Arpa Emilia-Romagna, Servizio Idro-meteo-clima
Bologna, 9-13 febbraio 2015

"Probability and uncertainty: two concepts to be expanded in meteorology"

Program

Monday 9 Feb

morning:

9.30-9.45 - *Carlo Cacciamani*: **Introduction**

9.45-11 /11.30-13 - *A. Persson*: **Classical statistics – not so "classical"**
The reason why the need of probabilities has become more important now when the computer forecasts have become more accurate is because the public has started to take the weather forecasts more seriously; they also more sensitive to details and the varying quality of the forecasts. The forecasters' role as "intuitive statisticians" will benefit from a good grasp of the nature of randomness, how probabilities can be combined and the role of correlated events.

13-14.30 Lunch

afternoon:

14.30-15.50 - *Roberto Buizza*: **Ensemble forecasting: how do we simulate initial and model uncertainties at ECMWF?**
There is not a unique way to simulate initial and model uncertainties in ensemble-based, probabilistic systems. In this lecture, the methods used by different operational centers to design global, medium-range ensembles are briefly reviewed, with particular focus given to the ECMWF medium-range/monthly ensemble.

15.50-16.10 Coffee break

16.10-17.30 - *Roberto Buizza*: **Ensemble forecast performance: how could we measure it?**
Ensemble-based, probabilistic forecasts have to be assessed considering a large sample of cases, and using different metrics that can highlight their performance considering a wide range of attributes. In this lecture, some of these metrics are presented, and are applied to ECMWF forecasts to review their performance.

Tuesday 10 Feb
morning:

9.30-11 /11.30-13 - *A. Persson*: Common statistics- the boring bit?
Frequentist statistics is what we normally hear and read about. A bit boring perhaps, but it helps us to understand why some forecasts are "good" and others are "bad", in particular with probability forecasting where an individual forecasts is never right or wrong. Besides, what looks "good" can often be "bad", and vice verse: increasing forecast errors can be a good sign! And then the mystery with the so called "Brier Score": how is it able to punish us if we do not forecast what we believe in?

13-14.30 Lunch

afternoon:

14.30-15.50 - *Roberto Buizza*: How long is the FiSH (Forecast Skill Horizon) length?
Today, operational ensembles provide skilful probabilistic forecasts of certain spatial/temporal scales up to weeks ahead, beyond the two-week predictability limit estimated in the 1970s. How can we explain this apparent paradox? How long is actually the FiSH (forecast skill horizon) length?

15.50-16.10 Coffee break

16.10- 17.30 - *F. Grazzini*: Probabilistic scenarios and predictability limit in long-range predictions (part 1)
Which tools are available for monthly-scale predictions? Experiences and graphical post-processing developed at Arpa-Simc.

Wednesday 11 Feb

morning:

9.30-11 /11.30-13 - *A. Persson*: Subjective probabilities – bluff or state-of-the-art?
How come that meteorologists have always been quite good at making subjective probability forecasts? But what is "subjective probability"? Why has there for about 200 years been a "statistical war" between "objective frequentists" and "subjective Bayesians"? Is the ensemble approach "Bayesian"? What kinds of mistakes are still common in probabilistic weather forecasting, for example with handling "conditional probability" and the most malicious peril of them all: "regression to the mean effect".

13-14.30 Lunch

afternoon:

14.30-15.50 - *F. Grazzini*: Probabilistic scenarios and predictability limit in long-range predictions (part 2)
Case studies and verification over Italy.

15.50-16.10 Coffee break

16.10 -17.30 - *C. Marsigli*: Introduction to short-range ensemble forecasting with LAM systems CANCELED

Thursday 12 Feb

morning:

9.30-11 /11.30-13 - *A. Persson*: **Decision-making probabilities - should I bring just a ¼ of an umbrella?**
 Ways to estimate, communicate and interpret probabilities will be discussed. Are we really following the simple logic of the "cost-loss" model? How come that it might be better not to say anything at all than to be over-confident? The science of probabilities is quite young so we should not be surprised if the public (and we!) have problems to understand probabilities. Ten non-mathematical ways to present uncertainties will be suggested and we may end the session by playing the "2005 Trento Dice Game".

13-14.30 Lunch

afternoon:

14.30-15.50 - *A. Montani*: **On the added value of an ensemble approach at small scales"**

15.50-16.10 Coffee break

16.10-17.30 - *C. Marsigli, A. Montani*: **Performance of COSMO-based ensemble systems for some case studies**

Friday 13 Feb

morning:

9.30-11 /11.30-13 - *A. Persson*: **Psychology of probabilities - deceiving ourselves and others?**
The science of probabilities is quite young and we still struggle to incorporate it in our "common sense". Here we list many of the conceptual pitfalls that complicate the use of probability forecasting. In a final summing-up we warn about the peril of overconfidence, not to underestimate the power of randomness, what looks good might be bad, that the ultimate quality of a forecast lies in the final decision and that we must update our "common sense" to apply our understanding operationally.

13-14.30 Lunch

Lecturers biography

Anders Persson has been a meteorologist for almost 50 years, half of the time at the Swedish Meteorological and Hydrological Institute dealing with weather forecasting (from short term aviation forecasts to weekly forecasts for the farming community, hydrological applications and ice braking service. The other half he has been active abroad mainly at the European Centre ECMWF with monitoring the forecast system, promoting the forecast products (in particular the probabilistic ensemble system) and advising the Member States on their use. He has also been a consultant at the Meteorological Office in Exeter. He is a Fellow of the Royal Meteorological Society and an Honorary Member of the Swedish Meteorologcal Society.

Roberto Buizza has a degree in Physics with University of Milano, a PhD in Mathematics from University College London and an MBA from London Business School. After four years at the Centre for Thermonuclear Research of the Electricity Board of Italy, in 1991 he joined ECMWF, where he has been involved in the design and development of the ECMWF ensembles. Since 2011, he has been working as Head of the Predictability Division of the Research Department, with responsibility for research and development of the ECMWF coupled forecast ensembles and of marine modelling and data-assimilation.

Federico Grazzini is a meteorologist with a degree in Physics with the University of Bologna and a long experience in operational forecasting, dating back to 1991. Being employed by the regional weather service of Arpa Emilia-Romagna almost since the beginning, he has also worked for others meteorological institutions like Servizio Meteorologico dell'Aeronautica Militare (1 year as assistant forecaster) and 5 years as synoptic analyst at ECMWF. Has been coordinator of the physical parametrization working group of the COSMO consortia for 4 years. His current interests, in addition to operational forecasting, are predictability and monthly-range predictions.

Chiara Marsigli got a degree in Physics at the University of Bologna in 1998, followed by a PhD in Physical Modeling for Environmental Protection. She has been working at the regional weather service of Arpa Emilia-Romagna since 2001, being employed in the Numerical Modeling area. Her work focuses on development of ensemble systems, predictability studies, probabilistic verification methods and applications. Since 2011 she coordinates the Working Group on Predictability and Ensemble Methods of the COSMO Consortium. She is involved in the coordination of ensemble activities within the C-SRNWP Programme of EUMETNET.

Andrea Montani got a PhD in meteorology at the Department of Meteorology, University of Reading, in 1998, and has been at the regional weather service of Arpa Emilia-Romagna since 2001. He works in the numerical modelling area dealing with limited-area-model ensemble prediction systems. He manages and develops the COSMO-LEPS system, which delivers ensemble forecasts at high resolution over several European countries. He has a long-term expertise in clustering techniques of atmospheric variables and in model evaluation.