Data Requirements and Dissemination for MetOcean Applications

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WMO Marine Meteorology and Oceanography Programme
JCOMM Implementation

Observations Programme Area
- OceanSITES
- Argo
- IOCCP

Management Committee

Services & Forecasting Systems Programme Area
- Ship Observations
- Data Buoy Cooperation
- Sea Level (GLOSS)

Data Management Programme Area
- Marine Climatology
- Data Management Practices

Maritime Safety Services
- Waves & Coastal Hazards Forecasting
- Operational Ocean Forecasting

Sea Ice
Main Communication Tool for JCOMM Community
- Archive for Documents
- People’s Database
- Latest News
JCOMM Coordination for Integrated Ocean Observations

62% as of April 2012, against GCOS requirements

- Surface measurements from volunteer ships (VOSclim)
- Global drifting surface buoy array
- Tide gauge network (GCOS subset of GLOSS core network)
- XBT sub-surface temperature section network
- Profiling float network (Argo)
- Repeat hydrography and carbon inventory

Reference time series 48% Global reference mooring network 34% Global tropical moored buoy network 73%

56 sites 29 moorings planned 119 moorings planned

System % complete
30 34 40 45 48 55 56 59 60 62

Original goal: 100% implementation in 2010
Marine Services and Forecasting Systems

- Enhanced efforts for **operational ocean forecasting** system development (*new development of Guide to OOFs*)
- Strengthen technical supports for coastal services & disaster risk reduction (Coastal Inundation Forecasting Demonstration Project)
- **Maritime Safety** and sea ice, as core of metocean services (METAREA coordination for GMDSS)
- Developing **Competencies for Marine Services**
# Sources of MetOcean Data

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Field data sources</th>
<th>Satellite data sources</th>
<th>Numerical model and analysis data sources</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sea state</strong></td>
<td>Wave buoys. Ship observations. Oil platforms. Coastal HF radar.</td>
<td>Satellite altimetry (wave height)</td>
<td>Wave model analysis and forecast systems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Synthetic Aperture Radar data.</td>
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<tr>
<td><strong>Surface wind</strong></td>
<td>Moored buoys. Drifting buoys. Ship observations. Oil platforms.</td>
<td>Scatterometer data.</td>
<td>NWP analysis and forecast systems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Satellite altimetry.</td>
<td></td>
</tr>
<tr>
<td><strong>Precipitation</strong></td>
<td>Ship observations. Coastal stations. Oil platforms. Weather radar.</td>
<td>Rain radar.</td>
<td>NWP analysis and forecast systems</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Infrared radiometers</td>
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<tr>
<td><strong>Sea surface temperature</strong></td>
<td>Argo floats. Ship observations. Moored buoys. Drifting buoys.</td>
<td>Infrared satellite data.</td>
<td>SST analysis systems.</td>
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<tr>
<td></td>
<td></td>
<td>Microwave satellite data.</td>
<td>Ocean analysis and forecast systems</td>
</tr>
<tr>
<td><strong>Currents</strong></td>
<td>Current meters Drifting buoys</td>
<td>Satellite altimetry.</td>
<td>Global ocean circulation models</td>
</tr>
<tr>
<td><strong>Bathymetry / shoreline</strong></td>
<td>Aerial photographs.</td>
<td>Satellite imagery.</td>
<td>Bathymetric chart data.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Gridded bathymetric datasets.</td>
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</tbody>
</table>
Sea Surface Temperature (SST)

- essential to monitoring and simulating ocean state, and to correctly determine the heat and momentum fluxes across the air-sea interface
  - Data available on GHRSSST GDACs/RDACs
  - EUMETCAST (e.g. IASI L2PCore SST – Metop)
- Operational Sea Surface Temperature and Sea Ice Analysis (OSTIA: [http://www.myocean.eu/web/24-catalogue.php](http://www.myocean.eu/web/24-catalogue.php))
  - multi-satellite SST product, by UKMO through MyOcean project

