

## Special note:

All programs used for the DA practicals are freely available from

<http://darc.nerc.ac.uk>

Follow the link ‘Simple models’

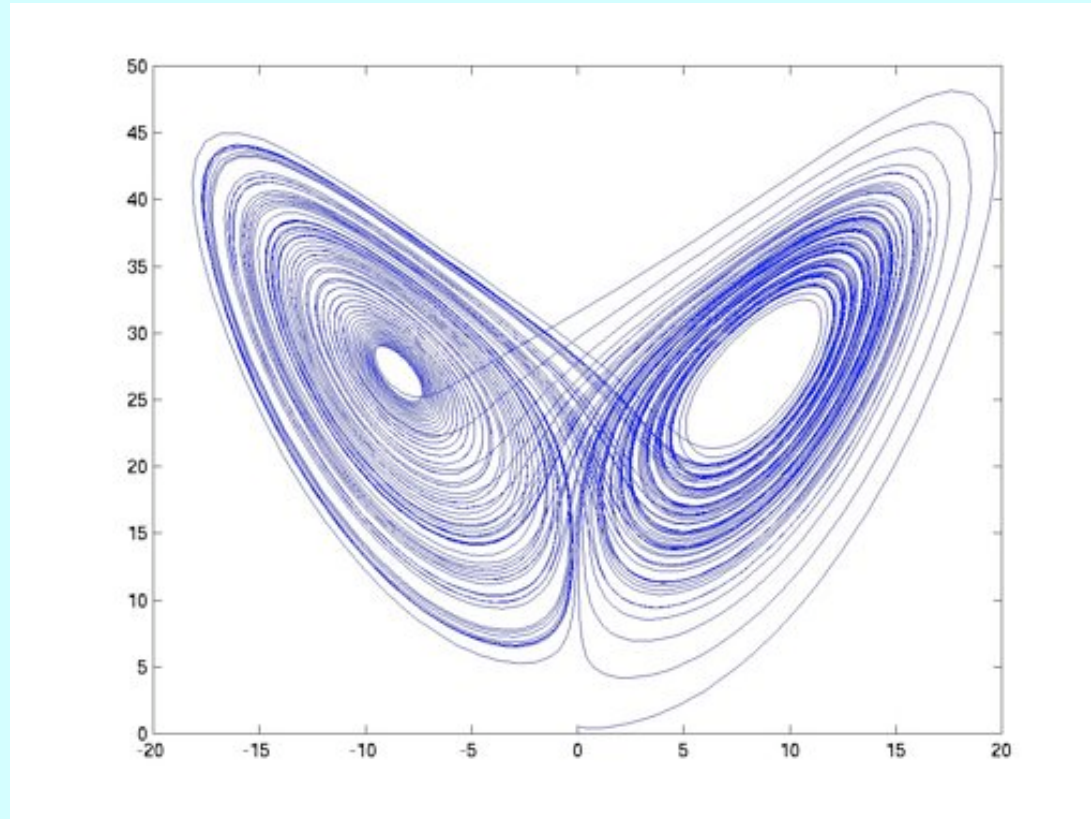


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# Lorenz equations: Sequential DA



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# Lorenz equations: Sequential DA

You will use the program *lorenz\_menu* in the directory *lorenz/sequential*.

You can experiment with four different sequential DA schemes

- Successive correction
- Analysis correction
- Optimal interpolation
- Kalman filter

