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HAL Authorization

Achieving uniform spread patterns on non-flat fields by the control of fertilizer spreading

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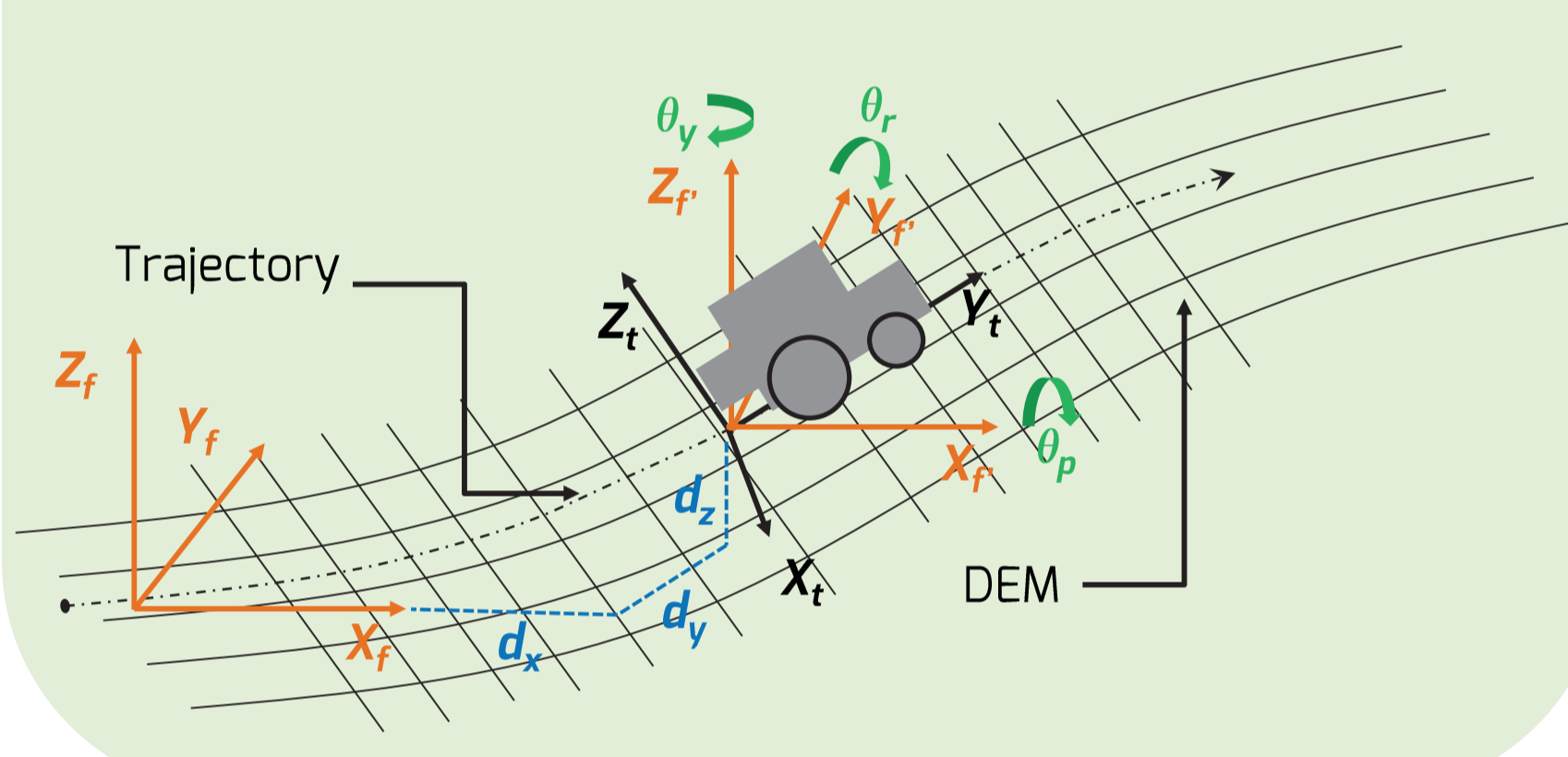
Aim of the project:

- Managing disturbances related to centrifugal fertilizer spreading (crop yield optimization).
- Addressing disturbances related to the field elevation and its variation, to develop appropriate corrections.
- Bridging knowledge gap around over-application and under-application on spread patterns.
- Assessing the effectiveness of the control solutions, in achieving uniform fertilizer distribution.

