Sant'Anna
Scuola Universitaria Superiore Pisa

International Conference on
Ensemble Methods in Modelling and Data Assimilation (EMMDA)

National Centre for Medium Range Weather Forecasting (NCMRWF)
Ministry of Earth Sciences (MoES)
Government of India
(Delhi, 24-26 February 2020)

Title: **Data assimilation and ensembles: two invaluable tools to increase predictability and quantify uncertainty**

Author: **Prof. Roberto Buizza**

Affiliation: **Scuola Superiore Sant'Anna (Pisa, Italy)**

Understanding the evolution of complex systems and being able to predict their evolution require the adoption of appropriate tools, approaches and methodologies. A typical example is weather prediction, where complexity is evident both when we try to understand and predict its small-scale, high-frequency variations (e.g. extreme events such as hurricanes) or its large-scale, low-frequency phenomena (e.g. continental-scale anomalies).

Two key tools developed and adopted in the past three decades have given us invaluable insights into the complex dynamics of the Earth-system, and have helped us managing weather risks: data assimilation and ensemble-based probabilistic methods. Thanks to these tools, in the past 4 decades we have gained days of predictability, and today we are able to predict extreme weather events such as hurricanes up to 10 days ahead, and large-scale anomalies such as the ones linked to the Madden-Julian Oscillation (MJO) up to one month ahead. Furthermore, we are able to provide not only the most likely future state of the atmosphere, but we can provide reliable and accurate estimate of the forecast uncertainty, e.g. in the form of weather scenarii or probabilities.

In this talk, I will briefly introduce these two approaches, and provide evidence of their value.