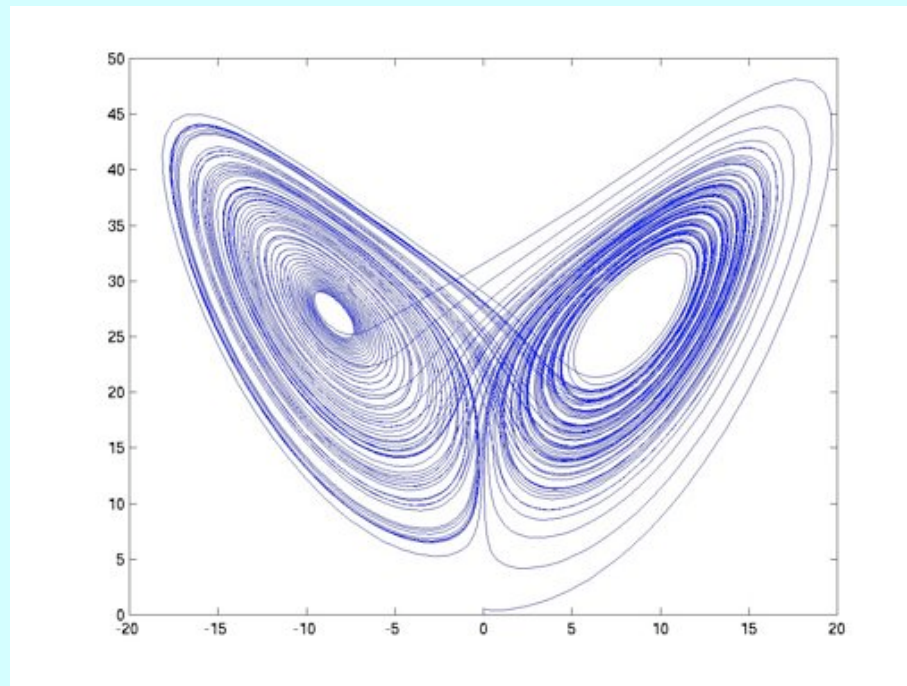


# You can choose various parameters:

- Iterations
- Correct/ incorrect covariance matrices
- Frequency of observations
- Noise on observations



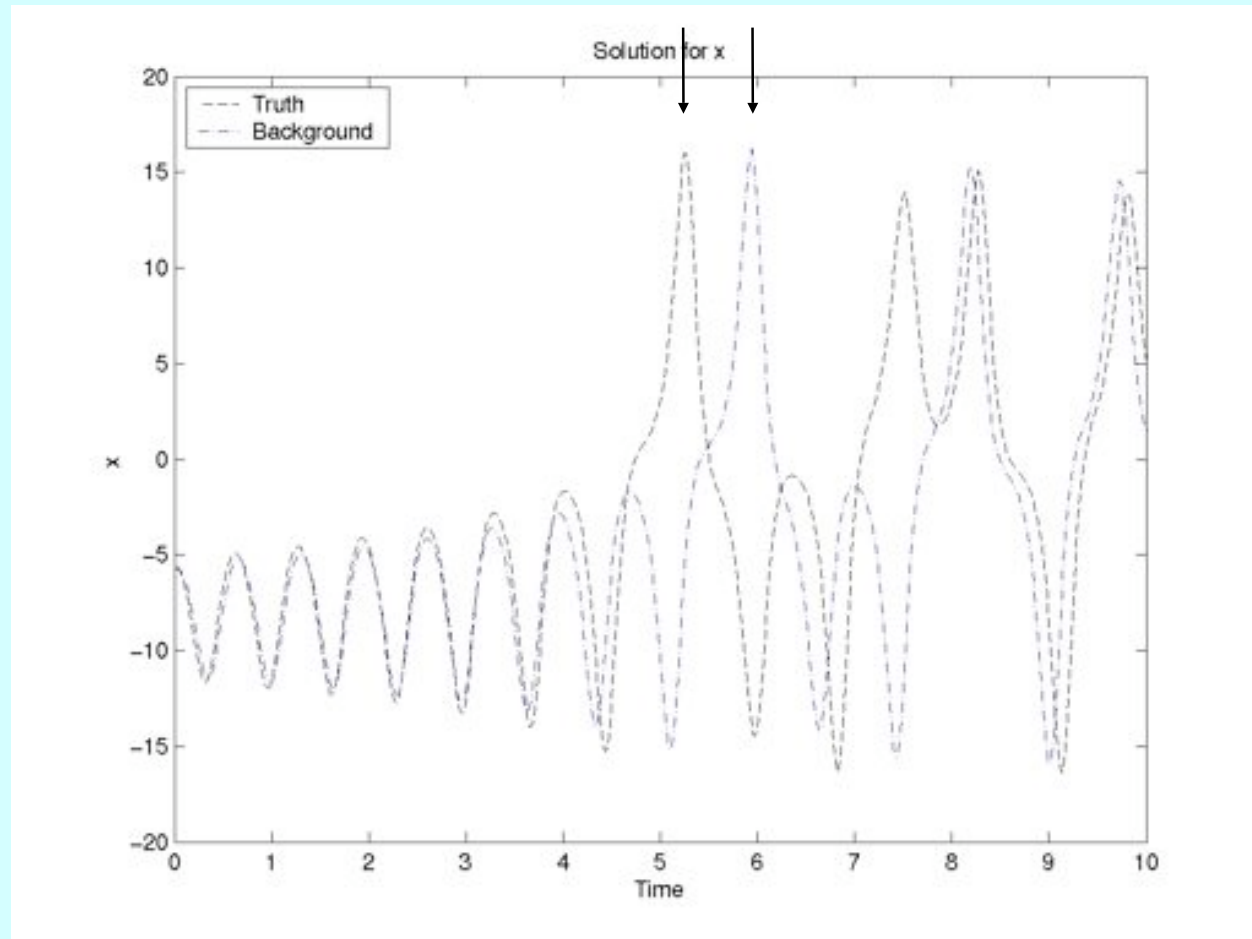
You are provided with a case in which the change in regime in the background occurs later than in the truth



