

Metocean Supporting O&G Design / Operations – What Next?

A black and white photograph of an offshore oil rig in the middle of a rough sea with large, white-capped waves. The rig is a complex structure with a tall derrick. The sky is overcast and grey.

(Courtesy of IOGP)

James Stear
Chevron

Overview

- O&G community concerns
- Current state
- Gaps / future work



(Courtesy of NASA)

IOGP Metocean Committee

- Composed of representatives from member companies
- Promotes use of sound metocean techniques in support of offshore and onshore facilities design and operation
- Leads industry efforts to frame and conduct studies to address gaps / uncertainties in criteria and forecasting capabilities

Upstream members

- Assala Energy
- Abu Dhabi National Oil Company (ADNOC)
- Aker BP
- Anadarko Petroleum Corporation
- BHP
- BP plc
- Capricorn (Cairn Energy)
- CC Energy Development
- CEPSA EP
- Chevron Corporation
- CNOOC Limited/Nexen
- ConocoPhillips
- DEA Deutsche Erdöl AG
- Dolphin Energy Ltd
- Dragon Oil
- eni SpA
- Equinor
- ExxonMobil
- GALP Energia, SA
- GeoPark
- Gulf Keystone Petroleum
- Hess Corporation
- Husky Oil Operations Ltd
- INEOS DENCOS
- INPEX Corporation
- KazMunayGas
- Kosmos Energy
- Kuwait Oil Company

- Maersk Oil og Gas AS
- MOL Group
- Neptune Energy
- North Caspian Operating Company (NCOC)
- North Oil Company
- Oil Search Ltd
- OMV
- Origin Energy
- Pan American Energy
- Petróleo Brasileiro SA (Petrobras)
- PETRONAS Carigali Sdn Bhd
- PGNiG
- PLUSPETROL SA
- Premier Oil
- PTT Exploration and Production Public Company Ltd (PTT EP)
- Qatargas
- Qatar Petroleum
- Repsol
- Sasol
- Saudi Aramco
- Shell International Exploration & Production BV
- SOCAR
- Sonangol EP
- Suncor
- Total
- Tullow Oil
- Wintershall Holding GmbH
- Woodside Energy Ltd
- YPF SA
- Zakum Development Company (ZADCO)