Global daily SST analysis from the Operational Sea Surface Temperature and Sea Ice Analysis Project (OSTIA) product (PODAAC), blending AVHRR, AATSR, AMSR-E and TMI
SST in MetOcean Applications

- The ocean modeling community is the key user of GHRSSST (requirements origin from GODAE)
- GHRSSST interaction with JCOMM Expert Team on Operational Ocean Forecasting Systems (ETOOFS), and with scientific panels of GCOS and WMO to review and meet requirements for ocean modeling (*WMO RRR/OSCAR)

Issues/Challenges

- The loss of AATSR → need for new reference dataset
- The loss of AMSR-E, possibly covered by AMSR-2 SST products
- The need for SST data from GEO over the Indian Ocean

Examples of just-released products from AMSR-2 from descending orbit on May 8, 2013
Scatterometer Wind Applications

- Scatterometer wind data are important sources of information for NWP, oceanography and climate.
- Key information for hindcast studies of past storms, and for assimilation in wave and storm surge forecast models, as well as for nowcasting.

- **Recently emerging requirement:** coordinated development/extension of integrated satellite and in situ Ocean Surface Vector Winds (OSVW), and its application for marine forecasts, similar to GHRSSST products for SST. (*International Ocean Vector Wind Science Team*)

Swirling winds at the center of Hurricane Sandy on Oct. 29 from ASCAT on MetOp-B
Scatterometer Wind Applications

- **Capacity Development**: Joint efforts by EUMETSAT, NOAA, NASA, IOC/IODE and JCOMM - Training on applications of satellite ocean surface vector winds for operational marine forecasting

- The use of EUMETSAT Ocean & Sea Ice Satellite Application Facility (O&SI-SAF) products is granted to every interested user, free of charge, preserving property rights of EUMETSAT. However, the Near Real-Time (NRT) OSCAT data can only be used by European, non-commercial users.

Swirling winds at the center of Hurricane Sandy on Oct. 29 from ASCAT on MetOp-B
Altimetry

- Accurate measurements of sea surface topography, through the analysis of radar echoes that provides sea surface height (SSH), significant wave height and surface wind speed.
- Significant impact on ocean modelling/forecasting (*Ocean Surface Topography Science Team: OSTST)
- Recent development on coastal altimetry (coastal research, storm surge/inundation)

<table>
<thead>
<tr>
<th>Satellite</th>
<th>Product</th>
<th>Cycles</th>
<th>Time Period</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERS1</td>
<td>OPR</td>
<td>83 to 101</td>
<td>01-08-1991 to 30-03-1992</td>
<td>Phases A &amp; B 3-days</td>
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<tr>
<td></td>
<td></td>
<td>not defined</td>
<td>14-04-1992 to 20-12-1993</td>
<td>Phase C 35-days</td>
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<tr>
<td></td>
<td></td>
<td>not defined</td>
<td>24-12-1993 to 10-04-1994</td>
<td>Phase D 3-days</td>
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<tr>
<td></td>
<td></td>
<td>not defined</td>
<td>10-04-1994 to 21-03-1995</td>
<td>Phases E &amp; F 168-days</td>
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<tr>
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<td></td>
<td>144 to 156</td>
<td>24-03-1995 to 02-06-1996</td>
<td>Phase G 35-days</td>
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<tr>
<td>ERS2</td>
<td>OPR</td>
<td>1 to 146</td>
<td>15-05-1995 to 11-05-2009</td>
<td>Mission going on</td>
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<tr>
<td>ENVISAT</td>
<td>GDR</td>
<td>9 to 84</td>
<td>27-05-2002 to 07-12-2009</td>
<td>Mission going on</td>
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<tr>
<td>TOPEX</td>
<td>M-GDR</td>
<td>1 to 481</td>
<td>25-09-1992 to 08-10-2005</td>
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<tr>
<td>Poseidon</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Jason-1</td>
<td>GDR</td>
<td>1 to 300</td>
<td>15-01-2002 to 03-03-2010</td>
<td>Mission going on</td>
</tr>
<tr>
<td>Jason-2</td>
<td>GDR</td>
<td>0 to 60</td>
<td>04-07-2008 to 26-02-2010</td>
<td>Mission going on</td>
</tr>
<tr>
<td>GEOSAT EF</td>
<td>GDR</td>
<td>37 to 222</td>
<td>07-01-2000 to 07-09-2008</td>
<td></td>
</tr>
</tbody>
</table>
New Requirements / Recent Developments
Improving Sea State information for GMDSS