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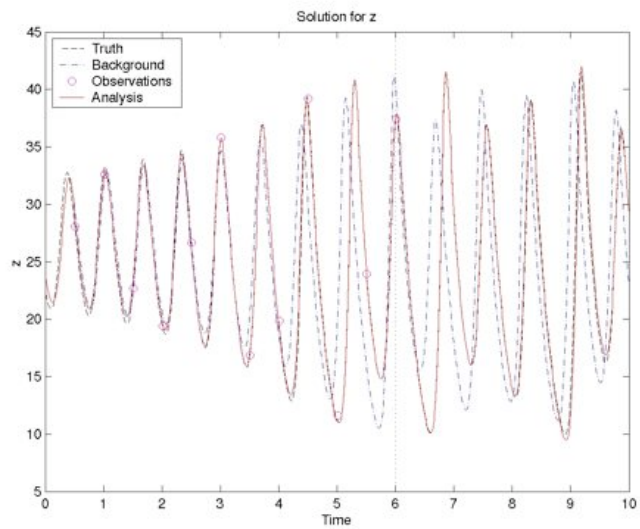
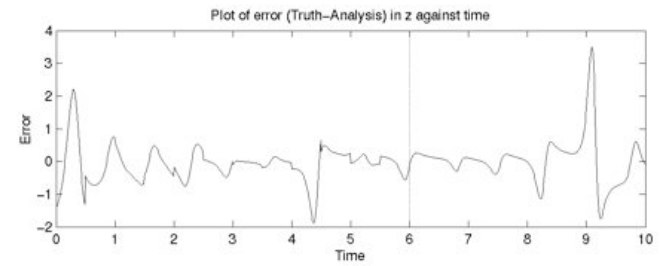
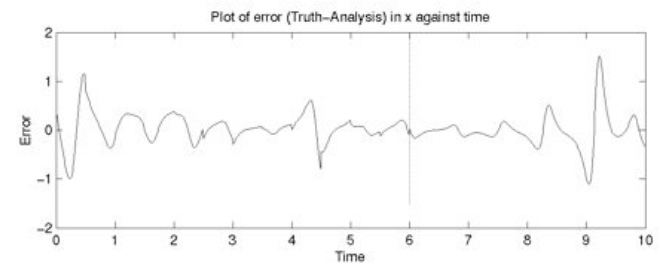
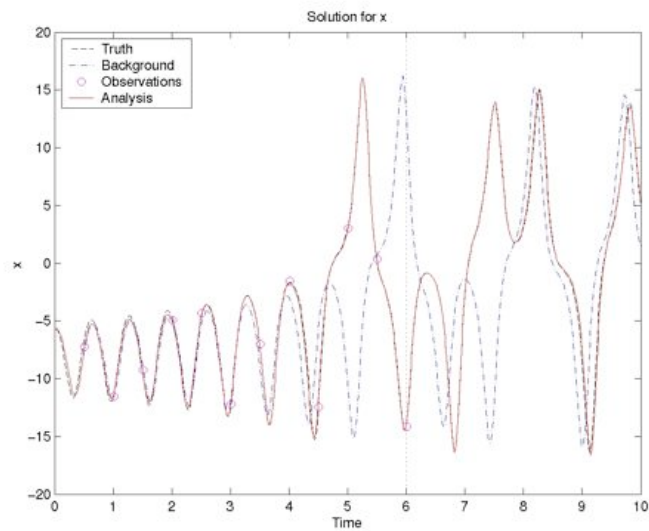


