CMEMS User Uptake 67-UU-DO-CMEMS-DEM4_LOT7


# IBISAR
# Skill Assessment Methodology

**August 9th, 2019**

# PURPOSE

This document explains the methodology of the IBISAR Skill Assessment service.

# LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| **CMEMS** | Copernicus Marine Environment Monitoring Service |
| **HF** | High-Frequency |
| **IBISAR** | Skill assessment service for real-time met-ocean data product ranking in the IBI area for emergency and SAR operators. |
| **NCLS** | Normalized Cumulative Lagrangian Separation |
| **SA** | Skill Assessment |
| **SS** | Skill Score |

# CONTRIBUTING EXPERTS

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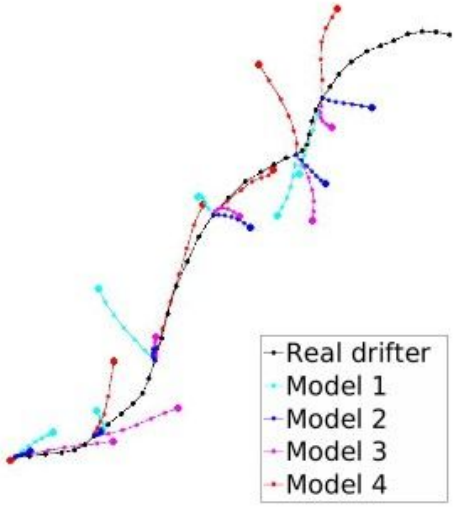
Built on an existing operational service developed by RPS Ocean Science -www.rpsgroup.com/-, the IBISAR Skill Assessment (SA) service consists of an automated process that evaluates the performance of ocean models and HF radar datasets in predicting the trajectory of particles. For each dataset, the service computes a metric named Skill Score (SS). This metric compares the predicted trajectories against real satellite-tracked drifters, based on the Normalized Cumulative Lagrangian Separation -NCLS- distance (Liu and Weisberg, 2011).

**For each dataset available in the area and period of interest** (to be defined by the user), **IBISAR** SA service evaluates its performance in **3 steps**:

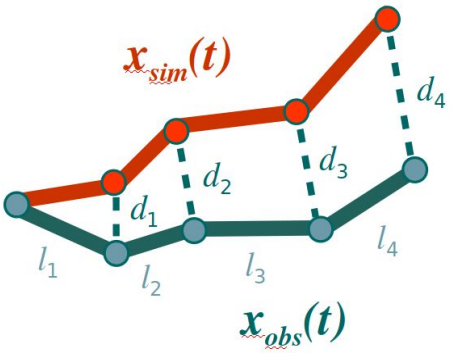
1. It simulates trajectories along the trajectories of all available observed drifters: simulated trajectories are initialized at the 6-hourly positions of the observed drifters and set adrift during 6 hours;




2. It compares the observed and predicted trajectories by computing the SS defined as follows:

$$SS = \begin{cases} 1 - \dfrac{\sum_{i=1}^{N} d_i}{\sum_{i=1}^{N} l_{oi}} & if \quad \sum_{i=1}^{N} d_i \le \sum_{i=1}^{N} l_{oi} \\ 0 & if \quad \sum_{i=1}^{N} d_i > \sum_{i=1}^{N} l_{oi} \end{cases}$$

