Wind flow across a forest edge

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Supervisors: Xiaoming Cai and Rob MacKenzie (University of Birmingham)

Photo: © Jack Sparrow

1. Why bother?

Forests around the world are becoming increasingly fragmented

Photo: Ricardo Beliel

2. A few comments about wind

Air flow is 3D and interacts with the forest at all scales

[VIDEO OMITTED]

3. Studying air flow at forest scales

It's hard to measure the interactions directly

High-resolution modelling can help fill in some of the gaps

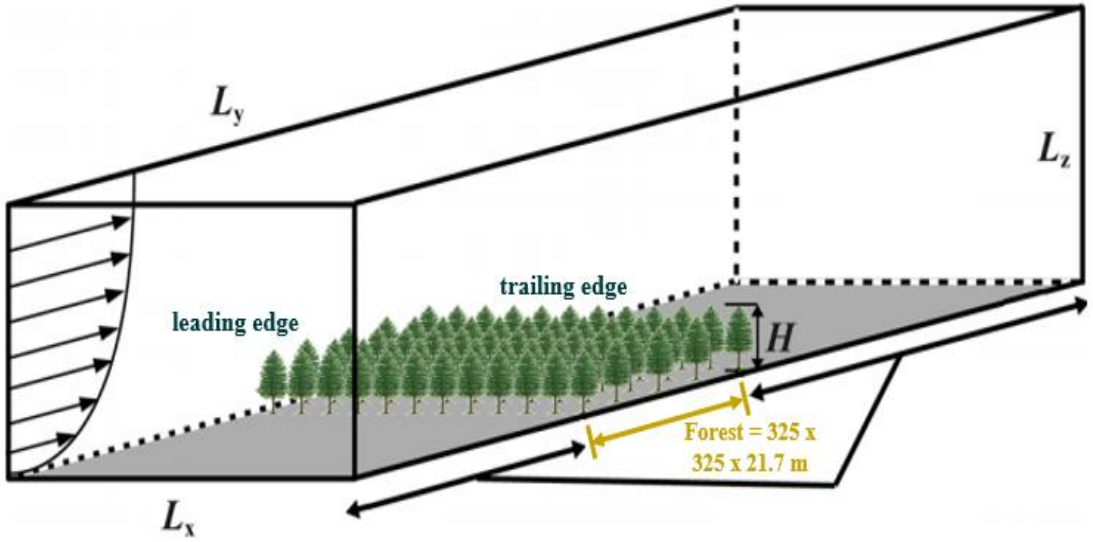
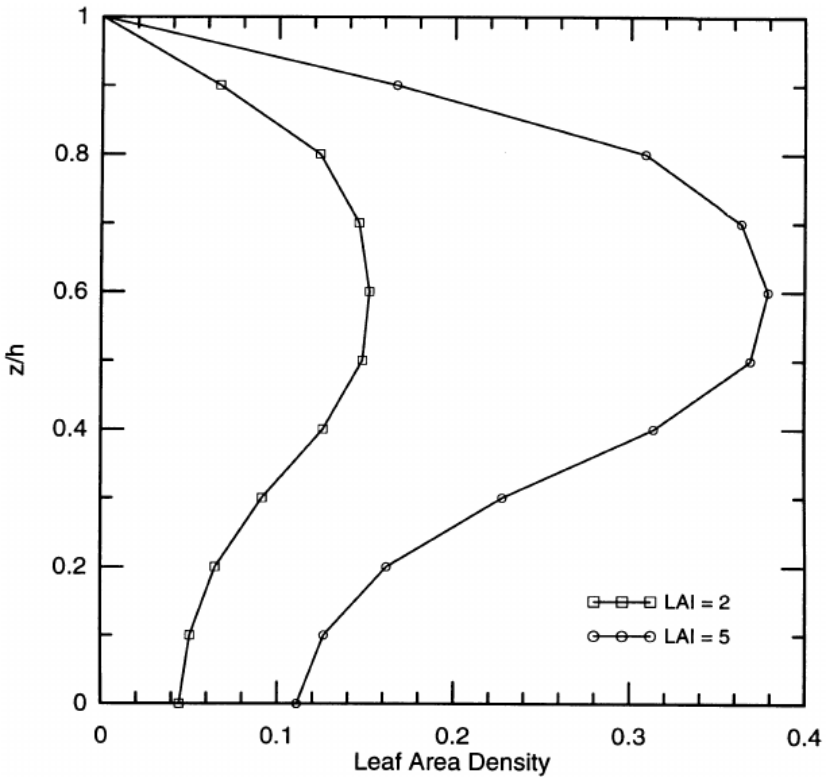
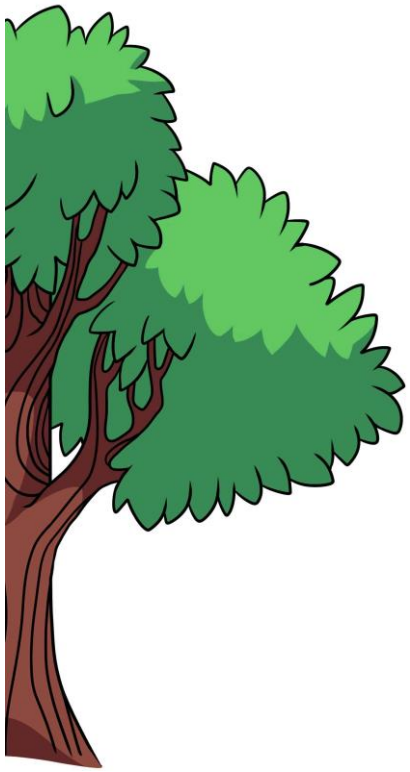