Towards uniformity control: three steps process

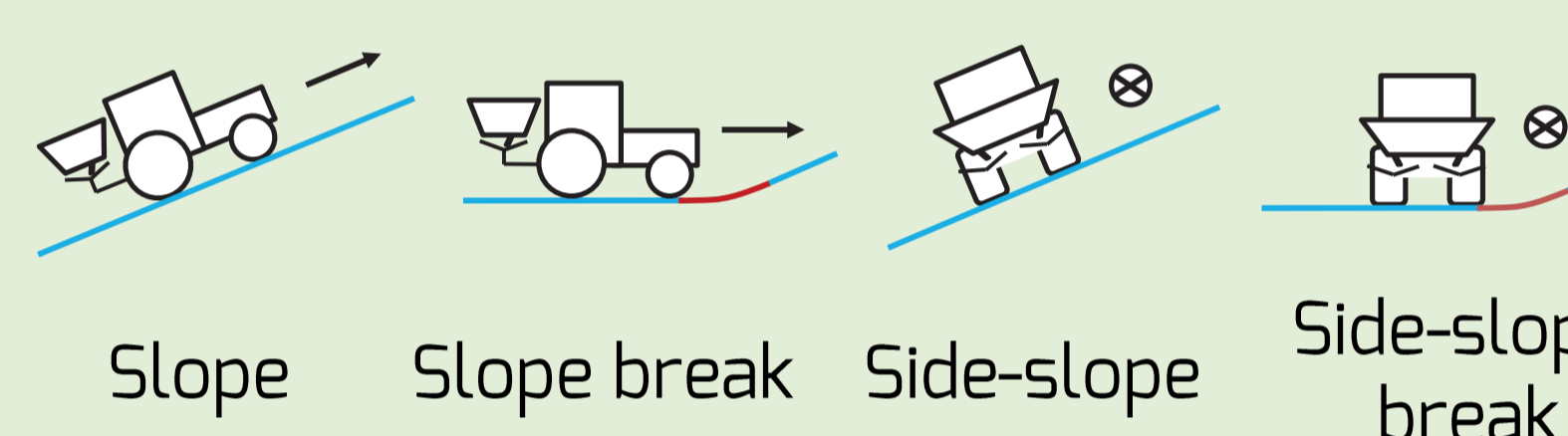
Modeling

- Updating equations of the ballistic flight of particles derived as a function of: $d_x, d_y, d_z, \theta_p, \theta_r, \theta_v$.



Sensitivity analysis

- Several cases investigated



- Spread pattern uniformity characterized for both positive and negative inclinations.

