Mathematical Physics

Modelling, Analysis and Control

STRATEGIC RESEARCH DIRECTIONS

Differential Equations

- -Modelling physical phenomena
- -Analysis of the model
- -Numerical Simulation of the model

Mathematical Data Science

- -Inverse Modelling
- -Filtering and control
- -High performance computing

Head of the Group

Arnold Heemink

APPLIED PARTIAL DIFFERENTIAL EQUATIONS

Estuarine Modelling

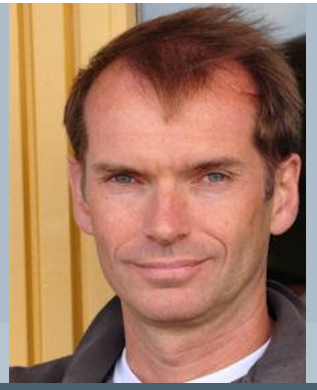
Henk Schuttelaars

Yoeri Dijkstra

Reservoir Engineering

Bernard Meulenbroek

Ocean Dynamics & Group theory



R. Van der Toorn

Vibrating Systems

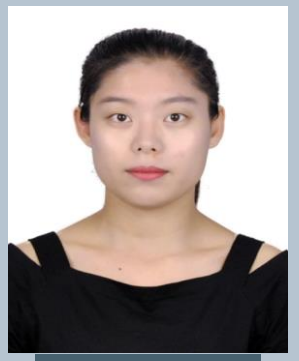
Wim van Horssen

Jie Liu

Xiao Deng

Henk Jongbloed

Marco Rozendaal



Jing Wang

DYNAMICAL SYSTEMS AND CONTROL THEORY

Jacob van der woude

Control & Max-Plus Algebra

Lisanne Rens

Mathematical Biology

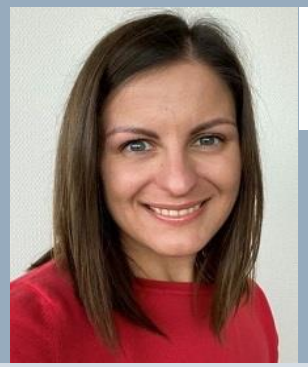
Anna Geyer

Wave Propagation

Reaction-diffusion systems

Johan Dubbeldam

MISCELLANEOUS



Kateryna Marynets

Fractional Differential Equations

Alethea Barbaro

Modelling Social organisms

No photo available!

Yves van Gennip

Network Dynamics, Variational Methods

LECTURERS

P.M. Visser

Kees Lemmens

Joost De Groot

Eva Coplakova

E. Van Elderen

MATHEMATICAL DATA SCIENCE

Arnold Heemink

Variational Data Assimilation and Stochastic PDEs

Martin Verlaan

Ensemble Data Assimilation

HaiXiang Lin

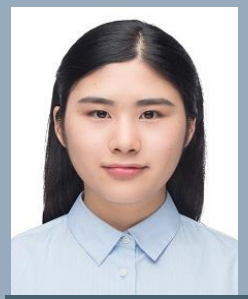
High Performance Computing and Machine Learning

