



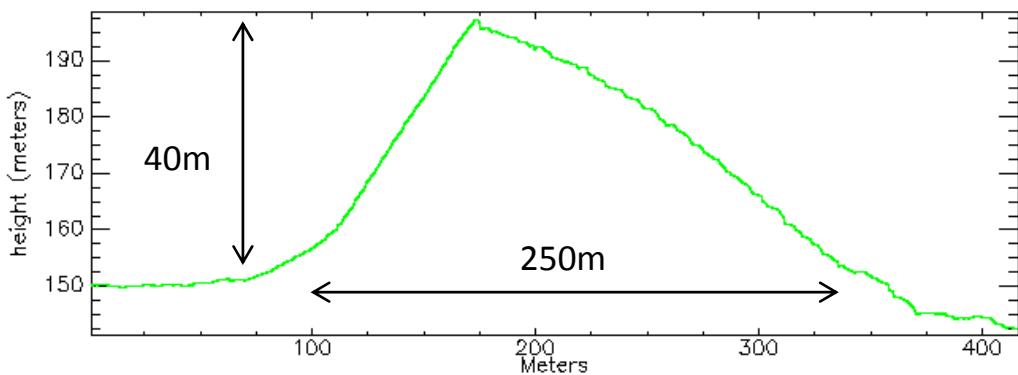
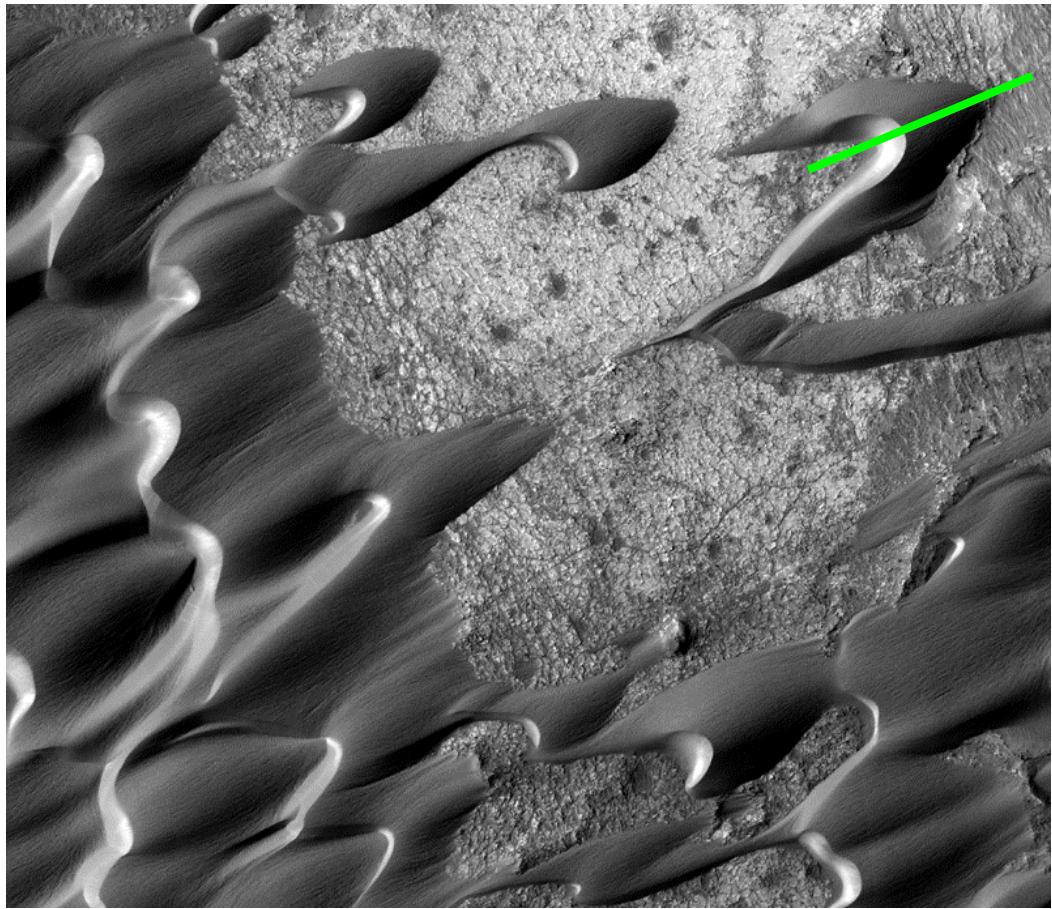
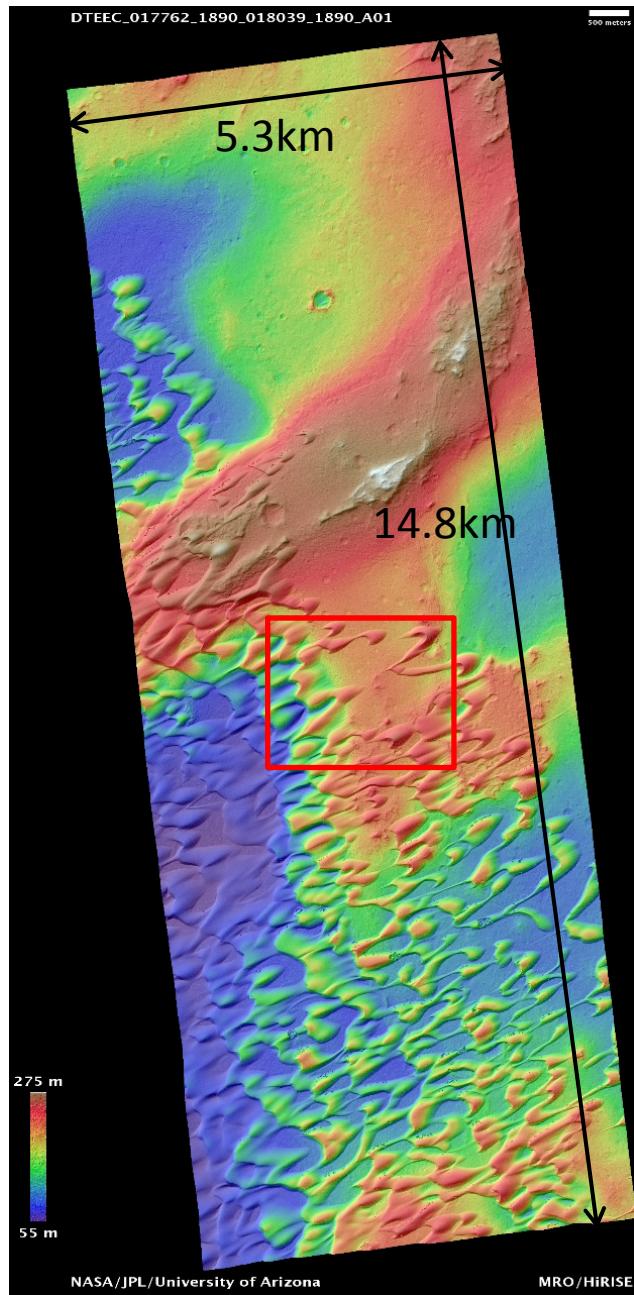
Mars sand dune ripple migration from HiRISE and COSI-Corr