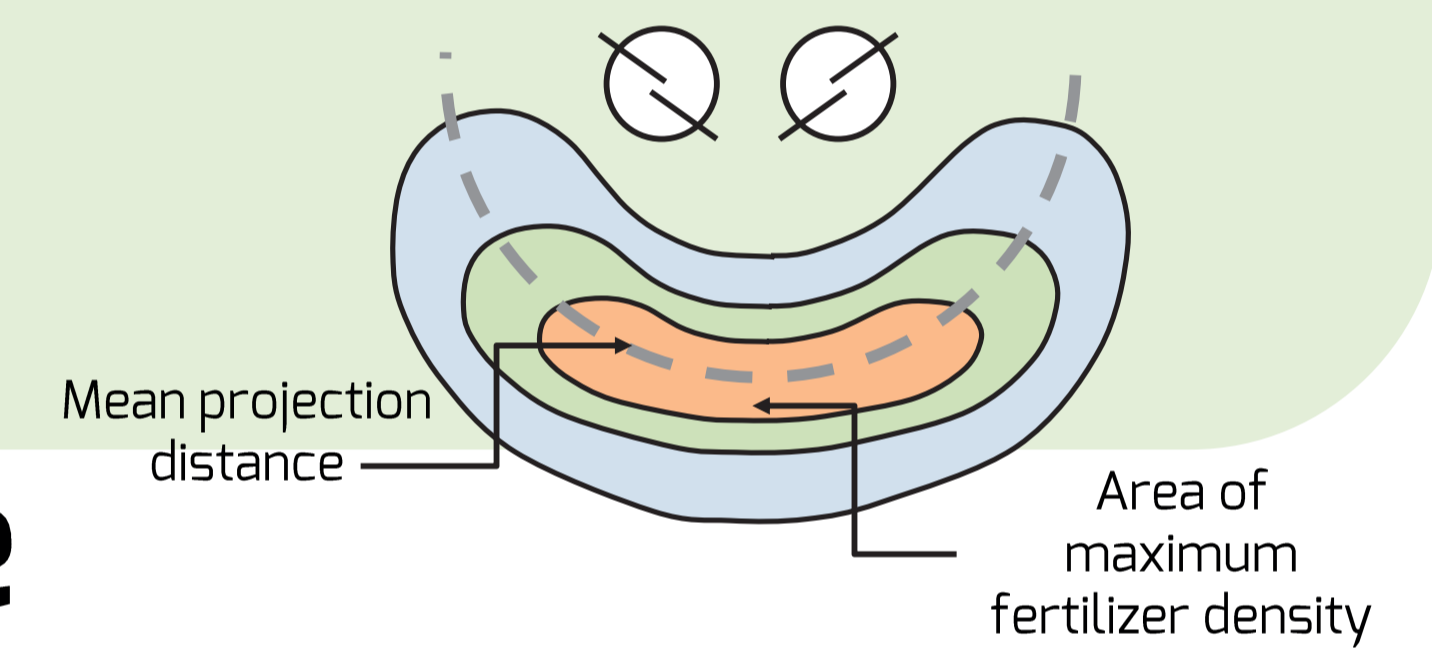
- DEMs used being representative for arable fields.