Andres Yarce

Santiago Lopez

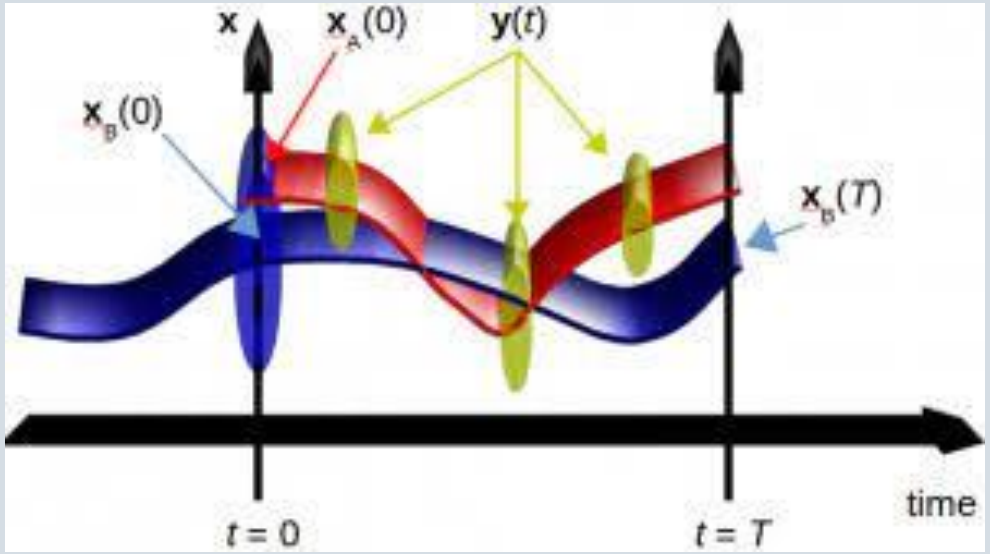
Amey Vasulkar

Henrique Guraneri



Xiaohui Wang

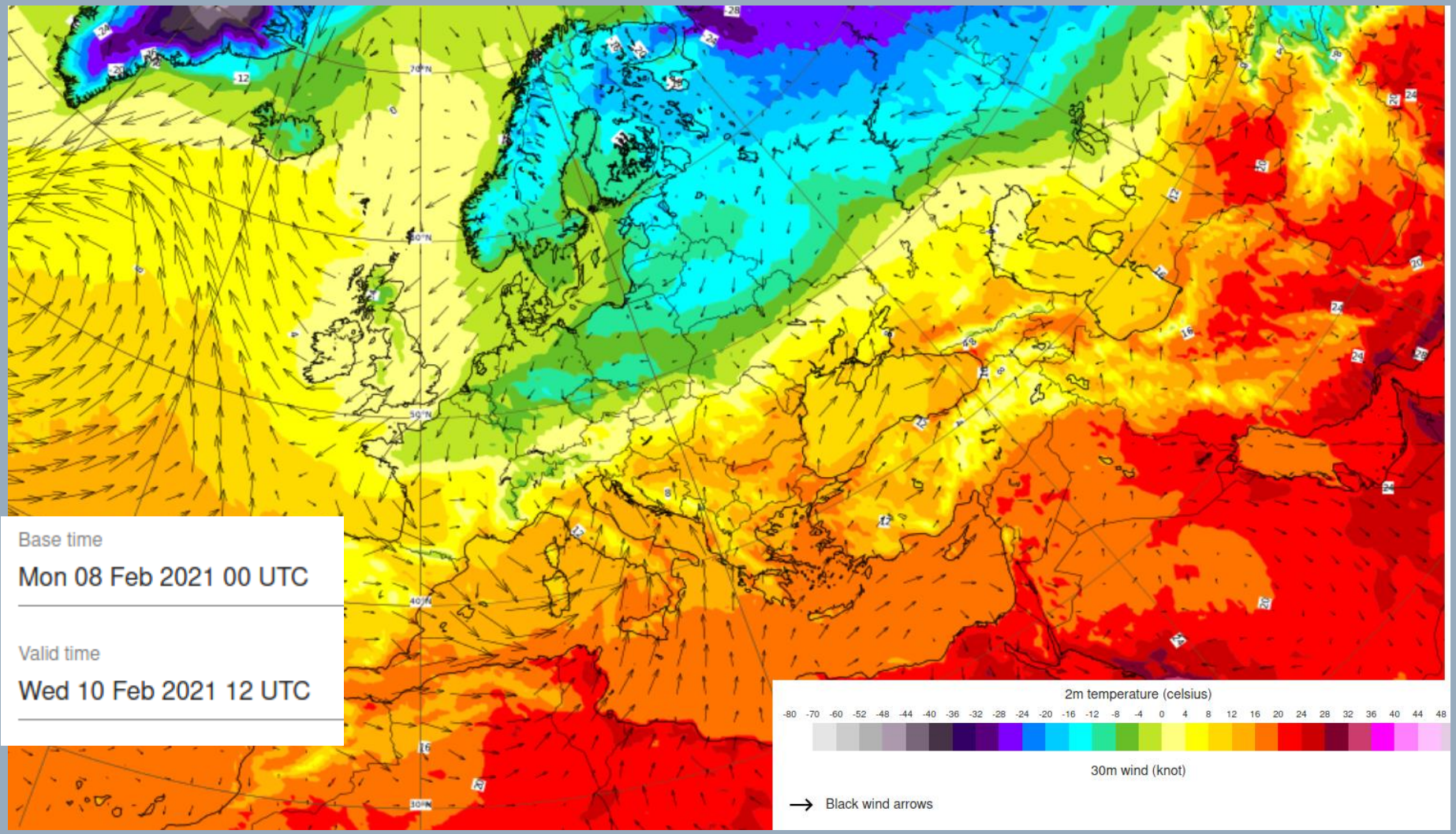
Tuo Deng



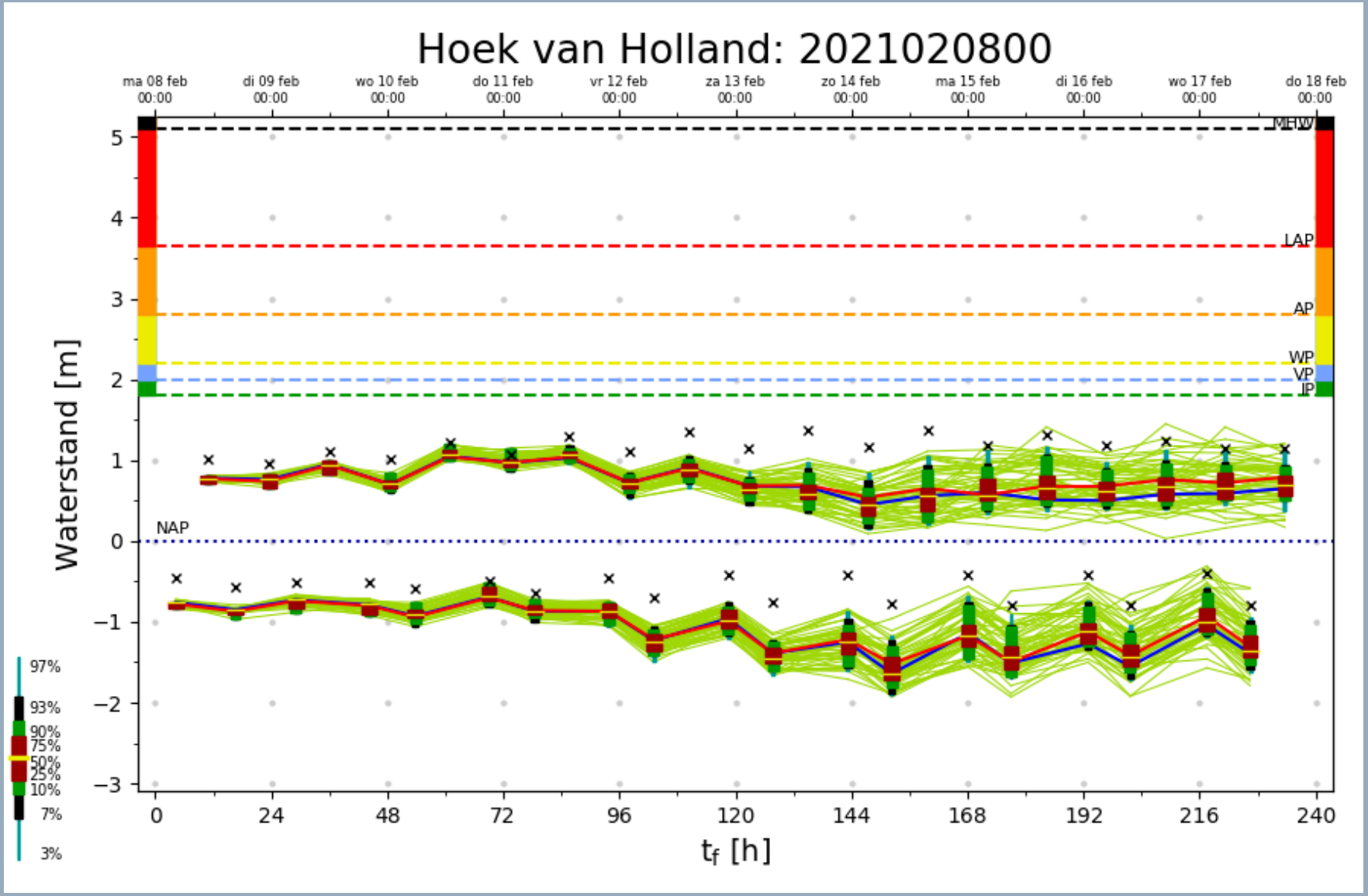
MATHEMATICAL DATA SCIENCE

NUMERICAL WEATHER PREDICTION