National and other associations

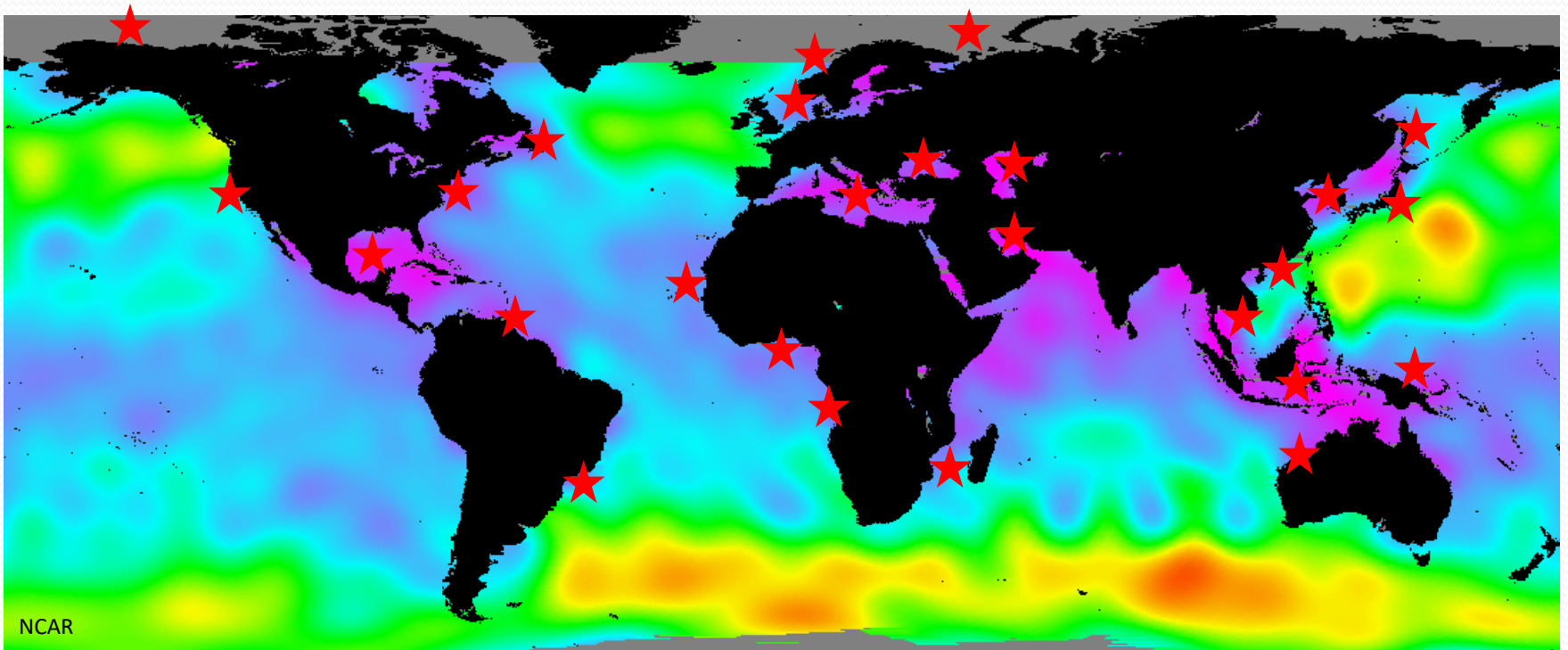
- American Petroleum Institute (API)
- ASSOMINERARIA
- Australian Petroleum Production & Exploration Association (APPEA)
- Bundesverband Erdgas, Erdöl und Geoenergie e.V. (BVEG)
- Canadian Association of Petroleum Producers (CAPP)
- Consejo Colombiano de Seguridad (CCS)
- Energy Institute (EI)
- HeliOffshore
- Instituto Brasileiro de Petróleo, Gás e Biocombustíveis (IBP)
- International Association of Drilling Contractors (IADC)
- International Association of Geophysical Contractors (IAGC)
- IPIECA
- Irish Offshore Operators' Association (IOOA)
- Netherlands Oil and Gas Exploration and Production Association (NOGPA)
- Norwegian Oil and Gas
- Oil Gas Denmark
- Oil & Gas UK
- Regional Association of Oil, Gas and Biofuels Sector Companies in Latin America and the Caribbean (ARPEL)

IOGP Associate Members

- Aker Solutions
- Baker Hughes, a GE Company
- Cansco International Corporation
- OPITO
- Schlumberger

O&G Offshore Operating Areas

- Operations in all the world's oceans
- Coastal / onshore are major considerations



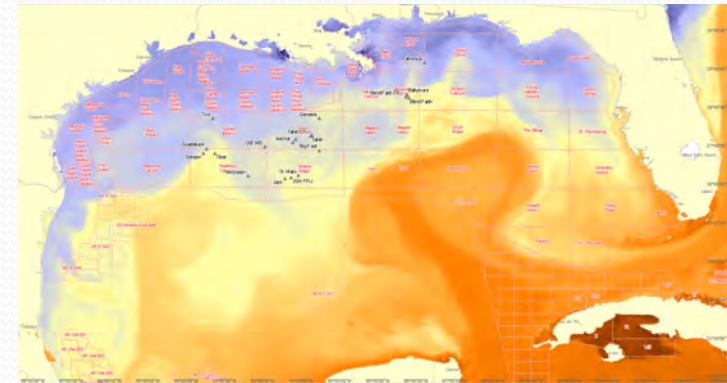
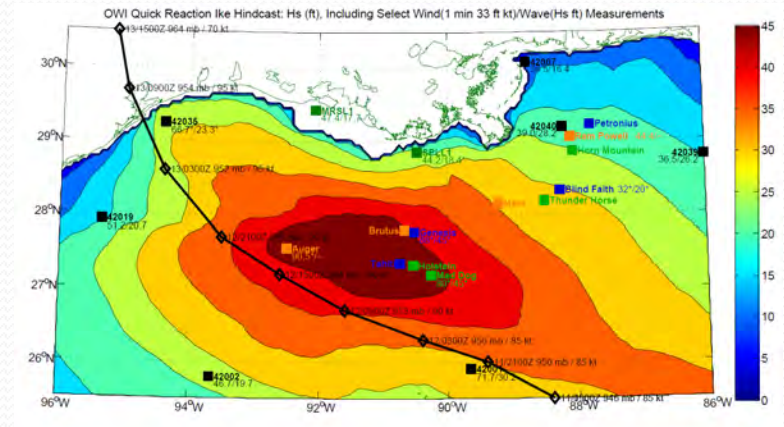
The Environment...

