Simulation of Potato Late Blight in the Netherlands: Validation of the BLIGHTSPACE Model Reveals Dichotomy in the Epidemiological Effects of Resistance Components.
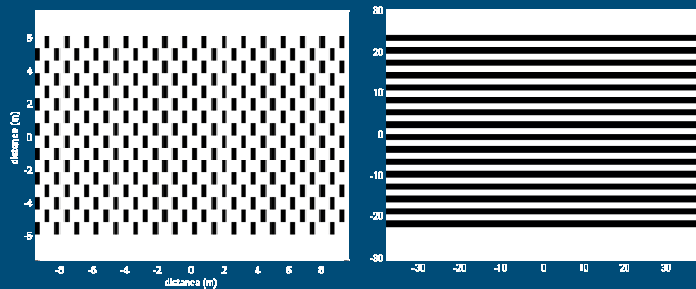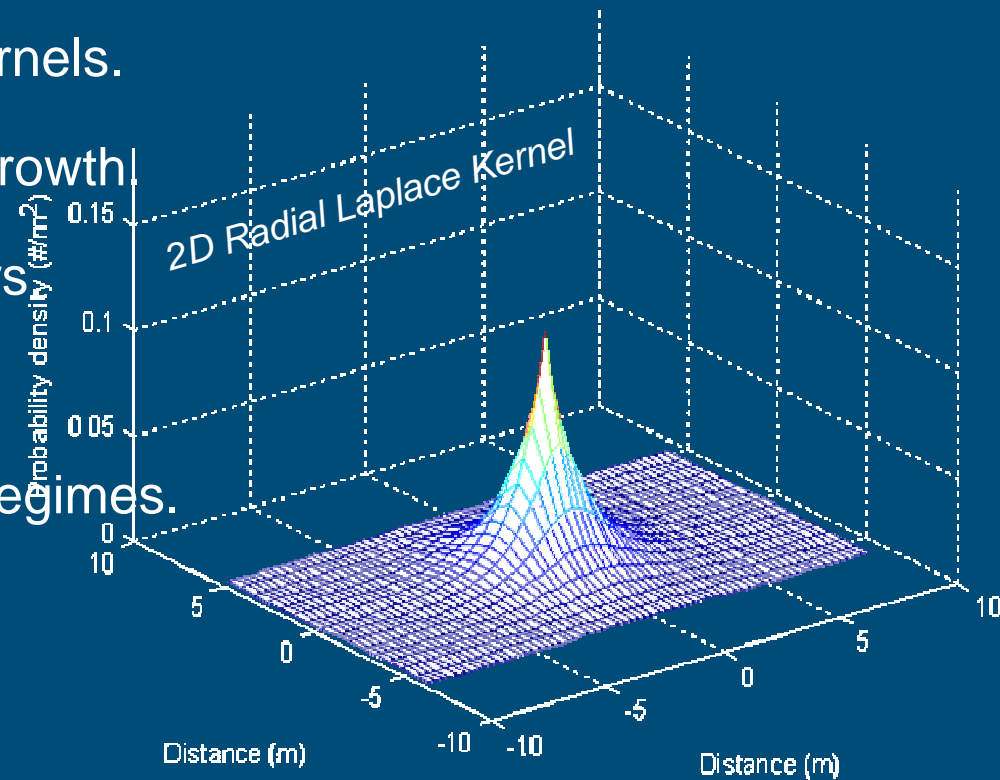
P. Skelsey, W. A. H. Rossing, G. J. T. Kessel, & W. van der Werf.

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BLIGHTSPACE – general aspects

- BLIGHTSPACE – spatio temporal MATLAB model.

- Local dispersal – dispersal kernels.

- Disease cycle – paralogistic growth.

- Host growth – different cutivars.

- Influence of the weather.

- Influence of man – fungicide regimes.

Fields (genotype mixtures) generated by BLIGHTSPACE

Objectives:

- BLIGHTSPACE is a research / educational tool.

  - we want to increase our understanding of epidemic dynamics.

- Our philosophy:

  - our models must be simple and the results transparent.

- Validation with field data:

  - not about forcing accuracy, but producing reliable, realistic results that facilitate learning,

  - graphically & numerically (t_5 and t_{50} points).