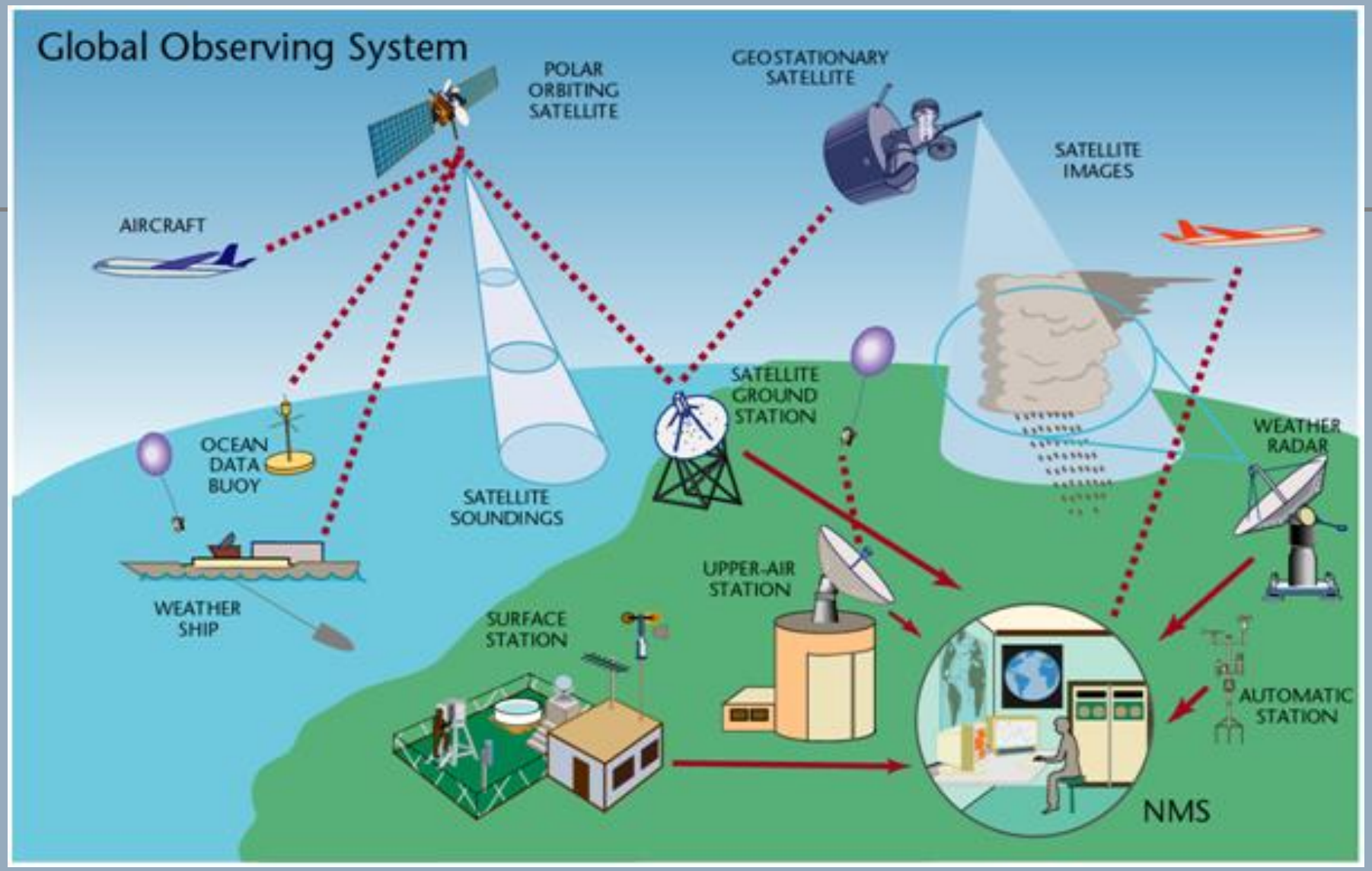
WEATHER FORECAST



UNCERTAINTY GROWS IN TIME



WEATHER OBSERVATIONS



DATA ASSIMILATION

Optimally combine dynamical models with observations to provide an estimate of the ‘initial’ state of the system which is better than what