# Truth and background conditions



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**List of options chosen**

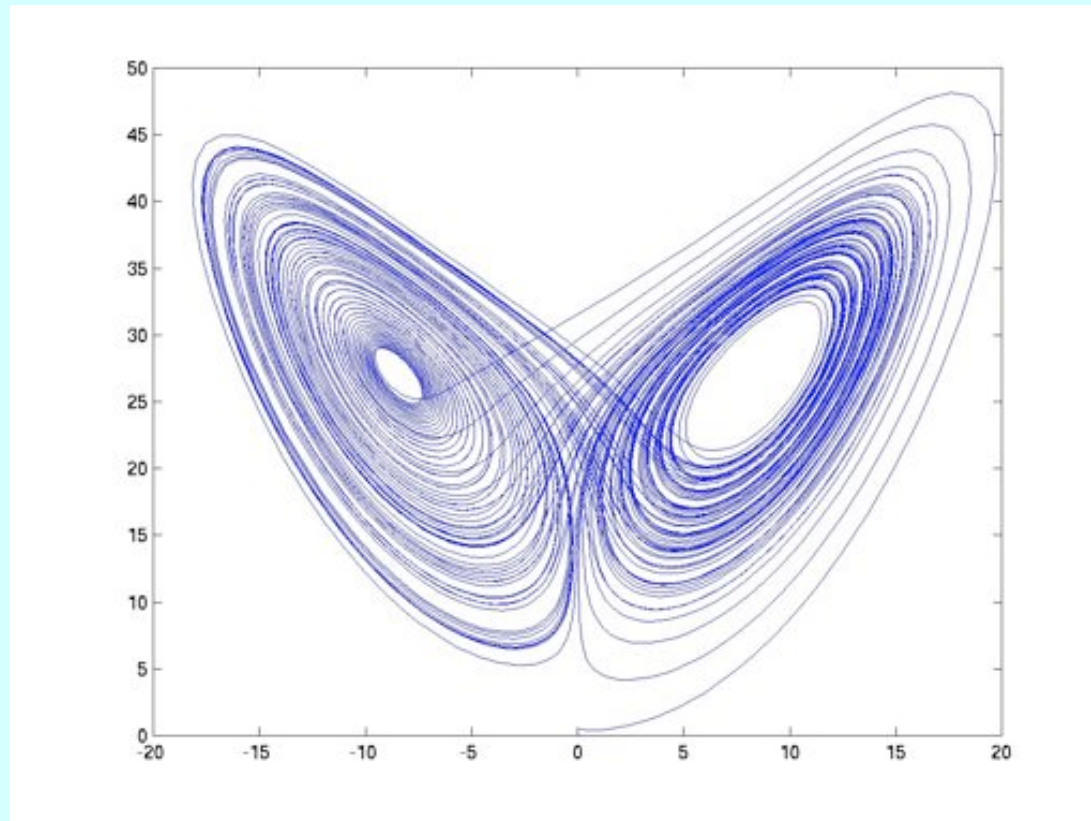
Analysis scheme: Successive correction  
 Number of iterations: 1  
 Time steps between observations: 50  
 Observations have random noise with variance 0.1  
 Noise generated in program and saved to file



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# Lorenz equations: 4D-Var



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# Lorenz equations: 4D-Var

In the directory *lorenz/var* you have various programs related to 4D-Var.