- Sensitivity analyses:

  - effect of parameters, initial conditions & different spatial scenarios,
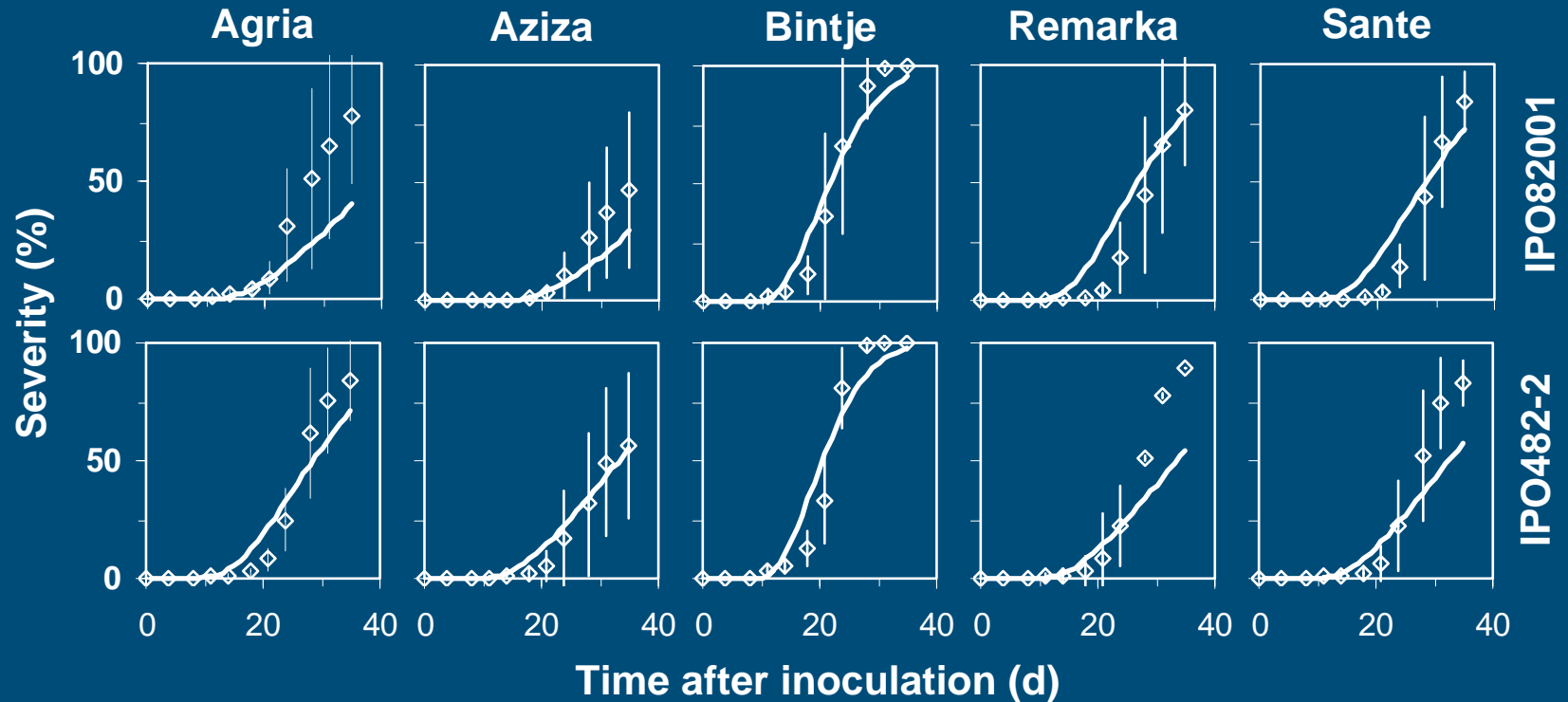
  - used to highlight uncertainties.

Validation:

- **Model parameters:**
  - *Resistance components – measured in the lab.*

- **Observational data:**
  - *Wageningen field trials in 2002 and 2004.*
  - *2 isolates – superblocks.*
  - *Each superblock contained a randomized block experiment with 3 replications for each cv.*
  - *Superblocks separated by 5 m soil, 5 m maize and 5 m soil*
  - *Individual plots separated by 3 m soil.*
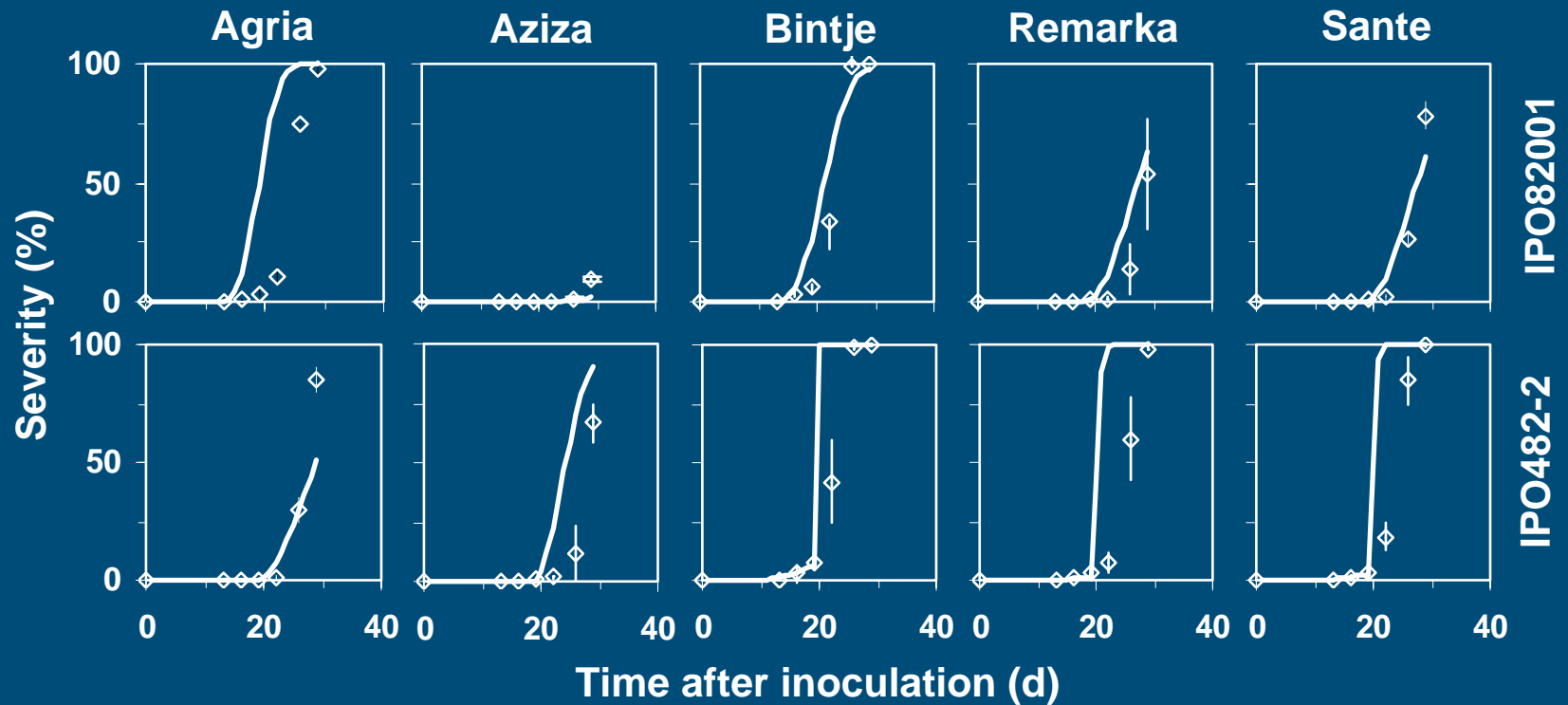
Results:

■ **Wageningen 2002:**

Results:

- **Wageningen 2004:**
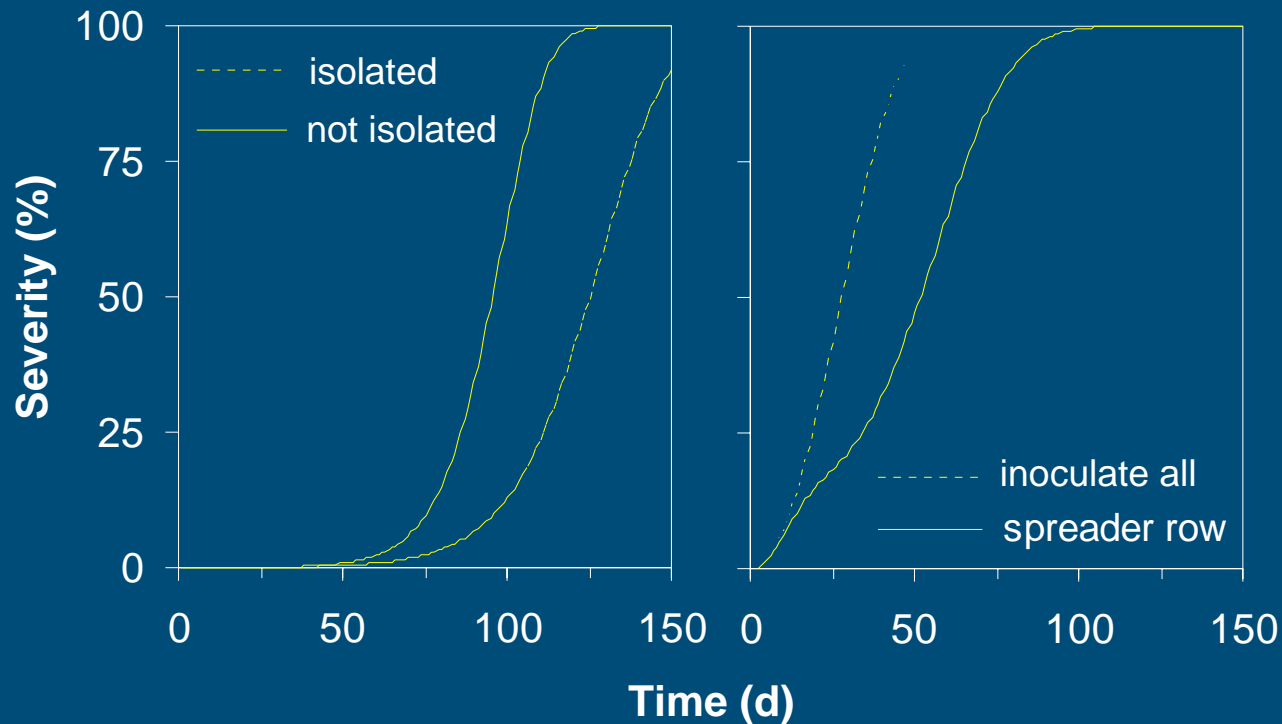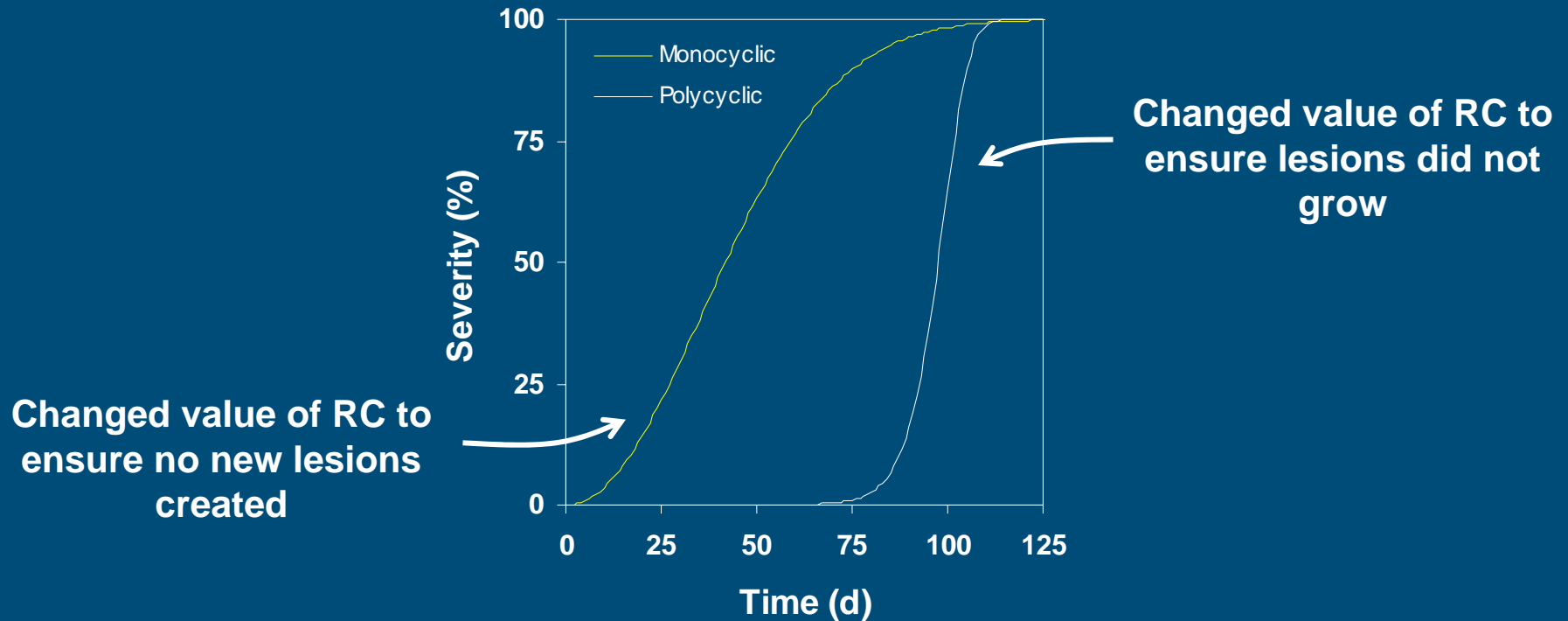
Sensitivity analyses – spatial aspects

- We wanted to better understand model predictions.
- With a spatial model, you can correctly reproduce field conditions.