could be obtained from just the data or model alone.

PRIMARY GOALS

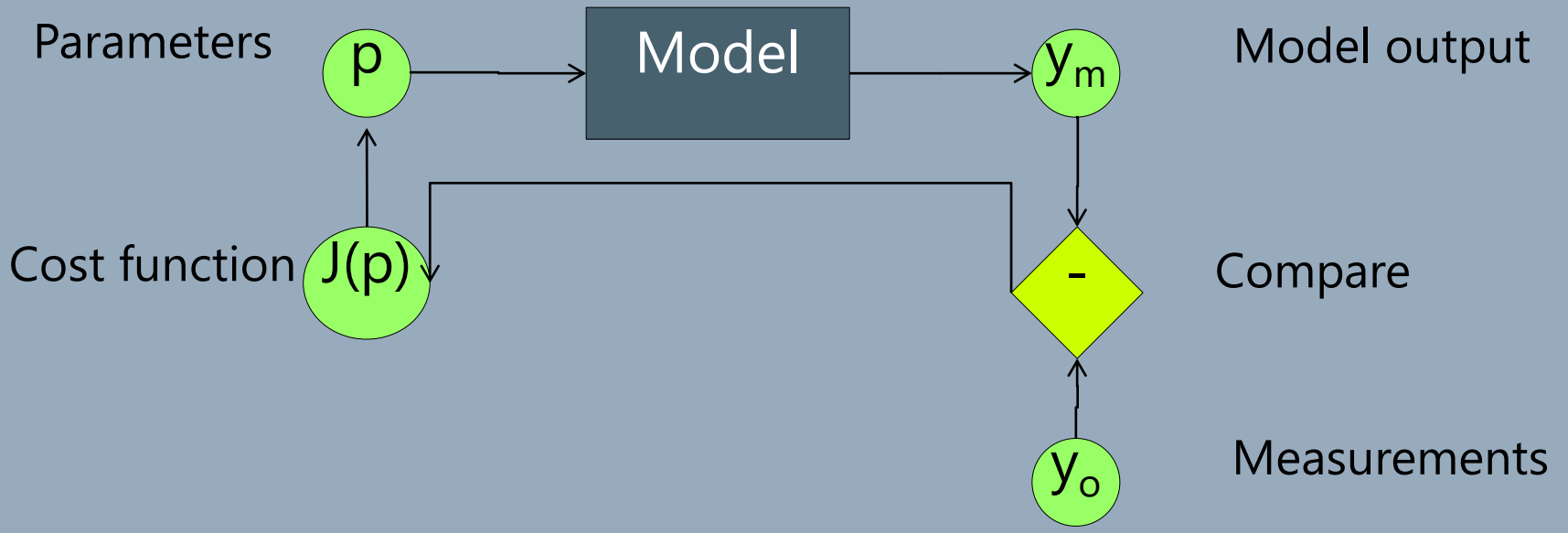
To make the best estimate of the initial state of the system from all the available information.

To quantify the uncertainty of our estimate of the initial state.

To train numerical model parameters based on observation data.

Depending on the application, it is also called state estimation, history matching, filtering, smoothing, inverse modelling.

PARAMETER ESTIMATION



COST FUNCTION IS OPTIMIZED

Computing gradient and Hessian.

