WEATHER OPERATIONS PROCESSES

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Air Force weather personnel execute eight processes—**collection**, **processing**, **analysis**, **prediction**, **tailoring**, **dissemination**, **integration, and mitigation**—to characterize weather and exploit weather effects information.

Collection

Weather collection is described as the process of gathering and storing raw weather data in databases from which weather products are later derived. This data includes surface, air, and space-based observations, including meteorological satellite imagery and weather radar data from worldwide military, civilian, government, and commercial sources. Since each collection capability has limitations, Air Force weather operations seek an optimal blend of measurements from ground, sea, air, and space-based sensors. Although the Department of Defense owns many of these sensors, most international data are obtained via data-sharing agreements with other countries, to include freely shared data under the auspices of international organizations such as the World Meteorological Organization and International Civil Aviation Organization.

Commanders should include non-traditional weather collection efforts throughout planning and operations to ensure receipt of adequate weather information in a timely manner. Inadequate sources or availability of weather data may be a problem in regions where military operations occur. The Air Force maintains the capability to deploy in close coordination with joint and coalition forces to establish weather support for military operations. In addition, non-traditional weather data sources, such as intelligence, surveillance, and reconnaissance (ISR) platforms and remotely piloted aircraft, can significantly enhance the quality and quantity of theater weather data collection.

A single piece of accurate weather information, regardless of the source, may provide the critical piece of information pivotal to mission success. Therefore, continuous collection of weather information and cooperation with outside sources are needed to ensure the optimal accuracy of weather products.

Processing

Weather processing is described as the act of converting raw data into useable weather information. Collected weather data flows into a net-centric repository where much of this data is processed into usable information primarily for weather personnel.

Observed conditions are input into predictive weather models. High-speed computer processors run physics-based simulations of the environment and develop output representing the spatial and temporal evolution of the environment. This processed data serves as the basis for the other processes in the exploitation function: analysis, prediction, tailoring, integration and mitigation. Data and information may be further processed and repeatedly refined to support military operations, for example, historical data is processed to produce climatic summaries.

Analysis

Weather analysis is described as the process of transforming collected weather data into useful weather information and enables production of accurate weather forecasts. It entails building a coherent, integrated depiction of the past and current state of the weather over a specified region. An effective analysis of collected weather data helps ensure the accuracy of the weather forecast provided to decision-makers. It enables identification of weather features and conditions requiring subsequent study and monitoring. The analyzed data is processed and disseminated to net-centric databases to provide inputs which weather personnel use in building forecast products for decision making.

Prediction

Weather prediction is described as the process of creating a forecast from analyzed weather information which anticipates future weather conditions. Weather operations leverage environmental data and analyzed weather information to predict how future weather conditions (such as temperature, cloud cover, and ionospheric scintillation[1]) may affect operations. Weather personnel employ computer models and analyze other information to produce detailed forecasts, which include temporal and spatial assessments of atmospheric and space weather features and their associated weather elements. Prediction accuracy is highly dependent on the timeliness, accuracy, and quality of the initial input. Weather personnel rely on constant feedback from updated weather collections of actual conditions and continually adjust and assess prediction information to improve their forecasts.

Tailoring

Weather tailoring is described as the process of transforming relevant weather information into actionable information by aligning it with operationally significant weather parameters. Weather information should be tailored to unique operational requirements. Weather personnel match products against mission, system, and platform requirements. Weather products should be customized based on known, specific environmental sensitivities of, and effects on, operations and systems. Some examples of tailored weather products include decision aids, weather effects matrices, terminal aerodrome forecasts, drop zone forecasts, and target-area depictions. Like the analysis and prediction processes, the process of tailoring is a function of both characterization and exploitation.

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[1] Scintillation is “the rapid, random variation in signal amplitude, phase, and/or polarization caused by small-scale irregularities in the electron density along a signals path. Ionospheric scintillation can cause degradation of satellite communications signals.” (AU-18, *Space Primer*, Air University Press, September 2009).

Dissemination

Weather dissemination is described as the process of delivering weather data and information to users in a suitable form. Dissemination occurs across the other weather processes and ensures that products created through the collection, analysis, prediction, and tailoring processes is received by the appropriate end-user. These users may be weather personnel or decision-makers, depending on which output product is being used. Processed weather data may be disseminated to weather personnel for use in analysis or prediction products. Tailored forecasts may be disseminated to operators for use in the decision-making cycle so that leaders can take action based upon this information. Because of its importance to the other weather processes, dissemination should occur in a timely, reliable manner. Interruption of the process of dissemination at any stage can disrupt the flow of accurate, relevant data to the decision-maker, significantly impacting their ability to exploit weather information.

Integration

Weather integration is described as the process of infusing tailored decision-grade weather and weather effects information into planning and decision-making cycles. Effective integration enables decision-makers to maintain battlespace awareness. Informed with timely, relevant, and accurate information, decision-makers can anticipate the weather's effects on planned operations, then exploit those conditions which facilitate achievement of the commander's objectives. Timeliness is critical to effective integration; therefore, commanders should ensure weather and weather effects information is fully integrated into decision-making processes and command and control (C2) systems in time to inform the appropriate decision points. Likewise, weather personnel should be pro-active and place great importance in reaching out to supported units to ensure integration occurs early in decision-making cycles. Air Force weather operations use a net-centric repository of weather and operational effects information to facilitate such integration. The net-centric repository also allows weather personnel to fuse relevant weather effects information with other operational information into an operational picture tailored to the mission.

Some C2 systems allow decision-makers to extract mission-specific weather information from the net-centric weather data repository through machine-to-machine interfaces without consulting weather personnel and without knowing if the specific weather information was tailored by weather personnel. Because decision-makers or other end-users may lack a thorough understanding of the strengths and weaknesses of the available weather information, it is critical that weather personnel remain integrated in all phases of the planning and execution process.

Mitigation

Weather mitigation is described as the process of providing decision-makers with options and courses of action, based on tailored and integrated weather information, so that they can adjust operational plans and exploit weather effects to operations. Large scale weather events can cause strategic impacts that can be devastating to military operations. Weather personnel provide this information to commanders, enabling them to determine the best employment packages and courses of action for those weather conditions. When weather information is used by leaders to

effectively mitigate, plans can be adjusted and optimal mission effectiveness achieved. The process of mitigation gives decision-makers options on beddown of forces, operational capabilities desired, and resource protection actions to take. Weather personnel should articulate their level of confidence in their predictions to decision-makers to be of value when leaders assess and manage risk in an operation. Weather personnel who are properly integrated, and have established a relationship of trust and relevancy with their supported decision-makers have greater influence in the mitigation process than others.