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Nili Patera dune field & HiRISE



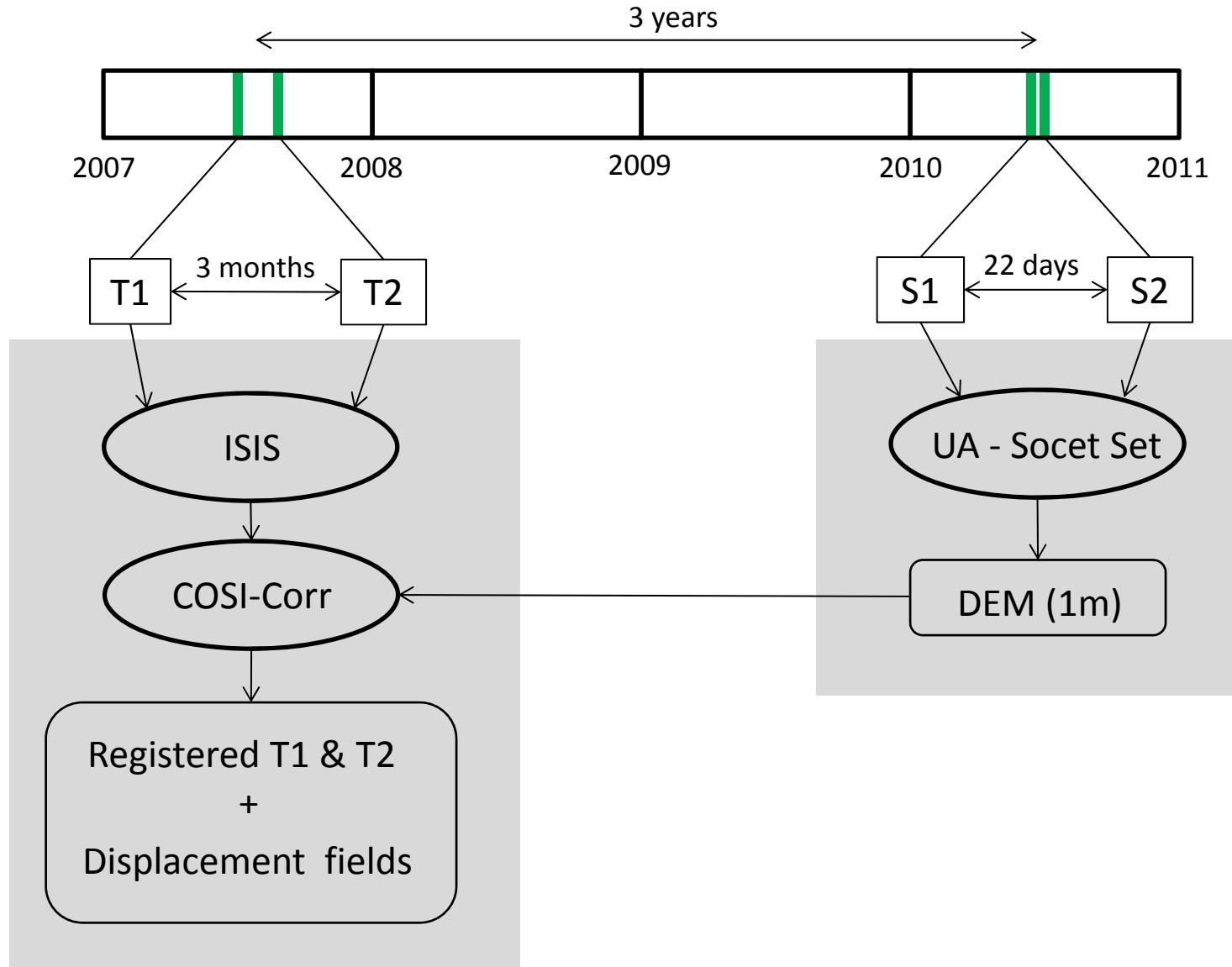