Currently, majority of Issuing Services of maritime safety information for Global Maritime Distress and Safety System (GMDSS) provide information on the significant wave height only, generally using the Douglas scale:

- Need for improved information indicating complex sea state (e.g. steep sea, abnormal freak waves)

- Need for better use of available products from models and other means
Improving Sea State information for GMDSS

Example of dangerous sea area marking, by using combined analysis of significant wave height, multiple waves (frequencies) and wave energy

Adjustment of wave height forecasting, through analysis against current speed
Improving Sea State information for GMDSS

- Identifying **operational requirements for MSI** (in progress: JCOMM white paper)
- JCOMM ongoing work to establish **extreme wave dataset** (SWH ≥ 14 m, under the International Comprehensive Ocean-Atmosphere Data Set), using in situ and satellite measurements
  - required contribution/provision of high quality wave measurements, with appropriate metadata
  - Integration to ICOADS
Integrated Database on Storm Surge Applications

- ESA DUE project, based on the recommendations from the 1st JCOMM Storm Surge Symposium (http://www.surgesymposium.org)
- Open access to Surge Event Database (SEV: http://www.storm-surge.info/data-access), including in-situ, satellite, model outputs, etc. for identified Storm Surge events in Areas of Interest

(to discuss in Nov.’13)
Integrated Database on Storm Surge Applications

SEV contains…

- Bathymetry Product
- Coastal altimetry – Envisat
- Digital Elevation Model Product
- Flood maps
- Infrared Meteosat6
- Infrared Meteosat7
- Ocean Colour Product
- SAR wave spectra
- Scatterometer Winds ASCAT
- Sea Surface Temperature (Multi-satellite)
- Sediment Concentration
- Tropical Cyclone Heat Potential
- Wave Products: Open Ocean Altimetry
- …

*List of available dataset within eSurge SEV, for the case Sidr (2007)*
New Requirements for
Operational Wave/Surge Modelling

- Follow-up to 8th JCOMM-TCP Workshop on Storm Surge and Wave Forecasting (SSW-8, 19-23 Nov’ 2013, Kenya: http://www.jcomm.info/SSW8)
- Kenya, Madagascar, Mauritius, Mozambique, Namibia, Seychelles, South Africa and Tanzania
- Training on operational forecasting models for storm surges and waves
- Countries plan to test/apply/operate storm surge and wave modelling
New Requirements for
Operational Wave/Surge Modelling

- In process: provision of wave model guidance data, upon national requests (West Indian / South Atlantic)

The indicated domains and locations are requirements expressed by RA I countries in Western Indian Ocean and South Atlantic coasts - Kenya, Madagascar, Mauritius, Mozambique, Namibia, Seycelles and Tanzania - reference points for operational wave forecasting, as a follow-up to the 8th JCOMM-TCP Workshop on Storm Surge and Wave Forecasting (SSW-8, 19-23 November 2012, Nairobi, Kenya).

JCOMM Expert Team on Waves and Coastal Hazards Forecasting Systems (ETWCH) is working with US NOAA to provide wave model guidance data from WAVEWATCH III® (from the 50km resolution global grids), for those required areas and locations.
Thank you for your attention

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