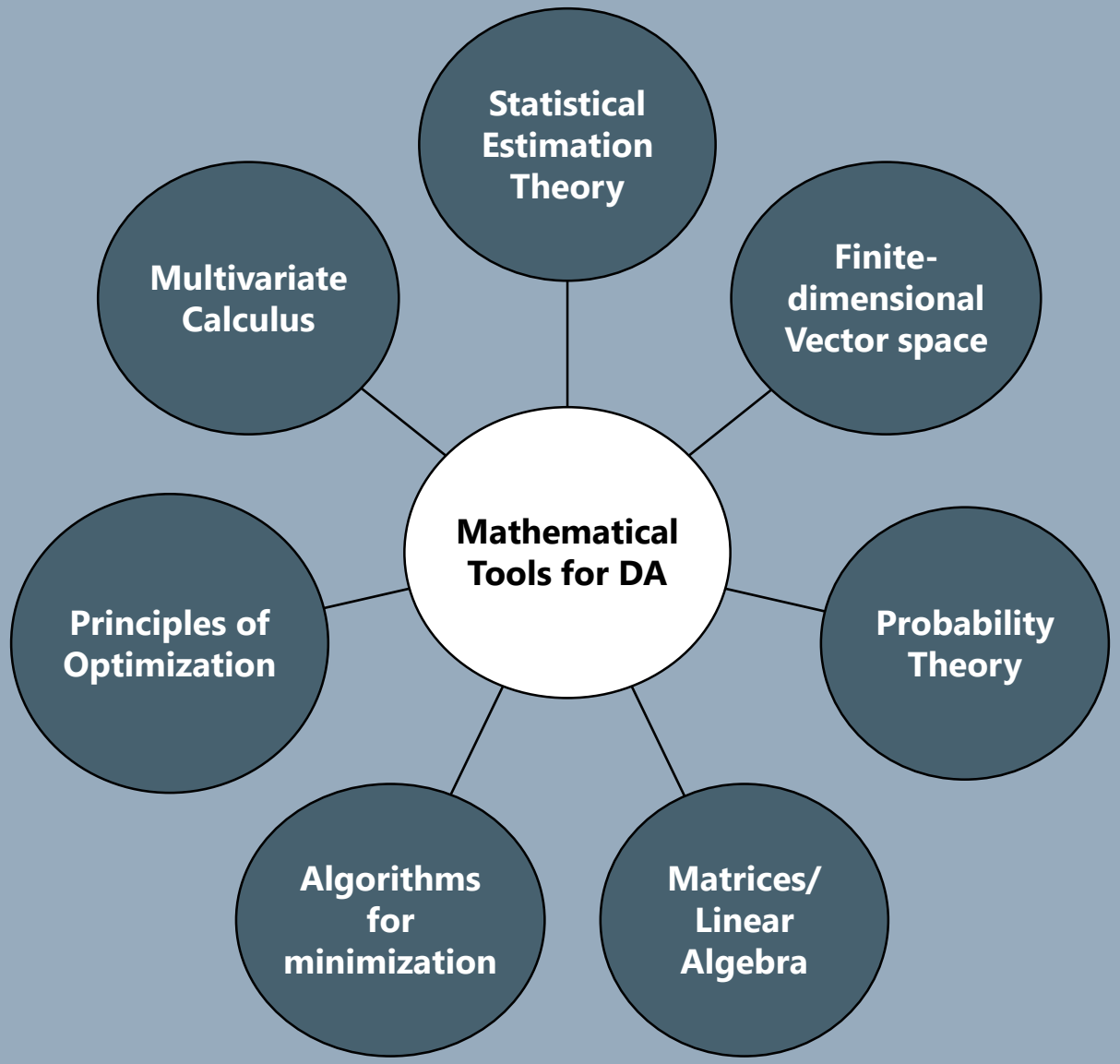
Bayes Theorem (Bayesian Optimization)

SOME APPLICATIONS IN OUR GROUP

Air pollution due to volcanic eruption

Dust Storm in China

Storm surge prediction (Deltaworks) Netherlands


Statistical Estimation Theory
Multivariate Calculus
Finite-dimensional Vector space
Mathematical Tools for DA
Principles of Optimization
Probability Theory
Algorithms for minimization
Matrices/ Linear Algebra