Data assimilation is the process of fusing information from priors, first-principles computer model results, and measurements of reality, to produce an optimal representation of a physical system of interest, such as the atmosphere. Data assimilation relies on comprehensive physical models with large numbers of variables, and on complex observational data sets. The resulting large-scale inverse problems need to be solved in faster than real time in order to, for example, meet the demands of weather forecasting.

In this talk we introduce variational and statistical estimation approaches to data assimilation. We discuss important computational aspects including the construction of efficient models for (background) errors, the construction and analysis of discrete adjoint models, solving the optimization problem using reduced order model surrogates, formally quantifying the information content of observations, optimal design of sensor networks, and inference methodologies that are robust with respect to errors in data.

**Bio:** Prof. Adrian Sandu obtained the B.S./M.S. degree in Electrical Engineering from the University Politehnica Bucharest, M.S. in Computer Science, and Ph.D. in Applied Mathematical and Computational Sciences from the University of Iowa. He was a postdoctoral researcher at Courant Institute, a Computer Science faculty at Michigan Tech, and in 2003 he joined the Computer Science Department at Virginia Tech. Sandu has broad research interests in the area of Computational Science. He co-authored over 134 journal articles, 11 software packages, and numerous book chapters and conference papers. His work was cited over 6,500 times, with an H-index of 41 and an i-10 index of 136 (according to Google Scholar). His research was funded by NSF, AFOSR, NASA, NIH, NOAA, with a total project value exceeding $23m, and a personal share of $6.5m. Seventeen Ph.D. and eleven M.S. graduated under Sandu’s immediate supervision, and six postdoctoral researchers have been trained. Sandu is ACM Distinguished Scientist, Honorary Fellow of the European Society of Computational Methods in Science and Engineering, and NSF CAREER awardee.