

# **COSTA** a problem solving environment for data assimilation

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# Outline

- Background
- COSTA project
- COSTA components
- Pilot COSTA for WAQUA/TRIWAQ
- Results and future work

# Background

- Usage of data assimilation in various areas:
  - Meteorology
  - Oceanography
  - Chemistry
  - etc
- Custom implementations for Data assimilation and calibration

# Background

- Advantages of custom implementations:
  - Computational efficient
  - Easy to handle model specific issues
- Disadvantages:
  - Not compatible
  - No reuse of existing software
  - Expensive

# COSTA

- PSE for data assimilation and calibration
  - Definition of components and their interface
  - Tools for easy creation of components
  - "Off the shelf" data assimilation and calibration methods
  - Development philosophy
- Free software (LGPL)

# COSTA Advantages

- Save on developments costs
- Reuse methods and models
- Quickly try out alternative methods
- Relatively easy to migrate existing software
- Less errors in the software
- Application for open and commercial models

## Keeping it generic

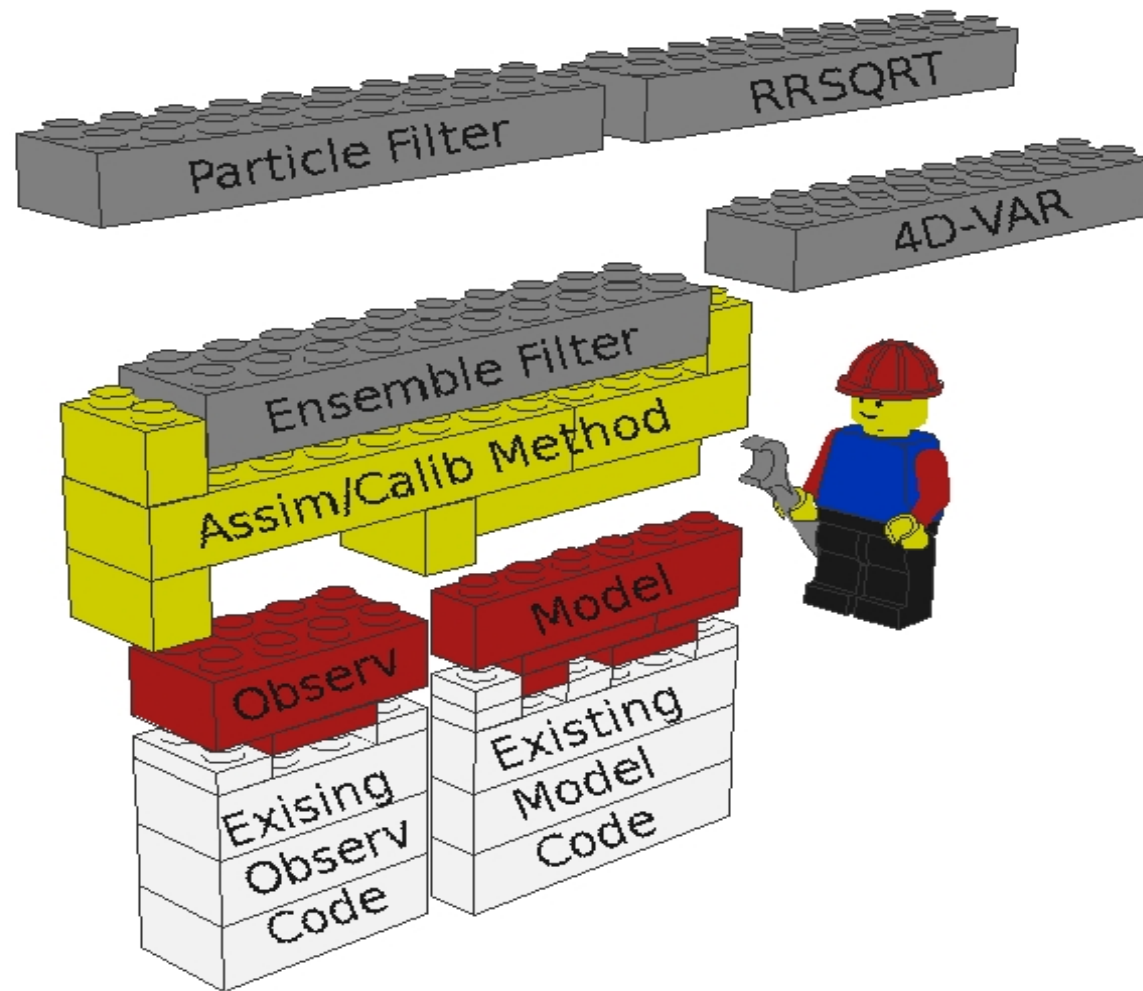
- COSTA users group
  - Data assimilation experts from various institutes
- Cooperation with other projects
  - Dutch National institute for Coastal and Marine Management (Rijkswaterstaat RIKZ) (Kalimero)
  - WL|Delft Hydraulics (DATools)

# Components

- Building blocks of COSTA
- Object oriented approach
  - Multiple instances of a component
  - Parallel computing
- Definition of powerful interface
  - Easy to use
  - Flexible, handle (model) specific issues
  - Good performance