Ripple height \approx 40cm

4m

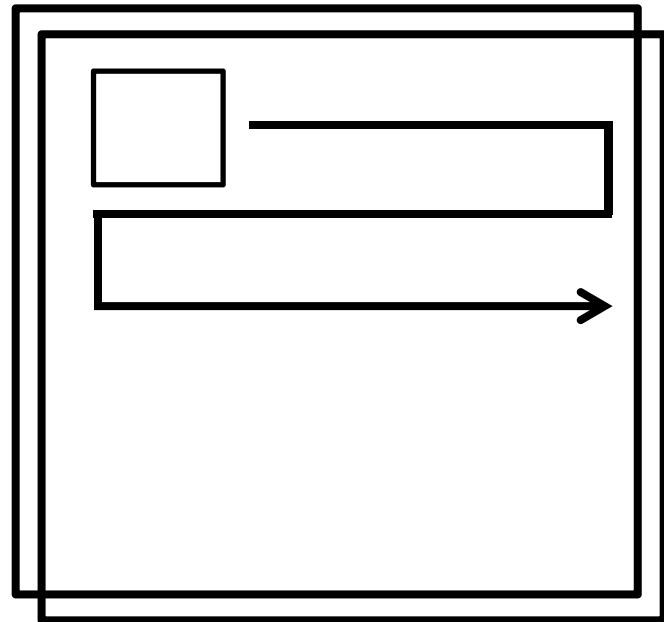
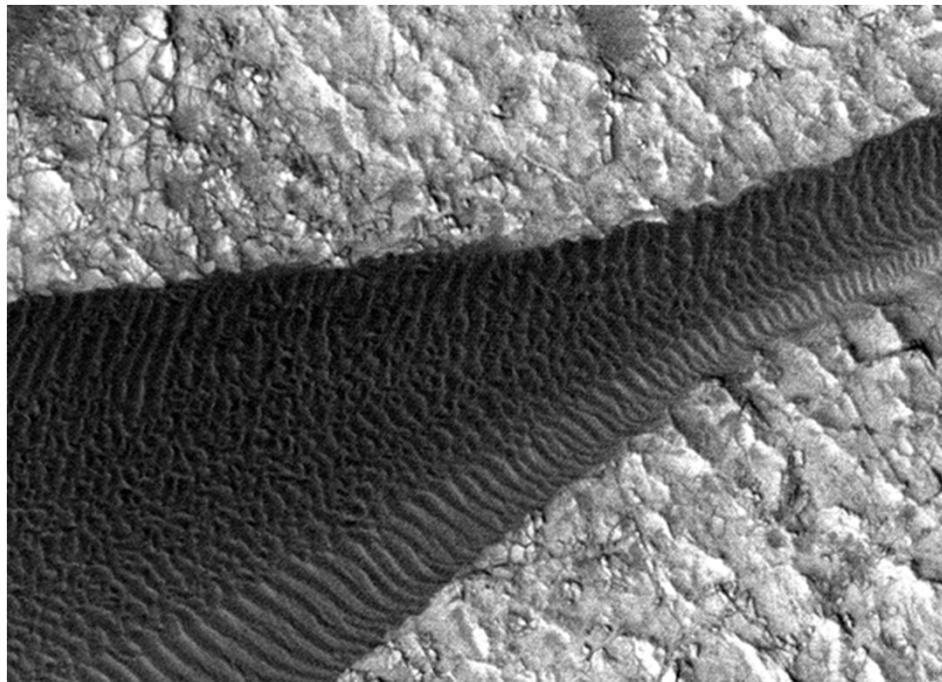


