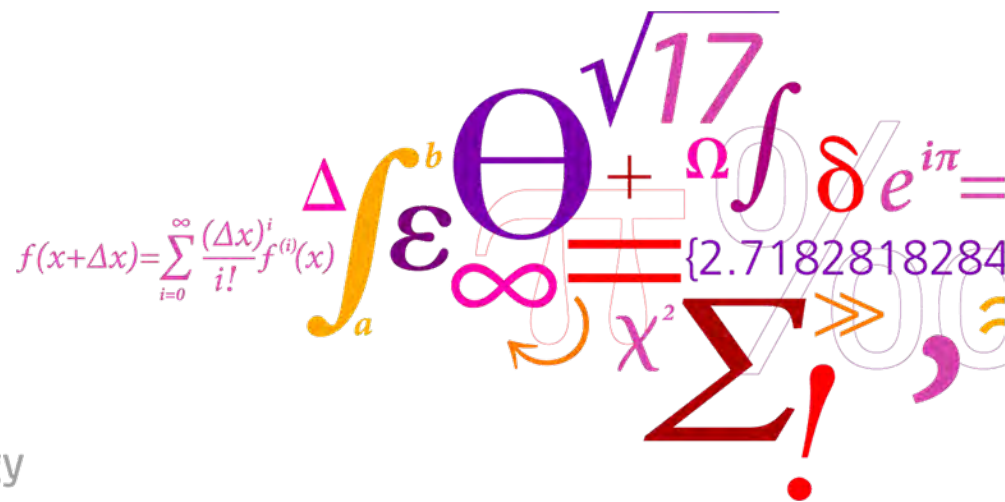


New data assimilation techniques for short-term wind energy forecast models with a rapid update cycle