# Components



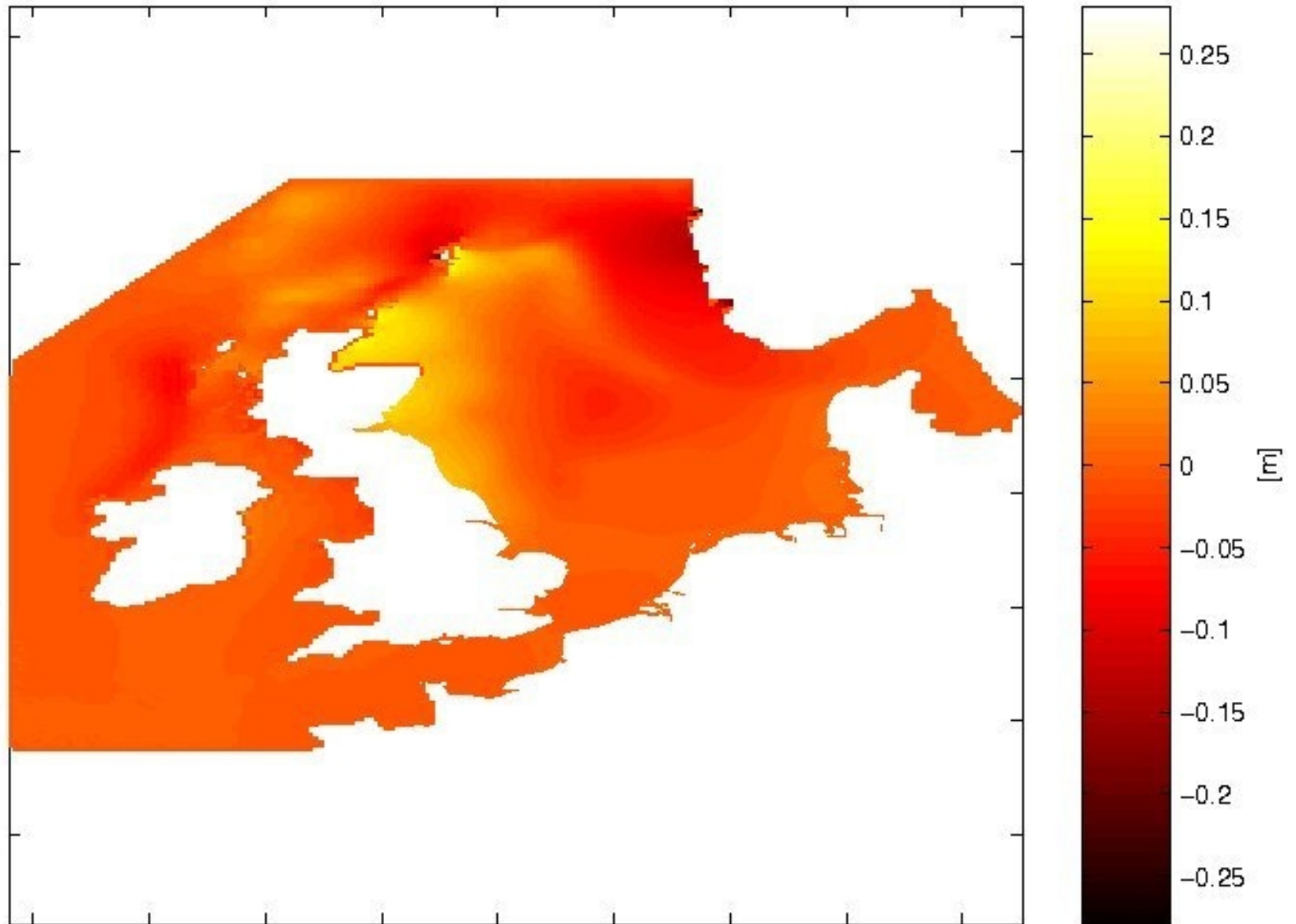
# Building Components

- Use generic component or create own
- No need to implement whole interface!
  - COSTA will implement method when possible
  - Limited use of Component but component can always be extended when needed

## WAQUA/TRIWAQ

- 2-D and 3-D shallow water simulation
- Data assimilation:
  - RRSQRT Kalman
  - Ensemble Kalman
  - Steady state Kalman
  - Calibration (adjoint/finite difference)
- Real model including:
  - Scaling
  - Discontinuities (drying and flooding)

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# COSTA & WAQUA/TRIWAQ

- Creation of Model Component:
  - Deterministic model
  - Noise model
  - Smoother
- Handle observations
- Create equivalent COSTA RRSQRT filter into a COSTA filter
- Correct simulation results

# COSTA developments

- Base system available:
  - Important components are available
  - Model interface
  - Observation interface (Stochastic observer)
- COSTA for real models
  - WAQUA/TRIWAQ
  - Lotos–Euros (air quality)

# COSTA developments 2006

- Model builders
- Parallel computing
- Model calibration
- First version of the software available at COSTA-website ([www.costapse.org](http://www.costapse.org))