- Impacts all aspects of operations
 - Safety
 - Environment
 - Efficiency
- Defenses:
 - Design
 - Monitoring
 - Forecasting



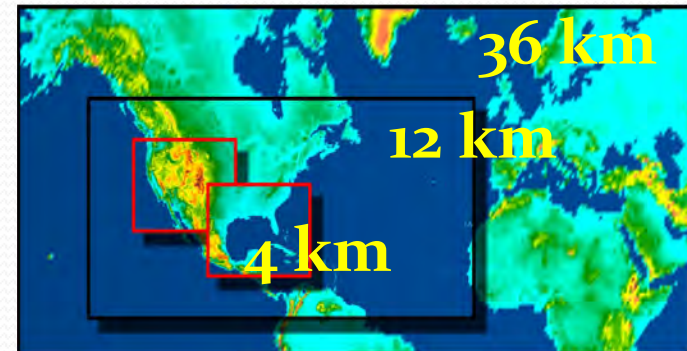
Current State

- Historical hindcasts for design / operating criteria
- Monitoring by conventional sensors
- Rudimentary use of existing satellite data
- Single-realization numerical forecasts
- Limited data sharing
- **Long tradition of industry collaboration**



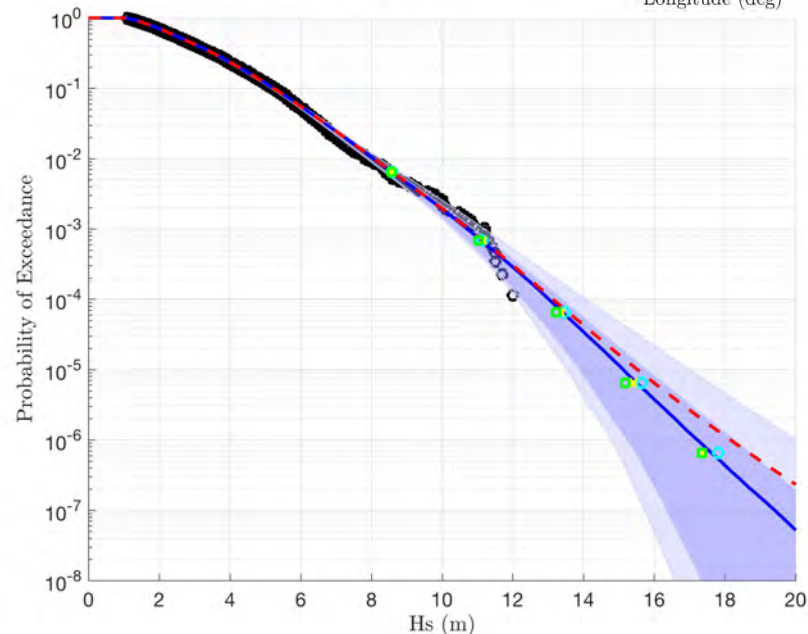
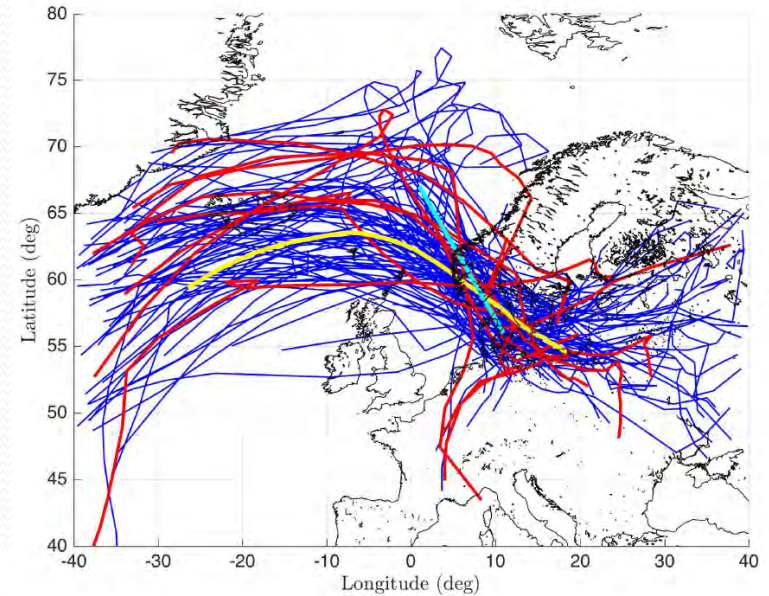
Quo Vadis?