Caroline Draxl



$$f(x+\Delta x) = \sum_{i=0}^{\infty} \frac{(\Delta x)^i}{i!} f^{(i)}(x)$$

$\int_a^b \varepsilon \Theta + \Omega \int \delta e^{i\pi} = \{2.7182818284\}$

∞ , χ^2 , Σ , \gg , $!$

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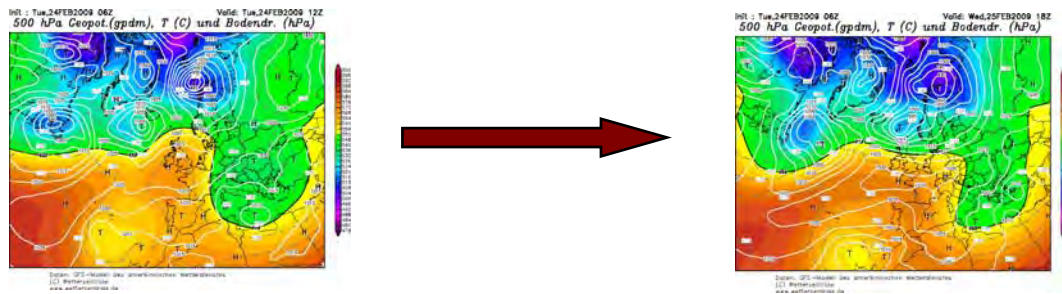
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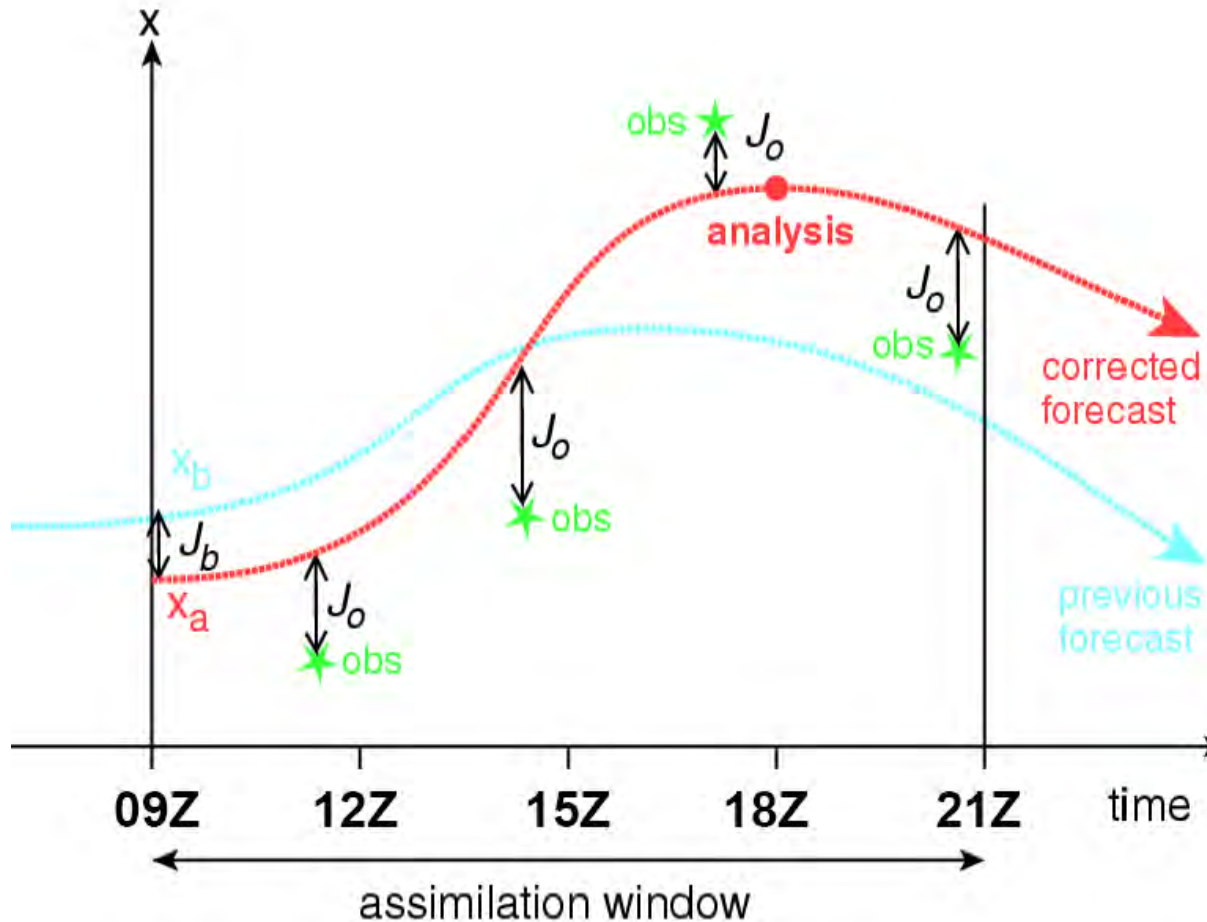
Data Assimilation

- Each meteorological forecast is wrong to a certain extent



- Analysis should be best to get forecast
- Data assimilation includes observations in high temporal and spatial resolution
- Not trivial but very complex
- Computationally expensive

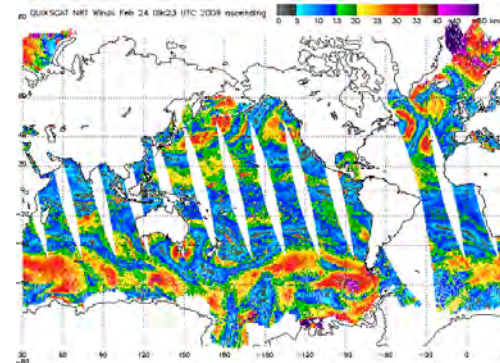
Data Assimilation



Data Assimilation Techniques

- Depending on data available
 - Satellite data (Quikscat data
10m ocean winds)
 - Turbine data, lidar data
 - DHI Radar data
Radar@SEA project:
high resolution information about rain and wind fields (radius of up to 60km around the site of interest, images every 1-5 minutes)