Figure adapted from Kanani-Sühring and Raasch (2015)

4. Work at BIFoR and Forest Research UK: improving models of forests

Most wind models represent forests quite crudely





WIND

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First step: approximate the trees as cylinders using point cloud data

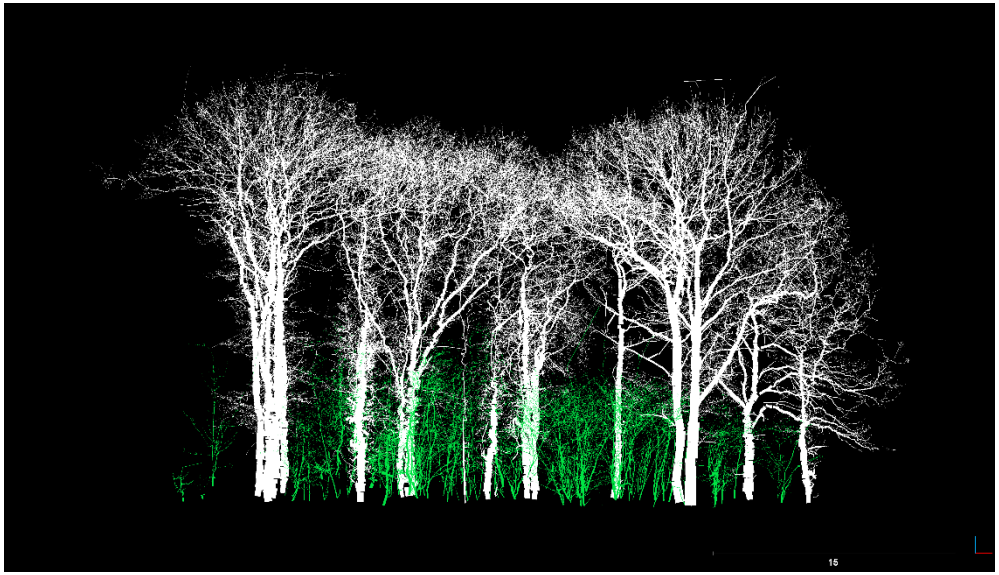
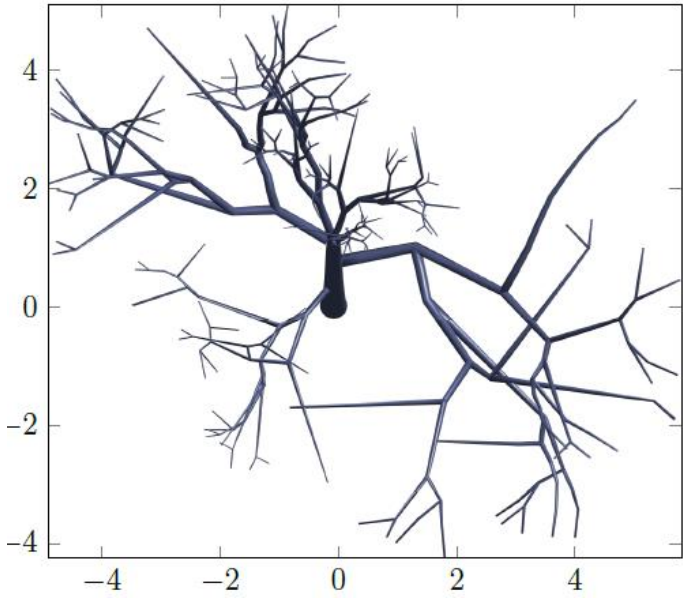