The first set of exercises allow you to understand how a 4D-Var system is tested, by running tests of

- Tangent linear model
- Adjoint model
- Gradient of cost function



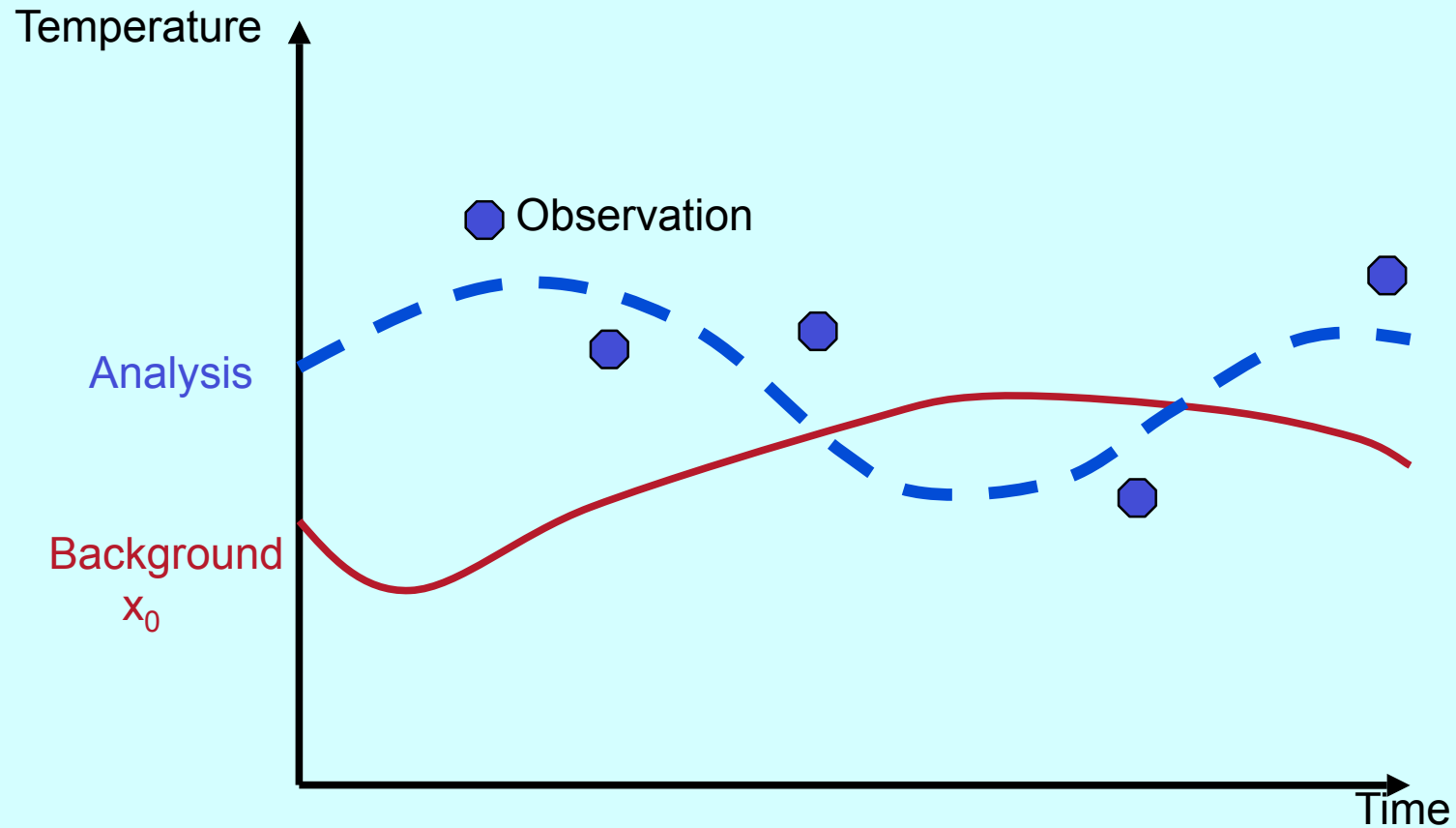