- Synthetic data sets / extended simulations
- New observation tools
- New / improved hazard modeling
- Forecasting enhancements / ensembles; data analytics
- Industry data sharing / networks
- Climate change influence on criteria



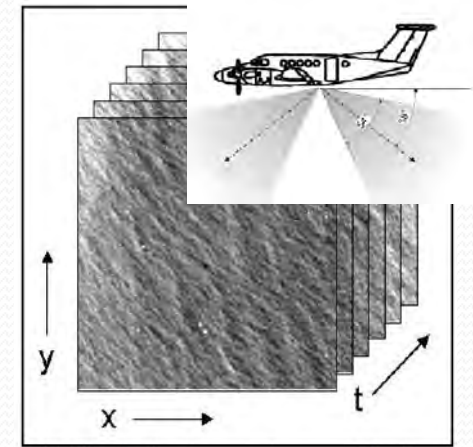
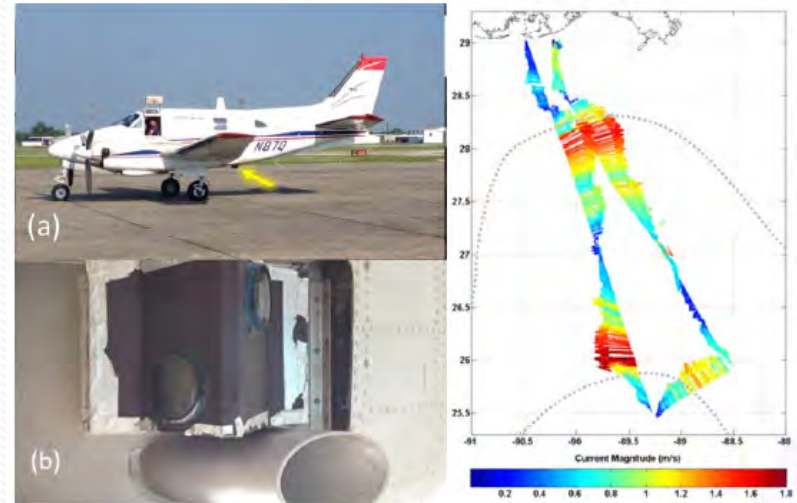
Design Data Sets

- Historical re-analyses
- Long time series for response-based analysis
- Free-running climate simulations vs. long historical data sets



New Observation Tech

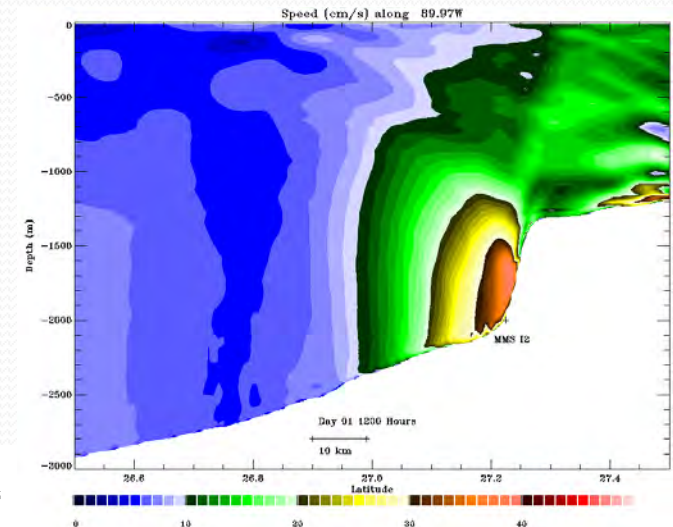
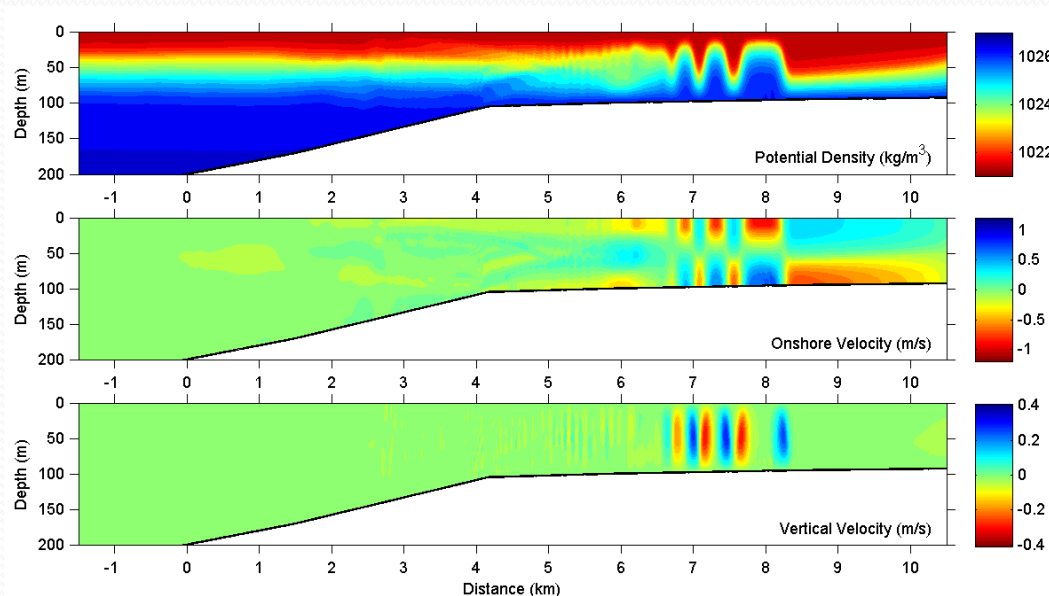
- HF radar
- ROCIS / optical
- Satellite
 - SWOT / Dopplerscat
 - Hi-Res imagery
- Small platforms
 - Drifters
 - Gliders
 - ASVs
 - UAVs