Image: Eric Casella (Forest Research UK)



Åkerblom et al. (2015) *Remote Sens*. 7, 4581-4603

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Then use those cylinders to approximate morphology of the forest

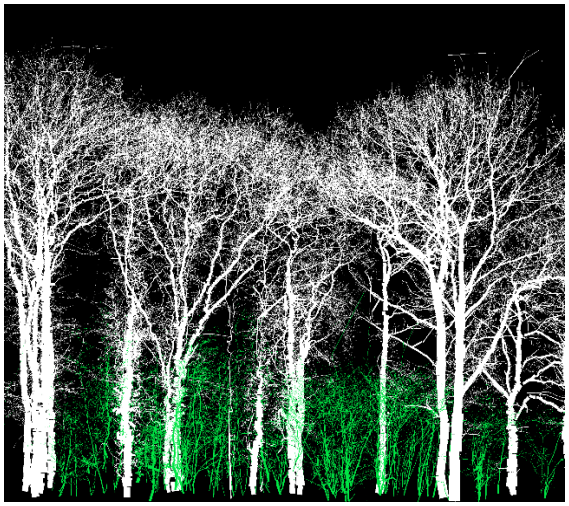
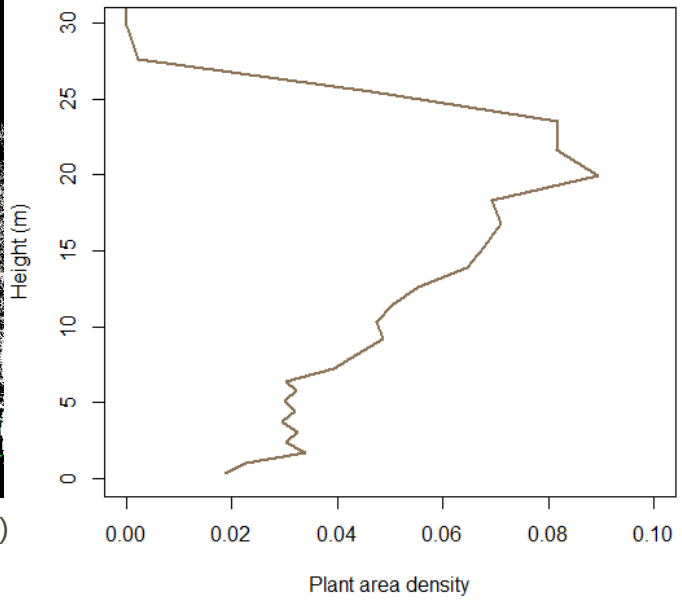
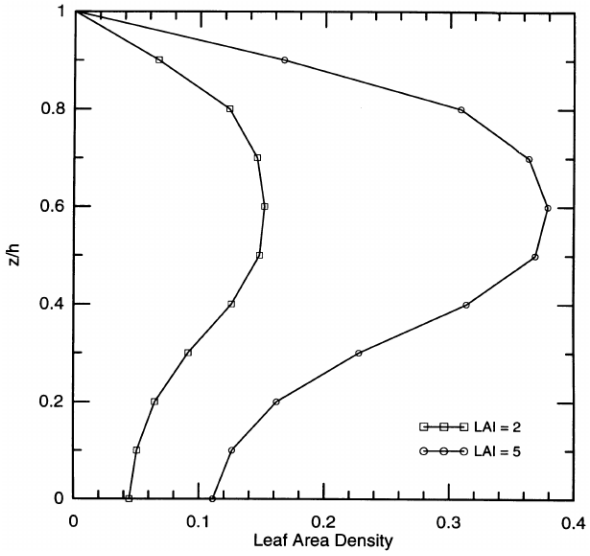


