

Balltracking method

Christian Gößl

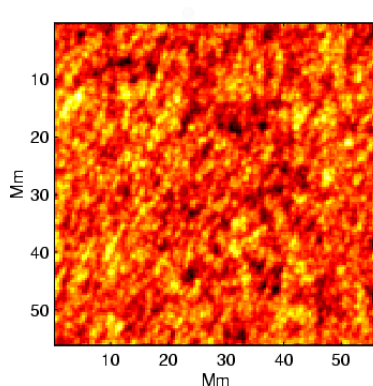
July 5, 2014

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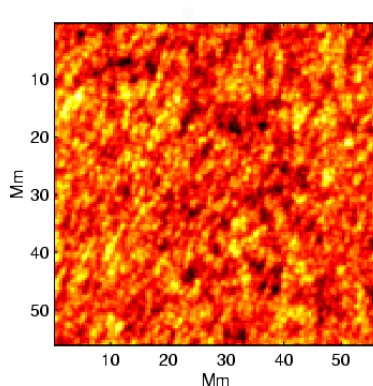
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- tracking photospheric flows of the surface of sun
- method for evaluation and calculation of datas from SOHO/MDI



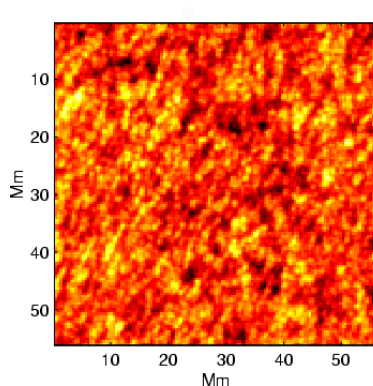
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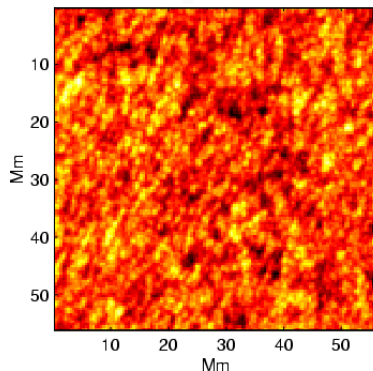
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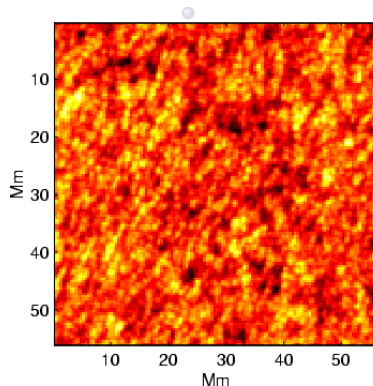
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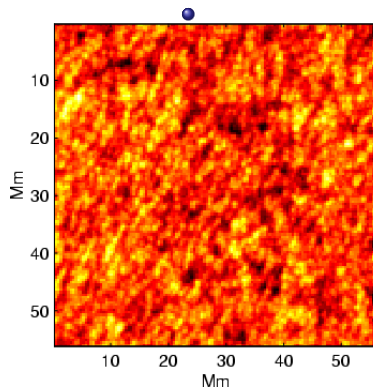
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Main Idea



- consist of bumps which moves(random walk), disappears and forming
- interaction between the bumps
- tracking the bumps with floating balls
- bumps push the balls
- approx balls have the average motion/direction of the bumps
- prediction of mean motion of the bumps

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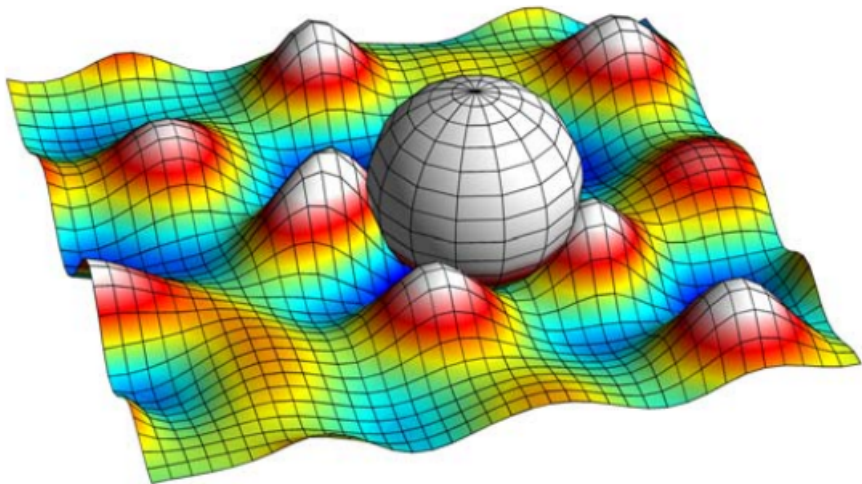