You can then run two types of 4D-Var

- Full 4D-Var
- Incremental 4D-Var

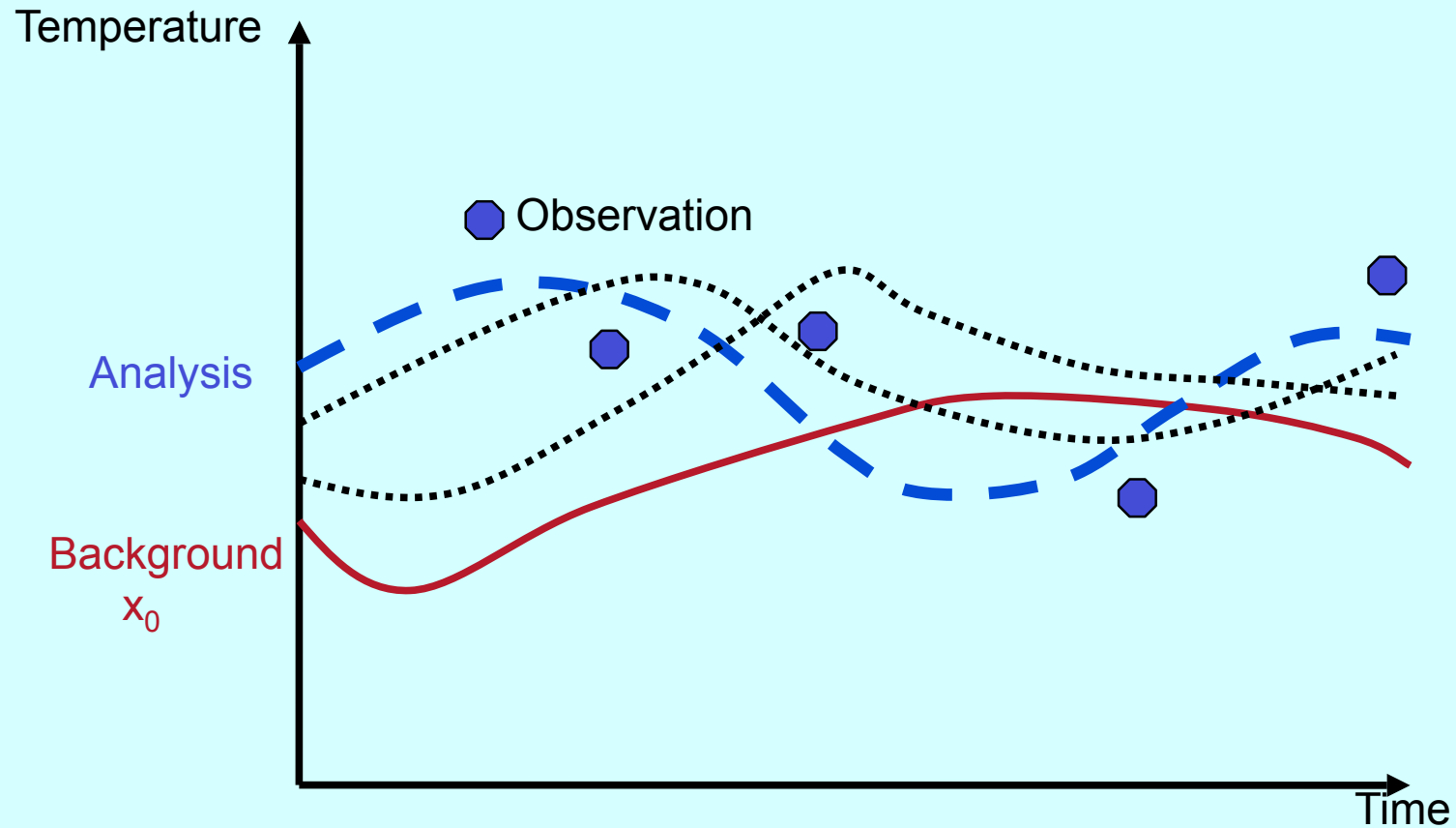
Start by using the parameters in the documentation and then try changing them to see the effect on the analysis.