(ROCIS – courtesy of RPSEA)

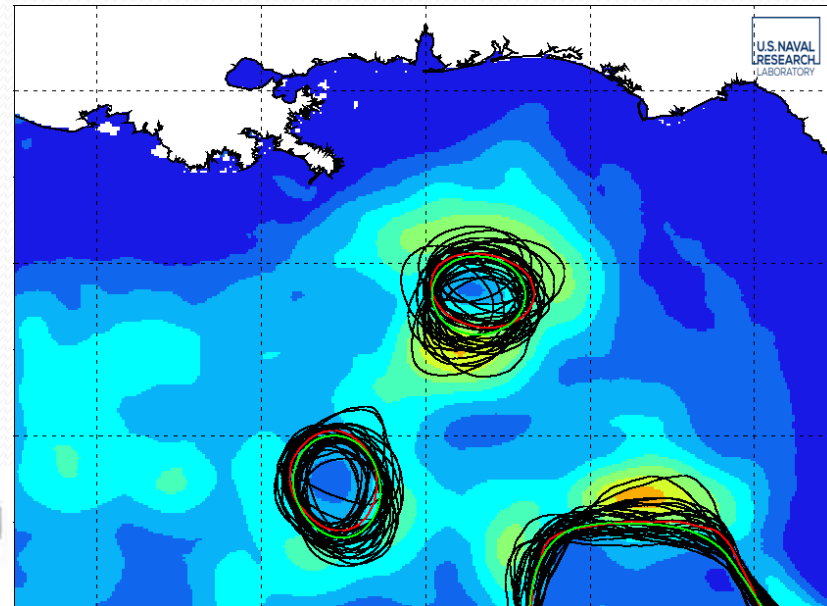
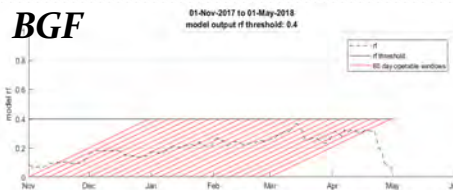
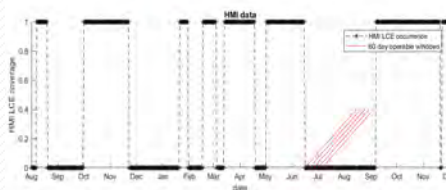
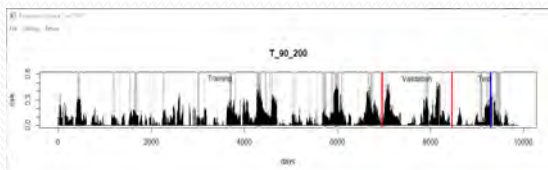
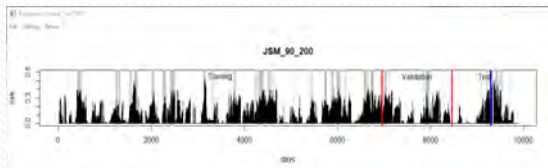
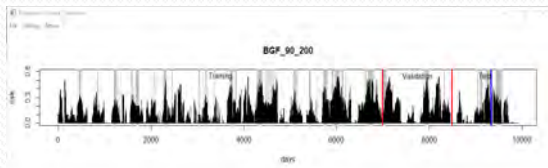
New / Improved Hazard Modeling