$$with \quad l_{oi} = \sum_{k=1}^{i} l_k$$



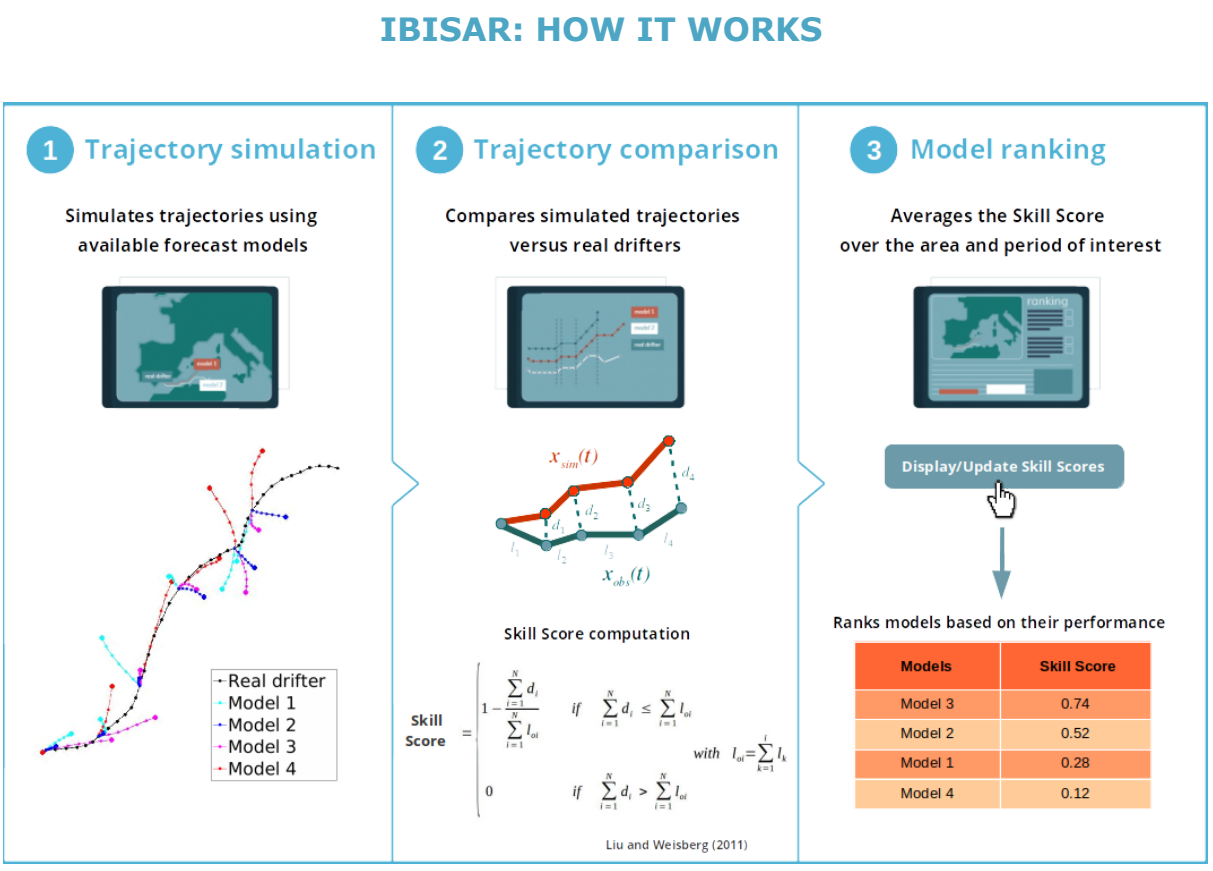
where:

$d_i$ is the separation distance between observed and predicted trajectories at time step $i$
$l_{oi}$ is the cumulative sum of the observed trajectory length at time step $i$
$N$ is the total number of time steps. The SS is computed hourly for 6 hours of simulation, so N=6.

3 It averages the SS over the area and period of interest.

The SS is a dimensionless index ranging from 0 to 1; the higher the SS value, the better the model performance, with a value=1 implying a perfect match between drift observation and prediction.

IBISAR SA provides both historical evaluation (using all drifters available in the area of interest during the last 6 months) and real-time evaluations (using all drifters available in the area of interest during the period specified in the calendar). If no period is specified in the calendar, the last 3 months are selected by default.




***IBISAR Skill Assessment methodology***

This methodology is gaining popularity in evaluating trajectory models for oil spill and SAR operations (Ivichev et al., 2012[1]; Mooers et al., 2012[2]; Röhrs et al., 2012[3]; Liu et al., 2014[4]) after being used in the context of the Deepwater Horizon oil spill (Liu and Weisberg, 2011[5]; Mooers et al., 2012; G. R. Halliwell et al., 2014[6]).

[1] Ivichev, I., Hole l. R., Karlin L., Wettre, C., Röhrs, J. (2012) Comparison of Operational Oil Spill Trajectory Forecasts with Surface Drifter Trajectories in the Barents Sea. J Geol Geosci 1.

[2] Mooers, C.N.K., E.D. Zaron, Howard, M.K., (2012) Final Report for Phase I of Gulf of Mexico 3-D Operational Ocean Forecast System Pilot Prediction Project (GOMEX-PPP),. U.S. Department of Energy.

[3] Röhrs, J., Christensen, K.H., Hole, L.R., Broström, G., Drivdal, M., Sundby, S. (2012) Observation-based evaluation of surface wave effects on currents and trajectory forecasts. Ocean Dynamics 62, 1519-1533.

[4] Liu, Y., Weisberg, R., Vignudelli, S., T. Mitchum, G. (2014) Evaluation of altimetry-derived surface current products using Lagrangian drifter trajectories in the eastern Gulf of Mexico.

[5] Liu, Y. and R. H. Weisberg (2011). "Evaluation of trajectory modeling in different dynamic regions using normalized cumulative Lagrangian separation." Journal of Geophysical Research: Oceans 116(C9)

[6] Halliwell G. R., J., Srinivasan, A., Kourafalou, V., Yang, H., Willey, D., Hénaff, M.L., Atlas, R. (2014) Rigorous Evaluation of a Fraternal Twin Ocean OSSE System for the Open Gulf of Mexico. Journal of Atmospheric and Oceanic Technology 31, 105-130.