONG THE TRAJECTORY IS A POSSIBLE STRATEGY, BUT NEEDS A COMMON, HIGH ORDER AND WELL DEFINED ESTIMATION METHOD

Conclusions

NCOM WAS VERY SUCCESSFULL IN PREDICTING VELOCITY FIELD, AND GIVE A GOOD FIRST GUESS OF THE DRIFTER PATH

QUASI REAL-TIME CORRECTION OF DISPERSAL PATTERNS USING A STATISTICAL APPROACH IS A VERY CHALLENGING AND COMPLEX TASK.

THE LAGRANGIAN SUB-GRID SCALE MODEL IS HIGHLY SENSITIVE TO THE STATISTICAL PARAMETERS

Outlooks

INCREASE THE DEGREE OF THE LAGRANGIAN STOCHASTIC MODEL BY ADDING A SPIN TERM?

ASSIMILATION?

BEST-FIT OF THE AUTOCOVARIANCE FUNCTION TO THE THEORETICAL EXPONENTIAL SHAPE?

THE PUZZLE NEEDS TO BE SOLVED FOR ENVIRONMENTAL APPLICATIONS (JELLYFISH STRANDING, OIL-SPILL DISPERSION)

TO BE CONTINUED.....

References

[1] Haza, Griffa, Martin, Molcard, Ozgokmen, Poje, Barbanti, Book, Poulain, Rixen, Zanasca, 2007: Model-based directed drifter launches in the Adriatic Sea: Results from the DART Experiment. Geophy. Res. Letters, 34.
[2] Haza, Piterbarg, Martin, Ozgokmen, Griffa, 2007: A Lagrangian Subgridscale Model for Particle Transport Improvement and Application in the Adriatic Sea Using the Navy Coastal Ocean Model. Ocean Modelling, (17), 68-91.
[3] Haza, Poje, Ozgokmen, Martin, 2008: Relative dispersion from a high-resolution coastal model of the Adriatic Sea. Ocean Modelling, (22), 48-65.
[4] Poje,. Haza, Ozgokmen, Magaldi, Garraffo, 2009: Resolution dependent relative dispersion statistics in a hierarchy of ocean models. Ocean Modelling, (31) 36-50.

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