MSC/COMET Applied Numerical Weather Prediction (NWP) Course:

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1MSC, 2 MSC, 3 The COMET Program, 4 MSC, 5 The COMET Program, 6 The COMET Program, 7 The COMET Program, 8 MCS, 9 MSC

Investing in the meteorologists of today, preparing for the impact and probability based forecasting of the future.

1. Background

A training needs survey was conducted within the Meteorological Services of Canada (MSC) in the summer of 2020. Forecasters were asked to self assess their NWP knowledge. 1-novice, 4 expert. Forecasters rated as having better knowledge of Deterministic NWP. Gaps existed in the and Ensemble Prediction Systems (EPS) understanding and use. Forecasters expressed they were very interested in EPS training for communicating uncertainty, which this course aimed to address. In addition, clients were also more and more interested in receiving probabilistic decision support services. At the same time, the WMO requirements were moving to a more impact-based forecasting and warning service delivery approach. This training is a steppingstone towards this transformation.

Self-Assessment NWP Knowledge Averages calculated/4	ALL	MT	PC	EG	EAST REGION	CENTRAL REGION	WEST REGION	SPCs	ADS	SERVICES	CIS	CHC	A&P	SCIENCES
Number of Respondents	227	185	20	9	44	113	70	85	55	37	12	2	12	19
Deterministic	2,7	2,9	1,8	1,7	2,8	2,7	2,8	2,9	2,8	2,6	1,5	3,5	2,7	2,1
Ensemble	2,4	2,5	1,6	1,7	2,3	2,4	2,4	2,6	2,1	2,4	1,5	3,0	2,7	1,8

Two synchronous courses were held; one in Fall 2022 and the second in the Winter of 2023. 14 different weather agencies participated in 6 sessions over 12 weeks.

The courses consisted of prerequisite readings, synchronous lecture-discussions and asynchronous forecasting exercises. The course allowed students to explore how different model constructions and schemes can manifest in the forecast, and how to interpret the resulting forecast output, including both Deterministic Prediction Systems (DPS) and EPS information.

Module topics included: resolution, post-processing, parameterization, distribution characteristics, probabilistic weather scenarios and a final synthesis. Pre and post tests were completed to measure knowledge retention and feedback surveys were used to improve each session.

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It was all completed virtually on zoom and was recorded to ensure folks could revisit topics and that we could use it for the asynchronous online course.

The online course is available at the QR Codes in English or go to COMET - MetEd Education and Training (ucar.edu) and in French or go to: COMET - MetEd Education and Training (ucar.edu)

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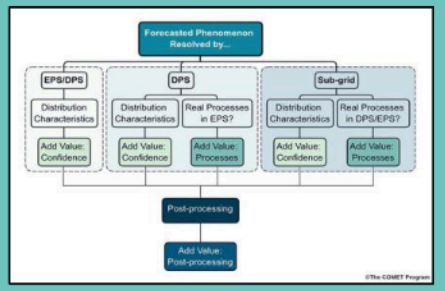
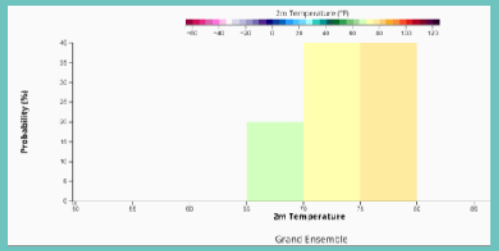
2. Applied NWP Course Highlights

In Module 1: Resolvability the framework is introduced to give participants a process that they can refer back to over and over again as they incorporate new models or new products into their forecasting process.

The intent of this is not only to guide the course itself and give participants a constant reminder or process to follow, but also to give them something to take back with them into operations, on the desk, to practice the skills they learnt during the course.



Module 4 covered Distribution Characteristics. Using DESI (Dynamic Ensemble-based Scenario for IDSS), interrogation of the entire ensemble dataset is possible. This module guides students beyond relying solely on standard charts or the mean. Instead, learners begin to understand and leverage the entire data set; all the members of the ensemble.



By looking at a histogram, plume or box and whisker diagram available in DESI, the probability density curves, medians, means, percentiles, etc., can be evaluated more efficiently.

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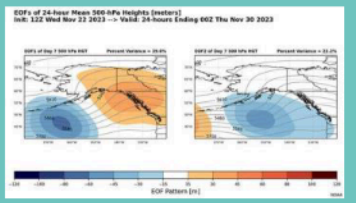
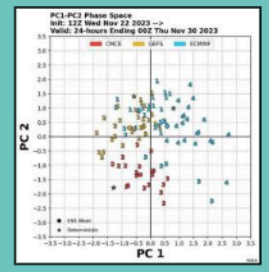
Cluster analysis was covered in Module 5: Probabilistic Weather Scenarios. Products from the Weather Prediction Center (WPC) Cluster Analysis Tool summarizes not only all the data within one ensemble but uses empirical orthogonal functions (EOF) and principle components (PC) to summarize the members of the 3 major weather agencies ensembles; ECMWF (50), GEFS (30) and GEPS (20), 100 members in the variable of interest.



The phase space diagram is a way to concisely compare the EOFs and PCs to individual ensemble model members, the deterministic models, and the ensemble models' means.

The most important aspect that was emphasized for operational forecasters, is that this statistical information has an associated physical and meteorological meaning. Their job is to interpret these numbers and apply them to the phenomenological scenario of the day/at hand in their confident probabilistic communication of likely scenarios and associated impacts to clients.



3. Results

Some of the top users of the course, for example, are: BOM Australia, US (College/University, Weather Enthusiast, NWS), and the MSC.

All units have so far received between 4 and 4.5 stars with just over 150 reviews.

This course was used as a large component in the American National Weather Service's internal EPS Fluency Course and is in the process to be made mandatory training within the MSC.