Control design

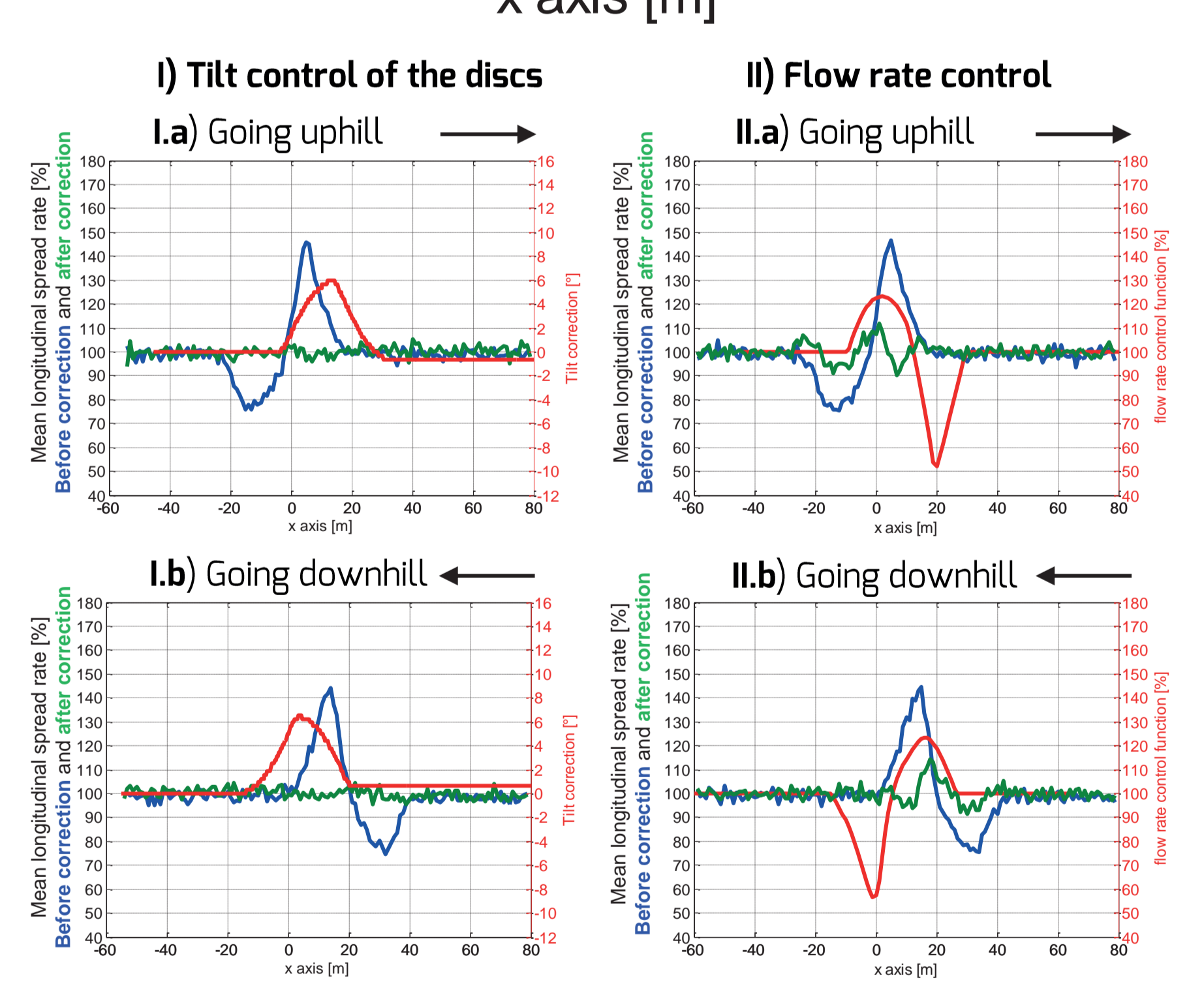
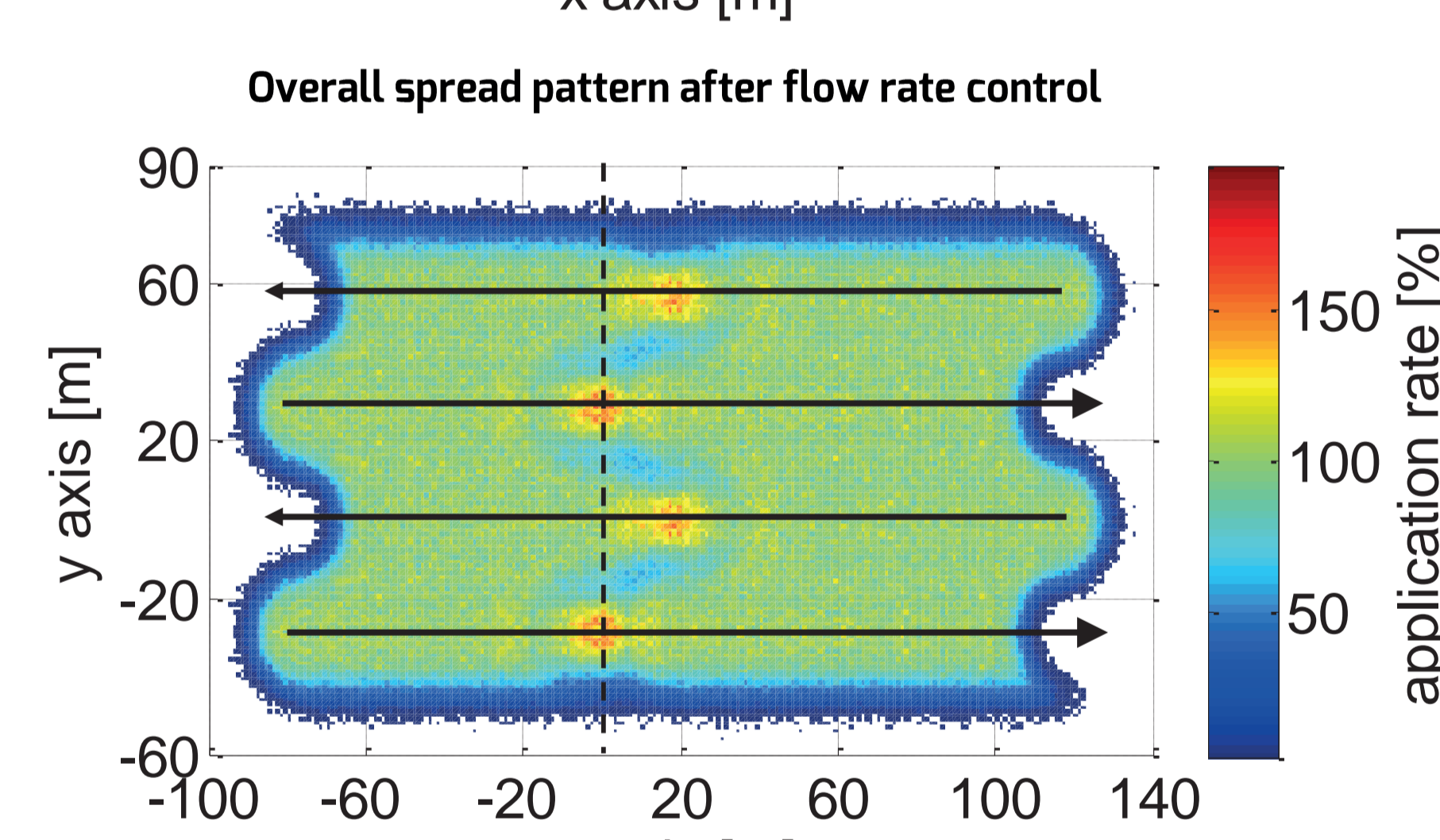
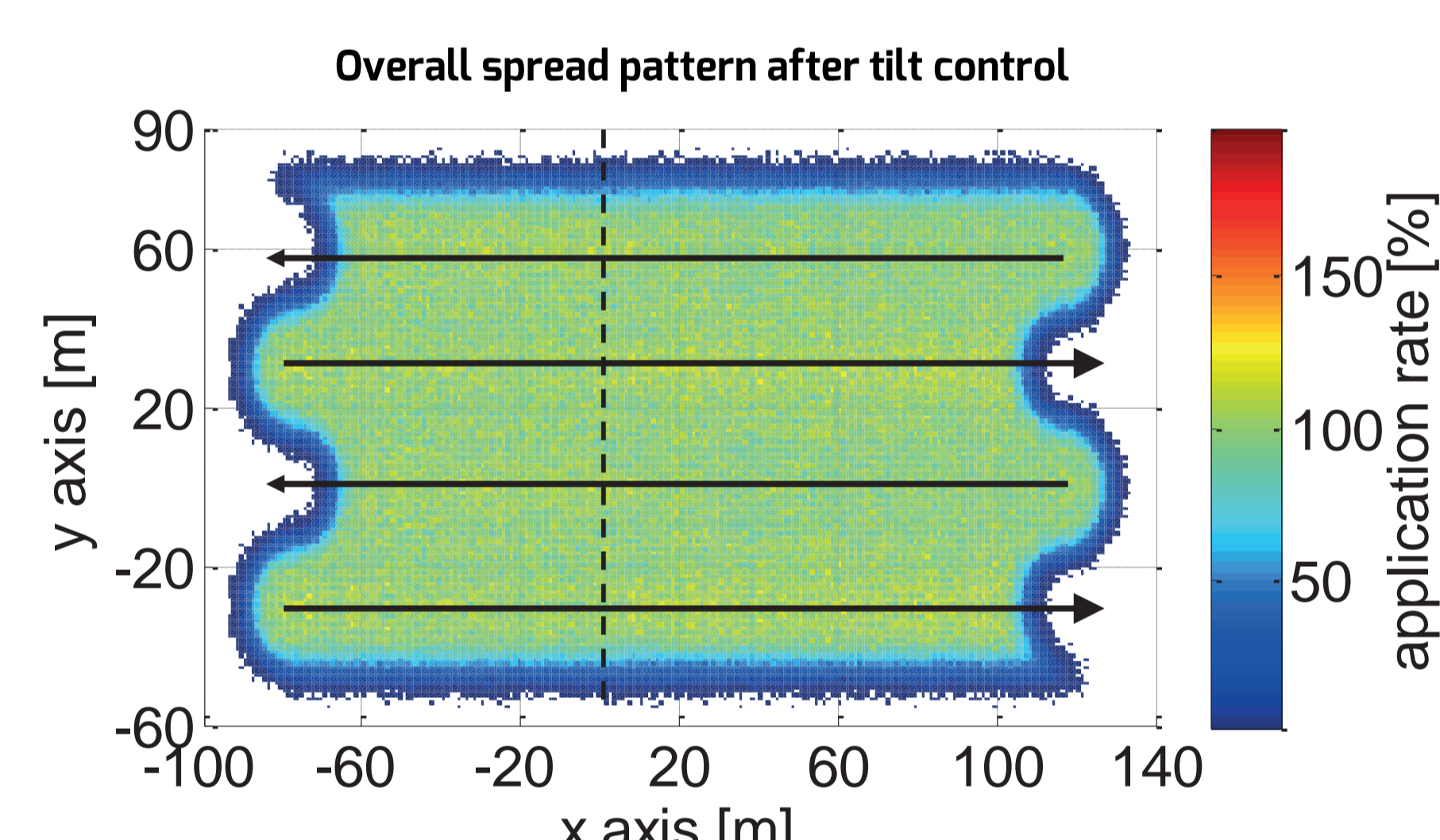
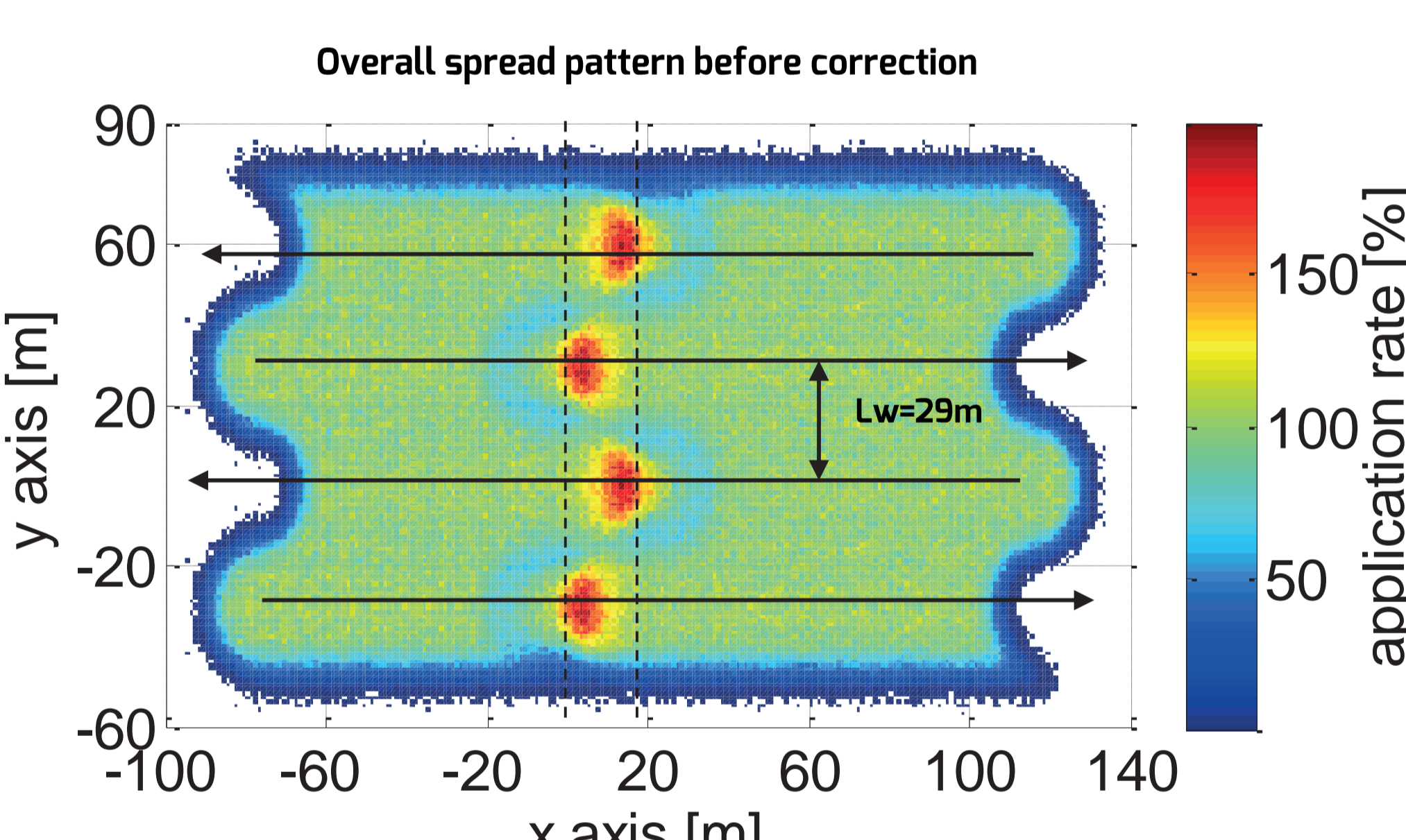
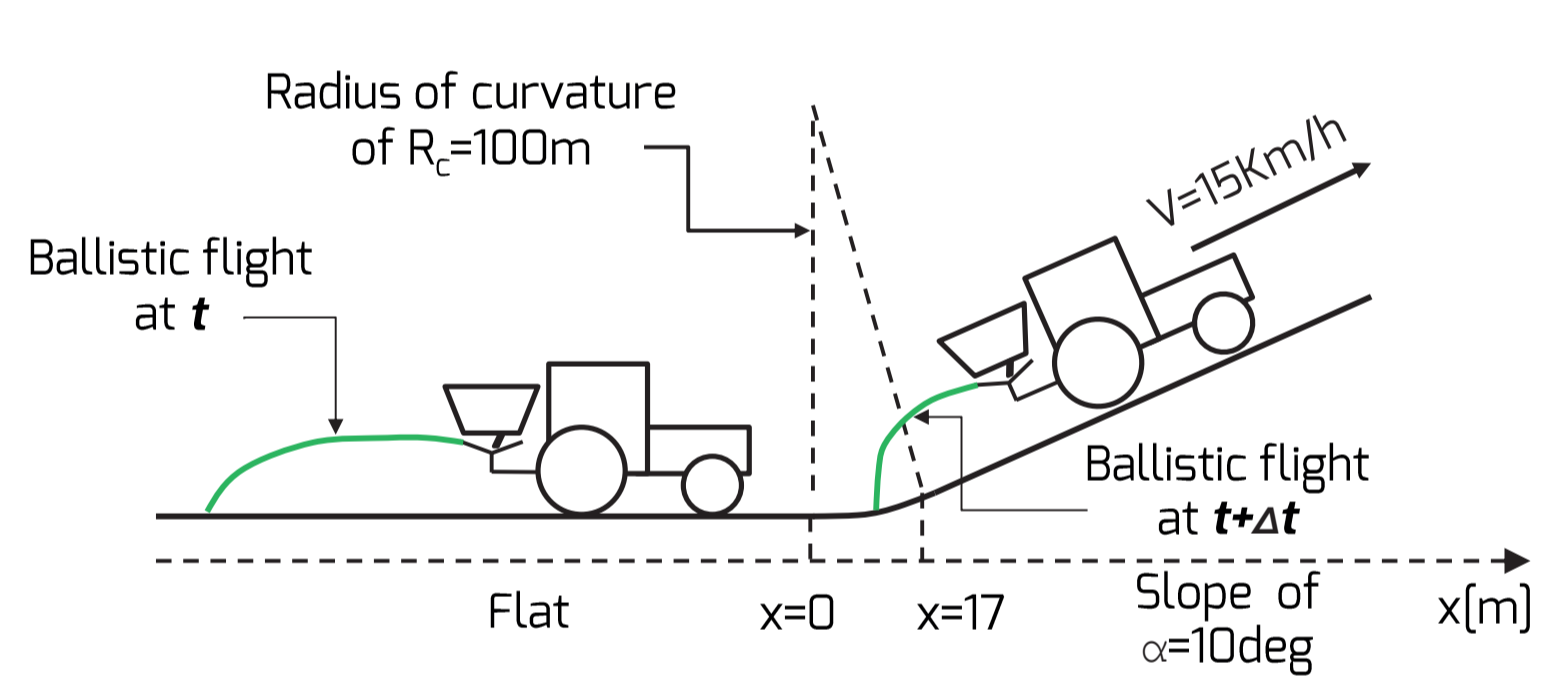
- Two possible corrections:

(I) discs inclination^(*): keeping constant the mean projection distance.

(II) flow rate variation^(*): keeping the mean application rate at $100 \pm 10\%$



Results for slope break case



- Discs inclination control requires the knowledge of 3D spread patterns shape along the trajectory.

- Flow rate control requires the knowledge of fertilizer distribution in the overall spread pattern.

- Both corrections allow keeping the mean application rate at $100 \pm 10\%$ instead of $100 \pm 40\%$ before correction.

^(*) both control actions were patented.

1st AXEMA-EurAgEng Conference

2017 February 25