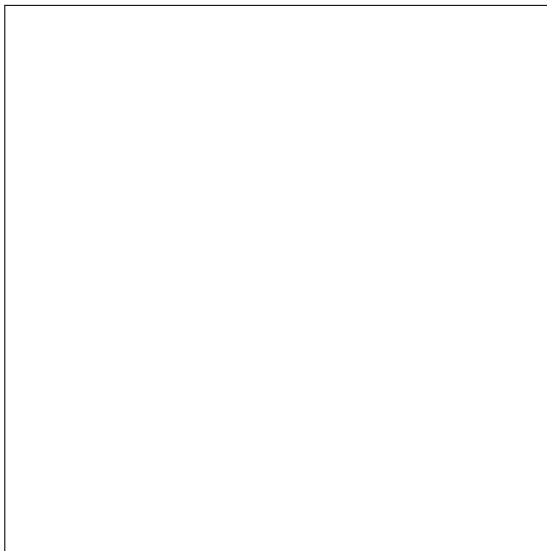
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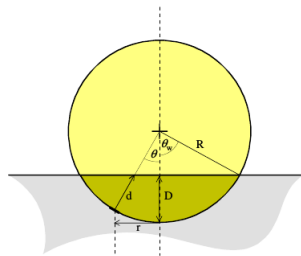
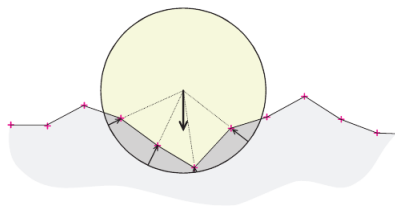


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Ball motion

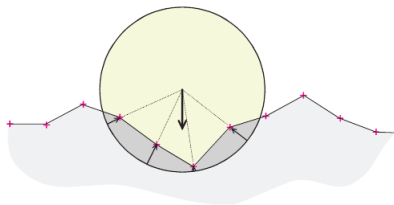


- $m\dot{\vec{v}} = \sum_i \vec{f}_i - m\vec{g} - \alpha\vec{v}$
- \vec{f}_i penetration force at each data points at the ball

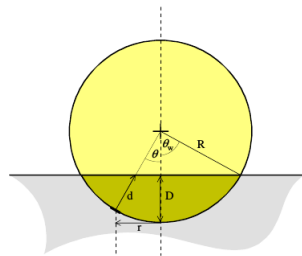
- $m\vec{g}$ gravitation force and $-\alpha\vec{v}$ damping force

- $$d\vec{v} = dt \left(\frac{\tilde{A}_m}{\pi \tilde{D}_p \tilde{R}_s} \sum_i \tilde{d}_i - \tilde{A}_m \hat{g} - \frac{\vec{v}}{\tilde{T}_d} \right)$$

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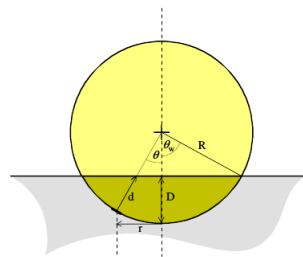
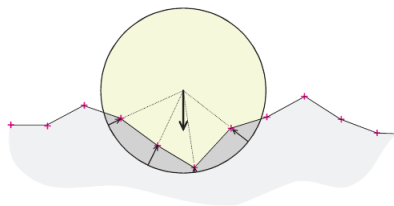


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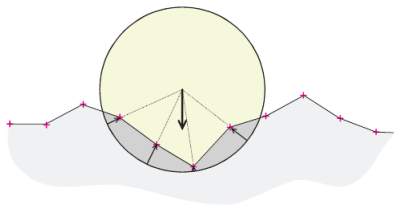


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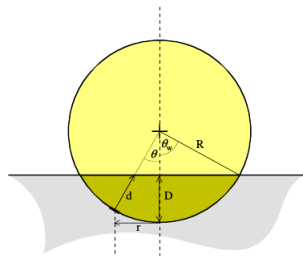
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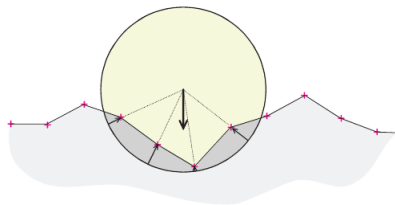
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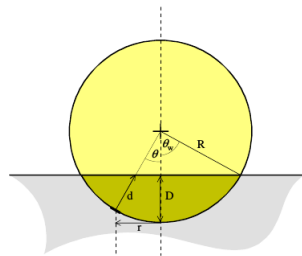
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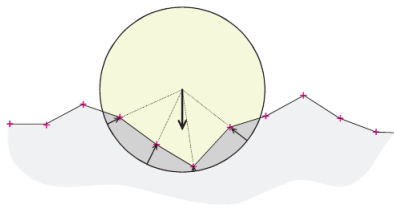


