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| **WMO**  **Ice Analyst Competency Framework** |
| The following is provided as minimum competence requirements to effectively perform the duties of ice analysts (IA) for all operational ice services and institutes in the world. The competency framework identifies the knowledge, skills and behaviours that should be demonstrated. Implicit in the background knowledge and skills is the recommendation that they should have successfully completed the Ice Analyst Training Program (IATP) or relevant parts thereof. It should, however, be recognised that national personnel qualification requirements for IA may be set at a higher level, e.g. a national requirement for an IF to also be degree qualified. |
| In general, the ice services are responsible for sea ice covered regions over Global Ocean, interior lakes and rivers and their interaction with the land and the atmosphere. There will be considerable variation in the legitimate functions of ice services worldwide. Consequently, it is not possible to write a document that exactly matches every service’s function. Therefore the performance criteria should be applied in a way that is consistent with these variations.  Once this competency framework is adopted, each ice service will define how the competencies relate to their own national operations. That is, the ice services will have to adapt the competencies, associated underpinning knowledge and performance criteria that are specific to their functions and region. Therefore, the performance criteria should be applied within the context of the following conditions:   * For the area of responsibility – <http://www.gmdss.org/metareas.html> * In consideration of the impact of sea and terrestrial ice phenomena, variables and parameters on marine operations; and * In compliance with user requirements, international regulations, local procedures and priorities.   The competency requirements are as follows:   1. Analyse and monitor continuously the ice conditions and parameters. 2. Ensure the quality of ice information and services 3. Communicate ice information to internal and external users   **Note:** As this competency framework is recommended and generic to all providers of ice forecast and warning services. Any priorities should be established by the individual ice service based on their mandate. |

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| **Format of the Framework** |
| The framework is provided under the following headings:   * The recommended competency * Competency description * Performance criteria * Background knowledge and skills   The details within each of the headings describe the aspects of each competency recommended for an effective service. The specific performance criteria for a given ice service’s program should reflect the roles and responsibilities of the office’s service.  The role of ice analyst will continue to change in response to evolving technology and user requirements. As such, any change will require high standards of competency and underlying knowledge and skills with a focus on continuous improvement. This framework is presented in an attempt to anticipate as much as possible those changes in the future. The adoption of a quality management approach is strongly recommended. |

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| **1. ANALYSE AND CONTINUOUSLY MONITOR THE ICE CONDITIONS AND PARAMETERS** |
| **Competency Description:**  Integrate multiple remote sensing sources and auxiliary data sources to monitor continually the ice conditions. Use applicable geographical information systems and local standard operating procedures to produce timely and accurate sea ice analysis. |
| **Performance Criteria** |
| 1. Use effectively basic satellite data, and in-situ observations in monitoring and analysing the ice conditions. |
| **Background knowledge, skills and abilities** |
| • Knowledge of the ice products (routine and non-routine), their issue times and the priorities applied in the region. |
| • Knowledge of ice analysis techniques (visual ice recognition and SAR interpretation). |
| • Knowledge of relevant observing systems, platforms, and sensors that may include remote sensing (satellite altimeters, microwave sensors); radar, in-situ sensors ( moored wave buoys, drifting buoys, bottom pressure sensors, ice thickness sensors); human observing procedures (ship, shore) and how their advantages and limitations vary with respect to prevailing seasonal and meteorological/ice conditions. |
| • Knowledge of bathymetry, coastal geomorphology, marine climatology, oceanic currents, any local phenomena and their potential impacts on ice movement, developing, melting and destruction in the area of responsibility. |
| • The ability to perform manual/subjective analyses |
| • The ability to perform analysis on ice related images. |
| • The ability to perform statistical data analyses. |
| • The ability to apply statistical analysis and other informational techniques to data which has a geographical or geospatial aspect. |

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| **2. ENSURE THE QUALITY OF ICE INFORMATION AND SERVICES** |
| **Competency Description:**  Ice analysis and related products are provided within a quality management framework. |
| **Performance Criteria** |
| 1. Apply the organisation’s quality management system and procedures as required. |
| 2. Assess the impact of known observational error characteristics (e.g. bias, achievable accuracy and limitations of observations and sensing methods) on ice analysis and products. |
| 3. Verify and validate ice data, products, forecasts and warnings (timeliness, completeness, and accuracy), using real-time verification tools. |
| 4. Monitor the functioning of operational systems, gather and assess customer comments, suggestions and complaints, and take remedial actions when necessary. |
| 5. Identify and evaluate ice analysis and products related problems and determine appropriate corrective and preventive actions for continuous improvement. |
| **Background knowledge, skills and abilities** |
| • Knowledge of quality management principles, practices and procedures. |
| • Knowledge of standard operating procedures (SOPs) for ice analysis. |
| • The ability to utilize verification techniques and statistics. |
| • Knowledge of contingency plans. |
| • Knowledge of relevant stakeholder operations and needs and applications of analysis, including:  - Stakeholder operations (e.g., procedures, tactics, planning processes and cycles)  - Stakeholder limitations, including operating limits, legal constraints, geopolitical limits)  - Stakeholder desired outcomes from operation |
| * General knowledge of stakeholder terminology (e.g., nautical terms, acronyms, abbreviations, technical terms related to forecast variables (e.g., ice concentration, stage of development, thickness, ice movement, freeze up, ice deformation, state of the sea, currents, waves, swell, tides), customer preferred measurement units) |
| • Knowledge of stakeholder communication and security systems, if required. |
| • Knowledge of the impact of ice conditions and parameters on stakeholder operations/activities. |

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| **3. COMMUNICATE ICE INFORMATION TO INTERNAL AND EXTERNAL USERS** |
| **Competency Description:**  Ice analysis and products are communicated in a timely and clear manner to meet user community needs. Participate in professional consultations. |
| **Performance Criteria** |
| 1. Ensure that all analysis and products are disseminated via the authorised communication channels to user groups. |
| 2. Provide ice briefings, support and/or consultation to meet specific user needs. |
| 3. Make use of additional ice information parameters, variables and phenomena to describe their impact on marine operations, safety of life and property, including the coastal environment and population |
| **Background knowledge, skills and abilities** |
| • Knowledge of primary users and operations and their ice related sensitivities. |
| • Knowledge of available communication systems, techniques and methodologies. |
| • Ability to inquire about user needs to improve ice operational services |
| • Ability to utilize cross-boundary consistency techniques – national and international, as well as inter-disciplinary / inter-agency checks as needed. |
| • Ability to communicate effectively, orally, graphically and in writing (level of details to meet the identified needs of specific users). |

**REGIONAL VARIATIONS**

Regional variations referred to within the document may include but are not limited to the following:

* Agreed and documented criteria and thresholds
* The range of environmental factors including but not restricted to:
  + Ice types
  + ice related hazards
  + Permanent/semi permanent local occurrences (ex. gyres and polynyas)
  + tides, sea level and storm surge
  + sea currents and drifting of ice
  + sea surface temperature and salinity where required
  + Seabed grounding
  + Icebergs
  + Ice shelf and/or glacier locations
* Designated offices responsible for advice on meteorology, sea ice, lake and river ice, ice bergs, oceanography
* Regional regulations
* Boundaries of analysis areas
* Communication language(s)
* Communications technology for analysis and related products transmission
* Extent of automation of observing and sensing systems

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