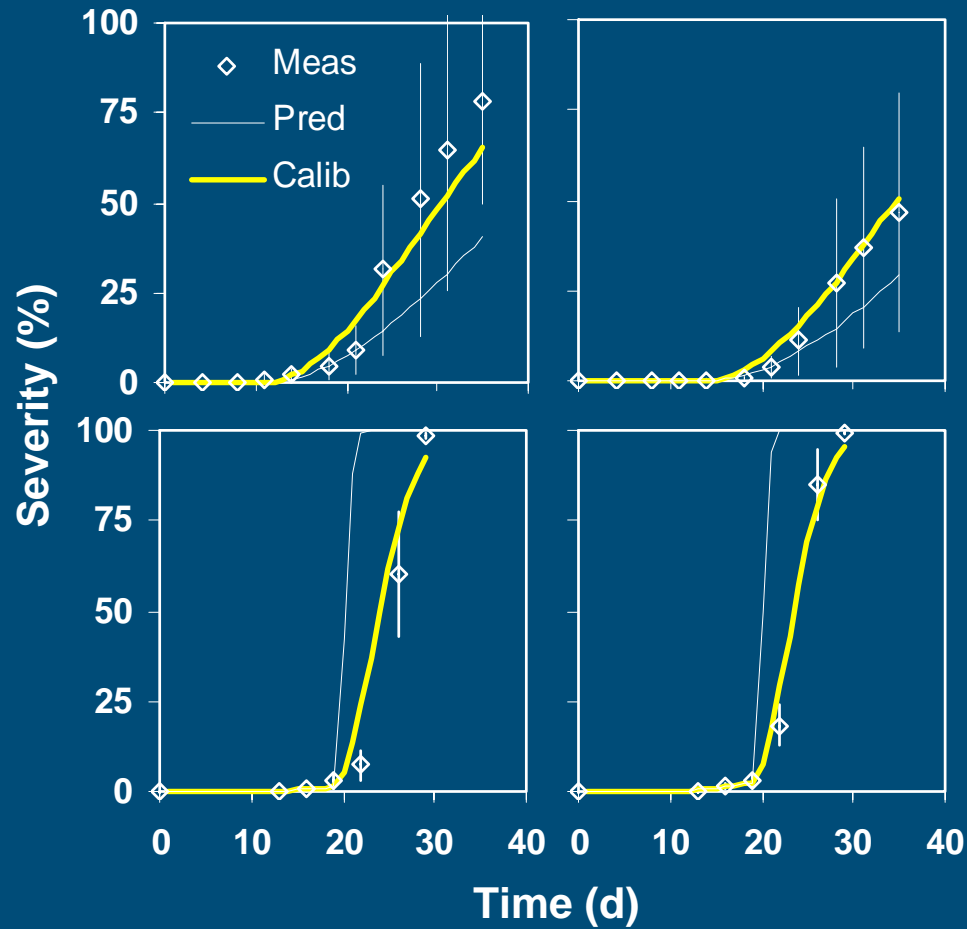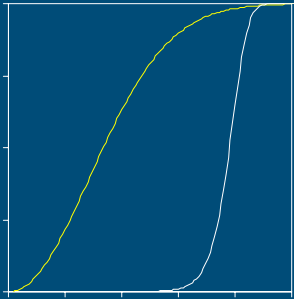
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Sensitivity analyses – dichotomy in RC effects

- Lesion growth (monocyclic) & creation of new lesions (polycyclic).

- Can separation of these processes give insight?

- Covers range of realistic parameter settings = 2 useful ref. curves

Changed value of RC to ensure lesions did not grow

Changed value of RC to ensure no new lesions created

Insight

Dominance of
monocyclic:

Human error?

Dominance of
polycyclic:

Fungicide
residue?

Conclusions:

- BLIGHTSPACE is able to produce realistic epidemics.

  - 16 / 20 epidemics met performance criteria.

- Simplistic model design:

  - identification of plausible sources of error

  - further validation of the use of the use of the model as

  a research and diagnostic tool.