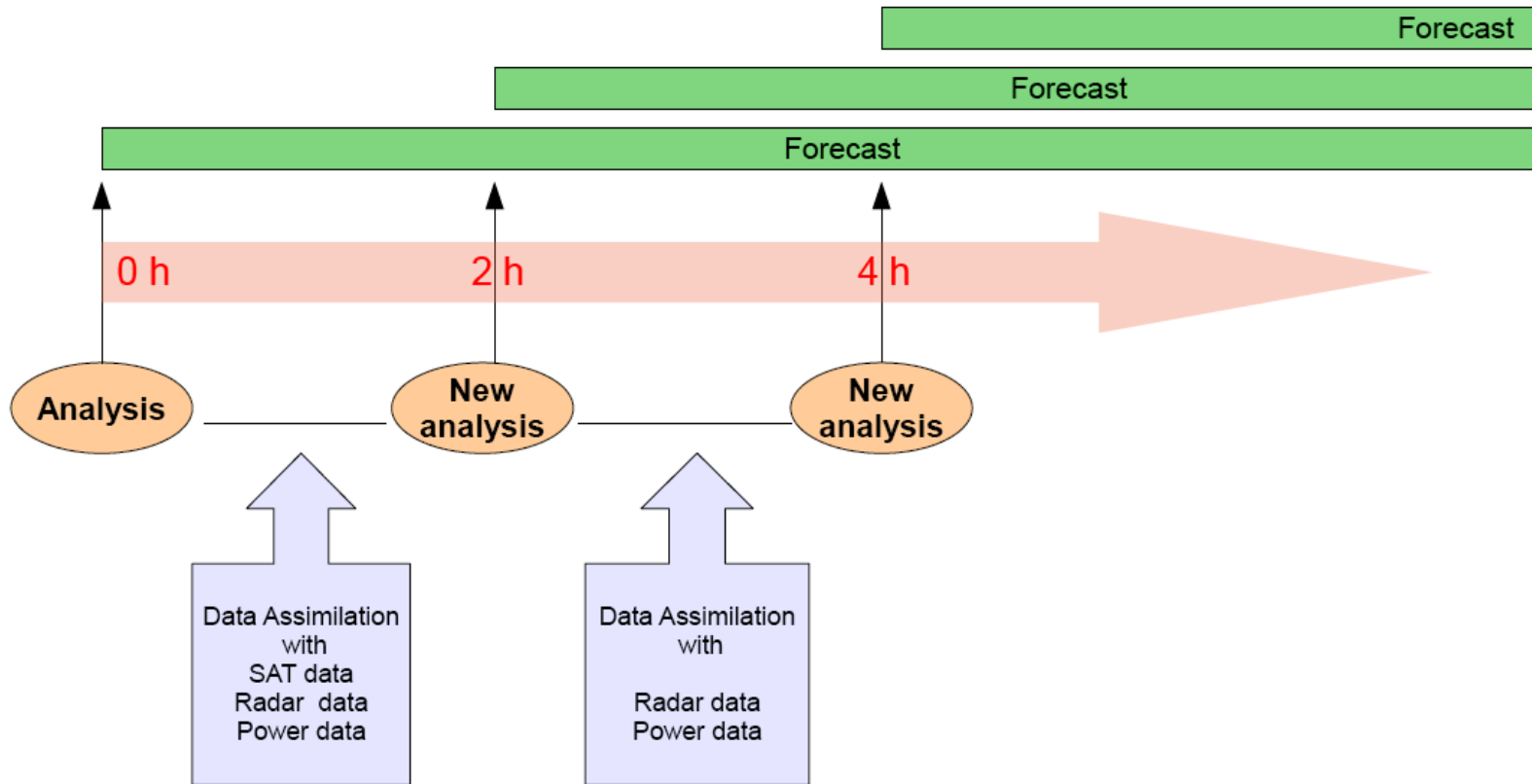
predict sudden rises or decreases of wind due to local effects
 - WRF Model



Forecast models with a **rapid update cycle**

- Forecasts are re-run every 6 hours – new set of forecasts every 6 hours
 - Winds can change within few minutes
 - 6 hour cycles not enough if speaking about wind variability
-
- data assimilation techniques: rapid, computationally cheap and simple
 - Rapid update cycle: new forecast every 1 or 2 hours

Forecast models with a **rapid update cycle**



Result: short-term WE forecast model

- Explain wind variability and mesoscale processes in PBL
- role of local rain showers and incoming fronts on wind power fluctuations
- see how inside of wind farm affected (wakes)
- Better “feeling” for timing of fronts
- Improved short-term wind forecasts for Horns Rev wind farm
 - Examine certain cases
 - Operational setup
- Power output control

Result: short-term WE forecast model

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... THANK YOU FOR YOUR ATTENTION !!!