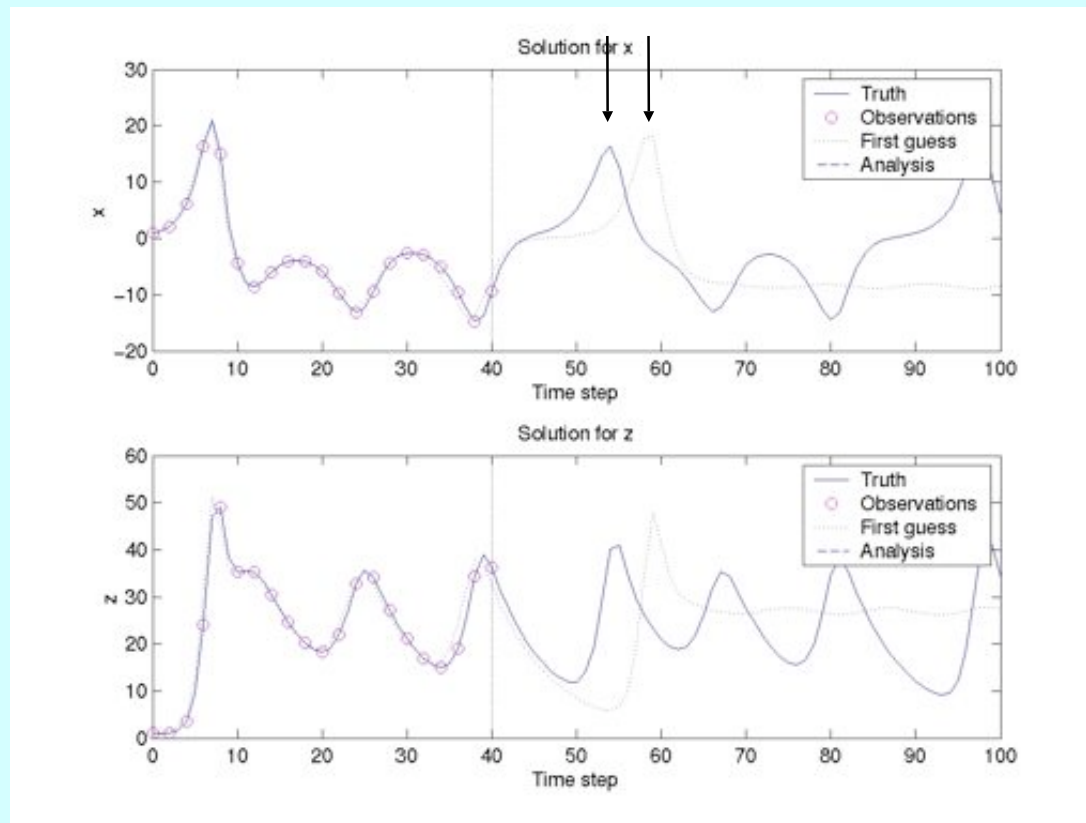
# Full 4D-Var

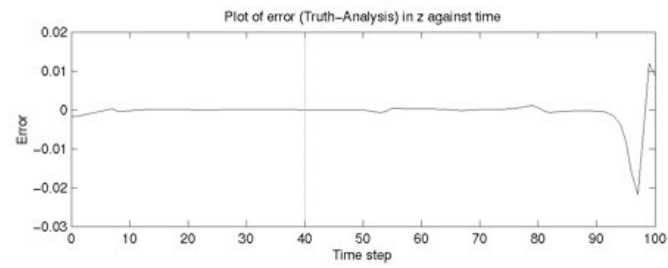
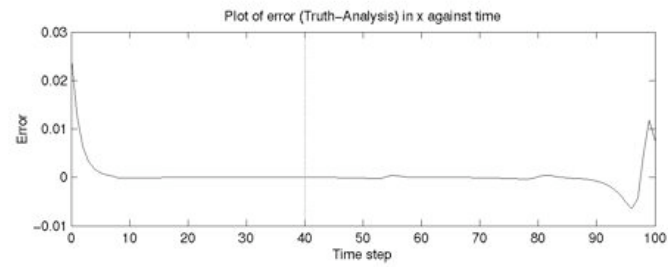
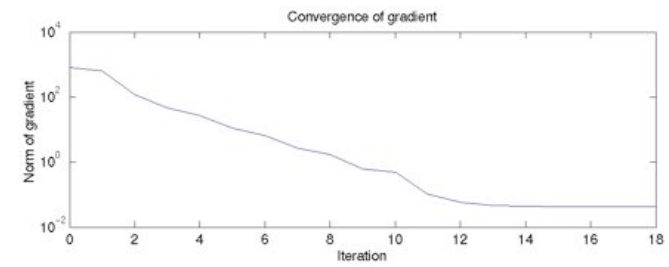
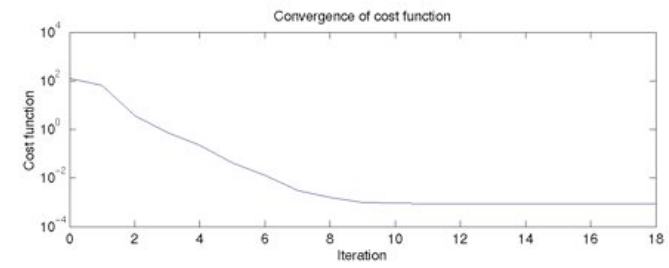
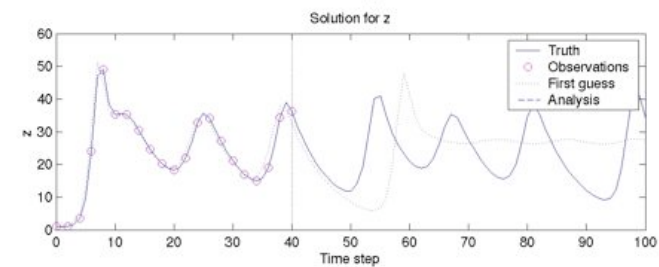
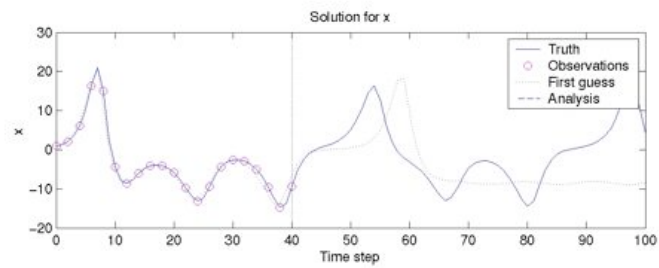


# Incremental 4D-Var



For this case a change of regime occurs towards the start of the forecast and is too late in the background





#### List of options chosen

True (xyz) at t=0: (1,1,1)  
 First guess (xyz) at t=0: (1.2,1.2,1.2)  
 Length of assimilation window: 2  
 Length of subsequent forecast: 3  
 Time step: 0.5  
 Frequency of observations = 2  
 Maximum iterations: 30  
 Tolerance:  $1d-5$   
 No noise on observations