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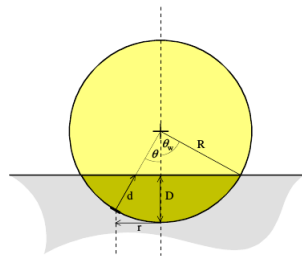


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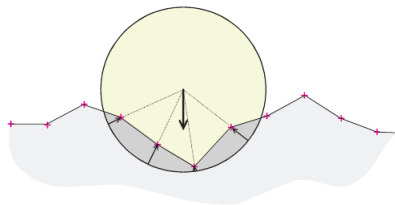


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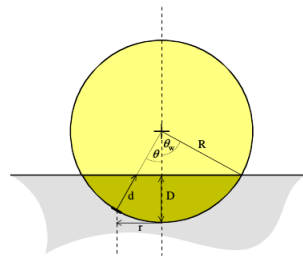


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Steps to Analysing data

- 1: choose number of balls
 - track every possible future
 - avoiding multiple balls that track the same feature
- 2: divide data surface in a grid and randomly set balls in grid cells
- 3: let the balls settle down to the nearest local minimum
- 4: update the surface to the next time step
- 5: bumps moving, disappearing, forming and pushed the balls to the next local minimum (store new position)
- 6: remove any balls which too close to each other balls and falling off the edge
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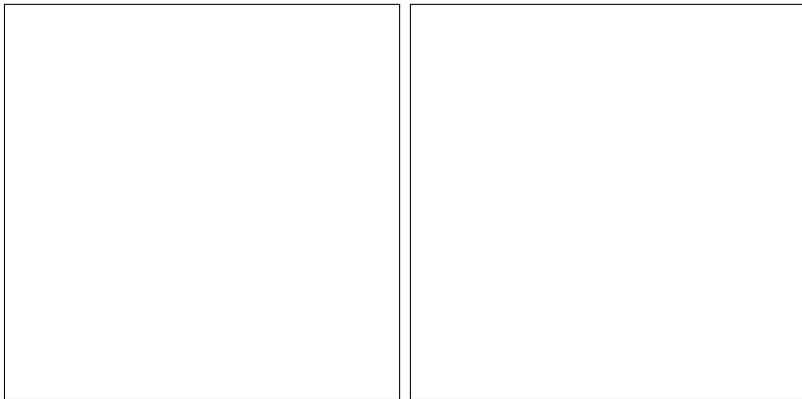
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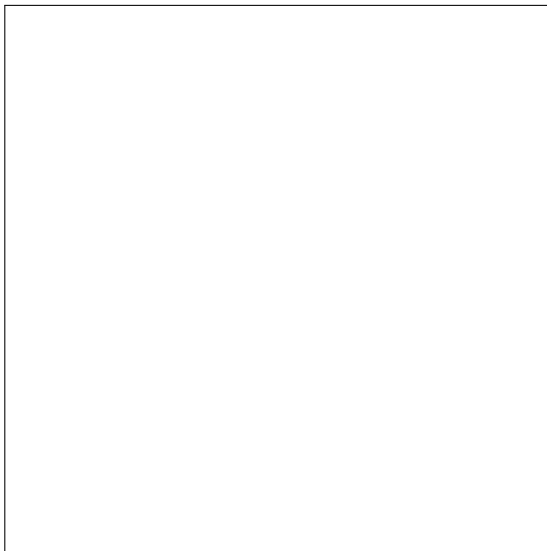
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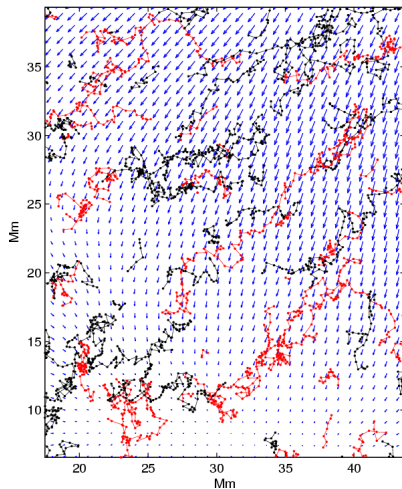
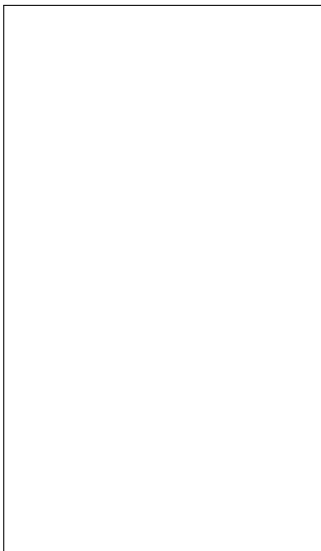
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Examples







Further aspects

- smoothing and rescaling the output data
 - smoothing resolution
 - speed calibration
- comparison between Local Correlation tracking LCT and Balltracking

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