



**International Training Centre for Operational Oceanography
Indian National Centre for Ocean Information Services (ESSO-INCOIS)
Ministry of Earth Sciences, Govt. of India
Ocean Valley, Pragathi Nagar (BO), Nizampet (SO)
Hyderabad-500090**

An intense short course on Ensemble Kalman Filtering - Methods and Algorithms

The International Training Centre for Operational Oceanography (ITCOO) of the Indian National Centre for Ocean Information Services (ESSO-INCOIS) is organizing an intense short course on Ensemble Kalman Filtering - Methods and Algorithms during July 15 - 26, 2013. The course will be conducted by Prof. S. Lakshmi Varahan, School of Computer Science, University of Oklahoma, USA Oklahoma, USA at ITCOO-INCOIS, Hyderabad.

I. Goal

The aim of this proposed intense short course is to provide a good theoretical, algorithmic and computational background on various aspects of ensemble methods fashioned after the well known Kalman filtering that constitutes the basis for the forecasting methods that are currently used in many of the leading forecasting centers around the world.

II. Topics

- 1) Dynamic Data Assimilation and its relation to filtering, prediction and smoothing problems
- 2) An overview of statistical estimation - theory and methods
- 3) Kalman filtering approach to linear filtering - an exercise in linear unbiased and minimum variance estimation
- 4) Nonlinear filtering problem and its challenges
- 5) Various approximations to Nonlinear filtering
- 6) Ensemble methods
- 7) Hybrid methods
- 8) Particle filtering and its relation to ensemble methods

III. A plan of Action

- 1) It is planned that these topics will be covered in a total of 20 lectures
- 2) Each lecture will be for 60 minutes + 10 minutes for discussions
- 3) There will be two lectures back to back on each morning for ten working days (covering two weeks from July 15th through July 26) with a break about 30 minutes in between the two lectures

IV. Suggested Reading

Text Book

- 1) **J. M. Lewis, S. Lakshmivarahan and S. K. Dhall**, (2006) *Dynamic Data Assimilation: a least squares approach*, Cambridge University Press, 654 pages 2

Reference Texts and papers

- 1) **Kalnay, E.**, (2003) *Atmospheric Modelling, Data Assimilation and Predictability*, Cambridge University Press, 341 pages
- 2) **Evensen, G.**, (2007) *Data Assimilation: The Ensemble Kalman Filter*, Springer Verlag, 279 pages
- 3) **Wunsch, C.**, (2006) *Discrete inverse and state estimation problems: with geophysical fluid applications*, Cambridge University Press, 371 pages
- 4) Papers from the current literature