- Waves / Swell
- TRWs
- Internal Waves / Solitons



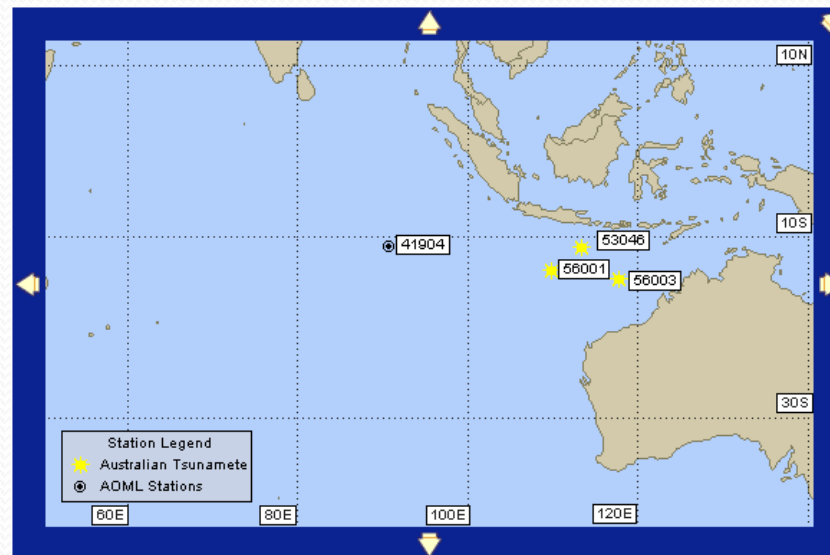
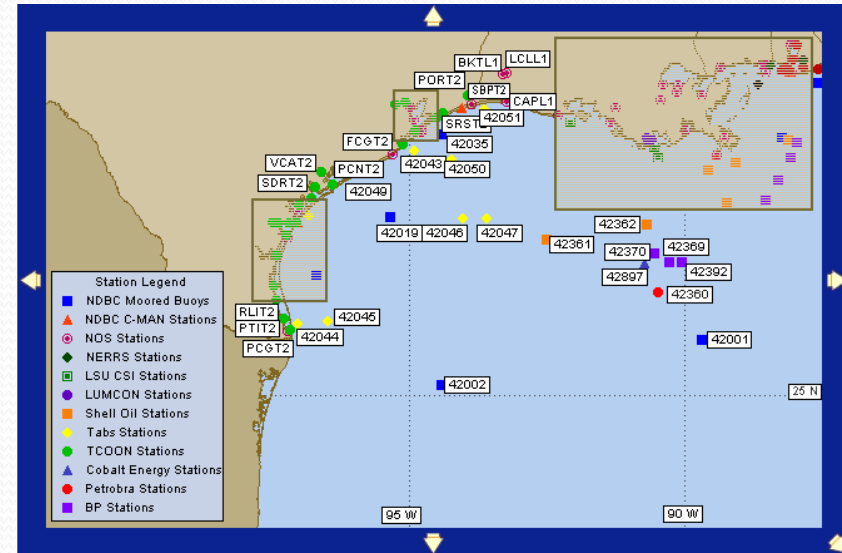
Forecasting Enhancements

- Data assimilation
- Ensemble methods
- Machine learning



Networks

- Improve real-time warning / forecasting
- Improve design conditions in long-term
- Increase safety in data-poor regions



Climate Change



- Stationarity of extremes / operating conditions
- Design basis health checks
- Operational vs. extremes
- Regional hazard studies
- Industry guidance for incorporation



Summary / Conclusions



(Courtesy of IOGP)

- Challenges / opportunities
 - Monitoring
 - Modeling
 - Forecasting
 - Data Sharing
 - Climate
- O&G metocean community able & willing to partner with academia / government / parallel industries to address

Thank You

- Questions?



(Courtesy of IOGP)