

Offshore Operators and Regulators Lead-Time Requirements for Near-Surface and Deep-water Currents and Transport

Almost all long-term and short-term offshore operations are sensitive to the accuracy, reliability and timeliness of ocean and weather forecasts. Accurate and reliable forecasts are essential to enable safety of offshore energy operations including activities such as transportation, installation, maintenance and removal of an offshore structure. For planning purposes, an analysis of a long time-series¹ of meteorological and oceanographic (metocean) variables such as significant wave height and period, mean wind speed or current spend is essential (API RP 2MET 2ND ED (2021) – Derivation of Metocean Design and Operating Conditions; Second Edition; ISO 19901-1:2015).

In terms of the safety of offshore energy operations in the Gulf of Mexico region, the industry pays a close attention to the following metocean parameters or events:

- Hurricanes
- Winter Storms
- Loop Current (LC) and Loop Current Eddies (LCE)
- Combined effects of the LC, LCE and storm events
- Topographic Rossby waves
- Air and sea temperatures
- Currents
- Waves
- Wind

Primary interest is Gulf of Mexico dynamics including Loop Current and Loop Current eddies forecasting (this interest in Loop Current and Loop Current eddies characteristics was derived from a number of meetings and references; these have included: Safer Offshore Energy Systems (May 2018), “Understanding and Predicting the Gulf of Mexico Loop Current: Critical Gaps and Recommendations”, and API’s RP 2MET):

- Currents profiles through the full water column: what current speed will be encountered, for how long, and over what depths?
- Effects of tropical storms and hurricanes on the Gulf of Mexico dynamics including the Loop Current and its associated eddies
- More cost-efficient ways to monitor Loop Current and Loop Current eddies
- Observations in the vicinity of active oil and gas sites and of major dynamical features (the Loop Current and its associated eddies)
- Increased observations further upstream such as Caribbean inflow
- Fluctuations of deep current speed or formation of topographic Rossby waves (TRWs) features due to the energetic surface eddies moving across the rough topography
- Models should be adequate to allow tidal decomposition to be carried out and the residual current to be separated out of the total current
- Attention should be given to long period, large-scale environmental fluctuation, which can affect the residual current climate
- Short term (1-10 days) and long-lead forecasting (ideally with windows of 3-6 months or at least 2+ months) of Loop / eddy encounters using both advanced statistical and numerical modelling
- Temporal resolution of interest varies depending on the time period:

¹ 10 years or more

- 1-5 days: hourly or better
- 5-10 days: 2-4 times daily
- Beyond 10 days: an estimate of what day contact with a feature generating current of 1.5+ knots would occur
- Spatial resolution:
 - 4 km or less on continental slope
 - 1 km or less on continental shelf
 - 1 km or higher near the Loop Current / Loop Current Eddies

References:

1. [API RP 2MET 2ND ED \(2021\) – Derivation of Metocean Design and Operating Conditions; Second Edition; ISO 19901-1:2015](#)
2. [SPE Summit on Safer Offshore Energy Systems](#)
3. [Understanding and Predicting the Gulf of Mexico Loop Current: Critical Gaps and Recommendations](#)