Image: Eric Casella (Forest Research UK)





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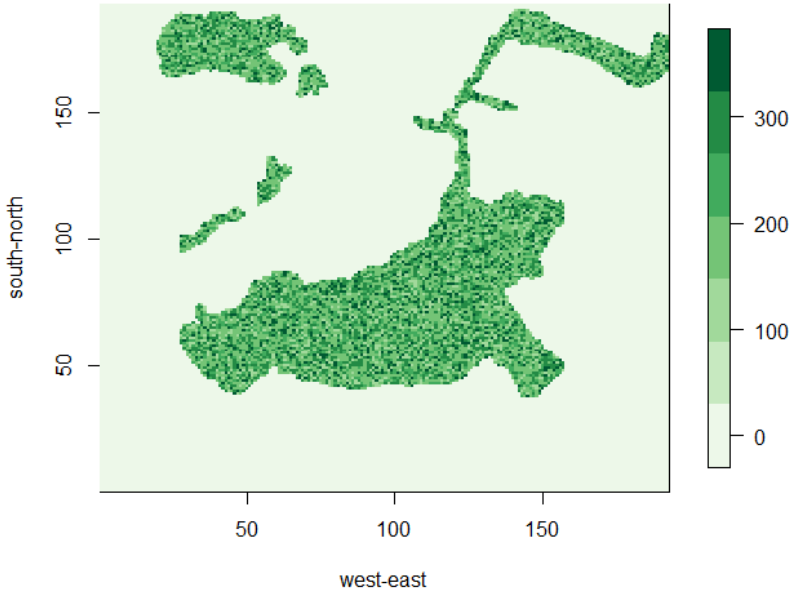
Use a random number generator to assign different densities throughout the woodland

Image: Google Earth



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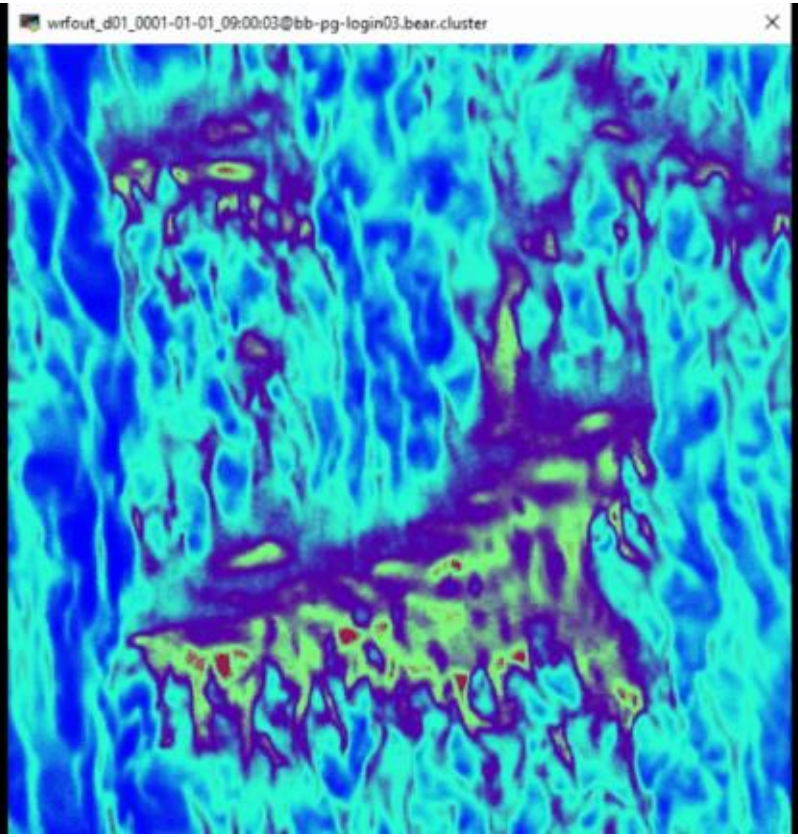
Wind blowing from the north

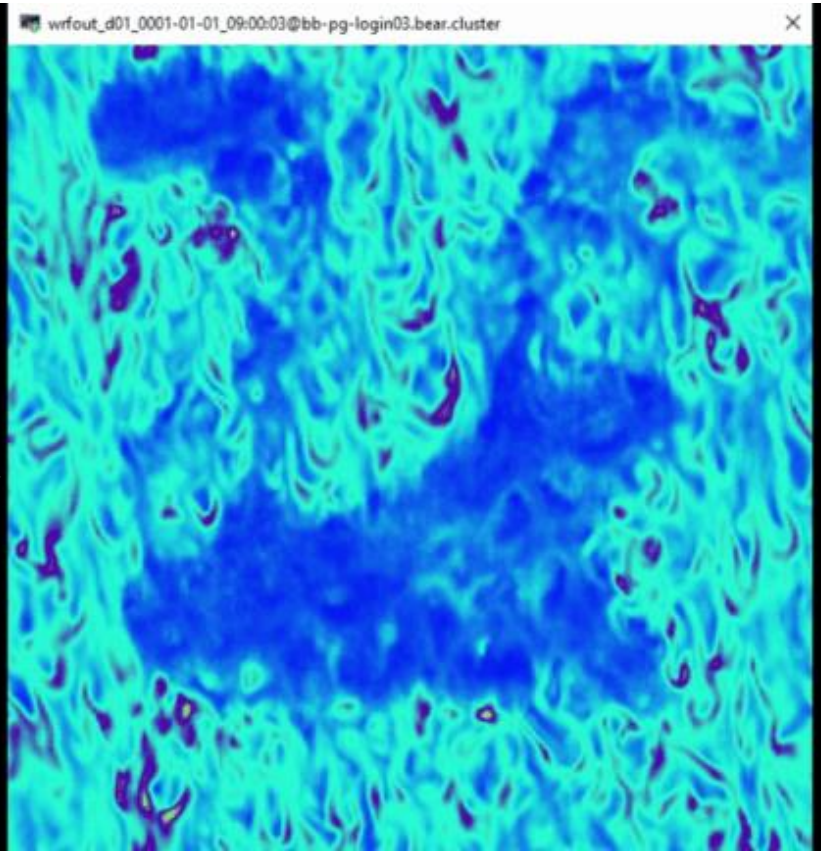
- Bird's eye view of flow field at 10 m
- Over a time period of 30-40s
- i.e. we're looking down on flow through the bottom half of the forest



- Red patches show recirculation of air

Turbulent kinetic energy in and around the forest

- Bird's eye view of flow field at 10 m
- Over a time period of 30-40s
- i.e. we're looking down on flow through the bottom half of the forest



- Light coloured rolls move through the woodland

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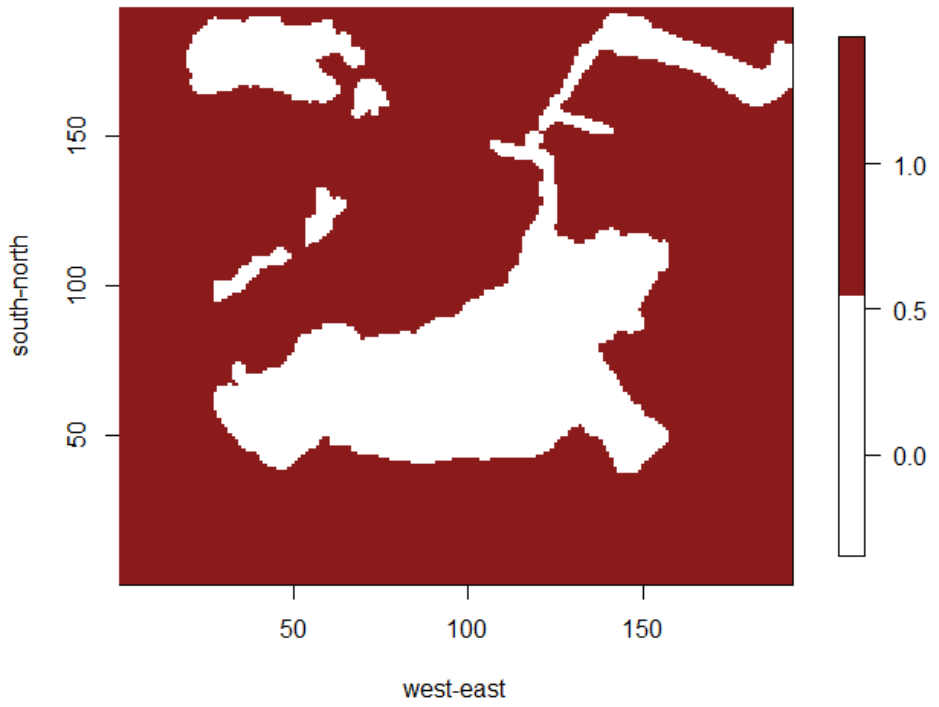
A scalar quantity – e.g. ammonia – moving from outside the forest



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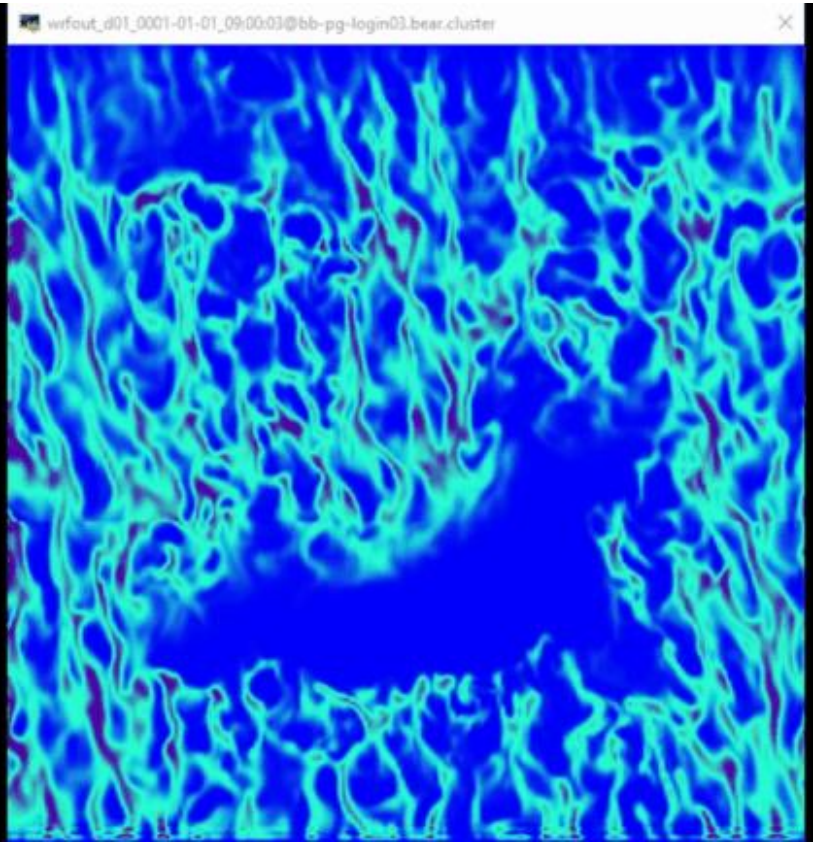
Ammonia moving from outside the forest

- Bird's eye view of flow field at 10 m
- Over a time period of 30-40s
- i.e. we're looking down on flow through the bottom half of the forest



- Woodland gradually fills up with the 'ammonia'

5. What next?

We have two main areas of work in the near future:

1. Comparing the model results to data from the BIFoR met towers

2. Refining the numerical model to make it represent flow more realistically

6. Quick summary

To sum up:

1. Forests are becoming increasingly fragmented
2. Forests are complex, as is the atmosphere
3. We've used large-eddy simulation to approximate flow over a real forest
4. We're working to incorporate meteorological data into the model

A special thanks to:

Dr Jian Zhong (UoB) for his help with the wind model

Supervisors: Dr Xiaoming Cai and Prof Rob MacKenzie

Much obliged to:

CENTA

NERC DOCTORAL TRAINING

The JABBS Foundation

For code, further information or references:

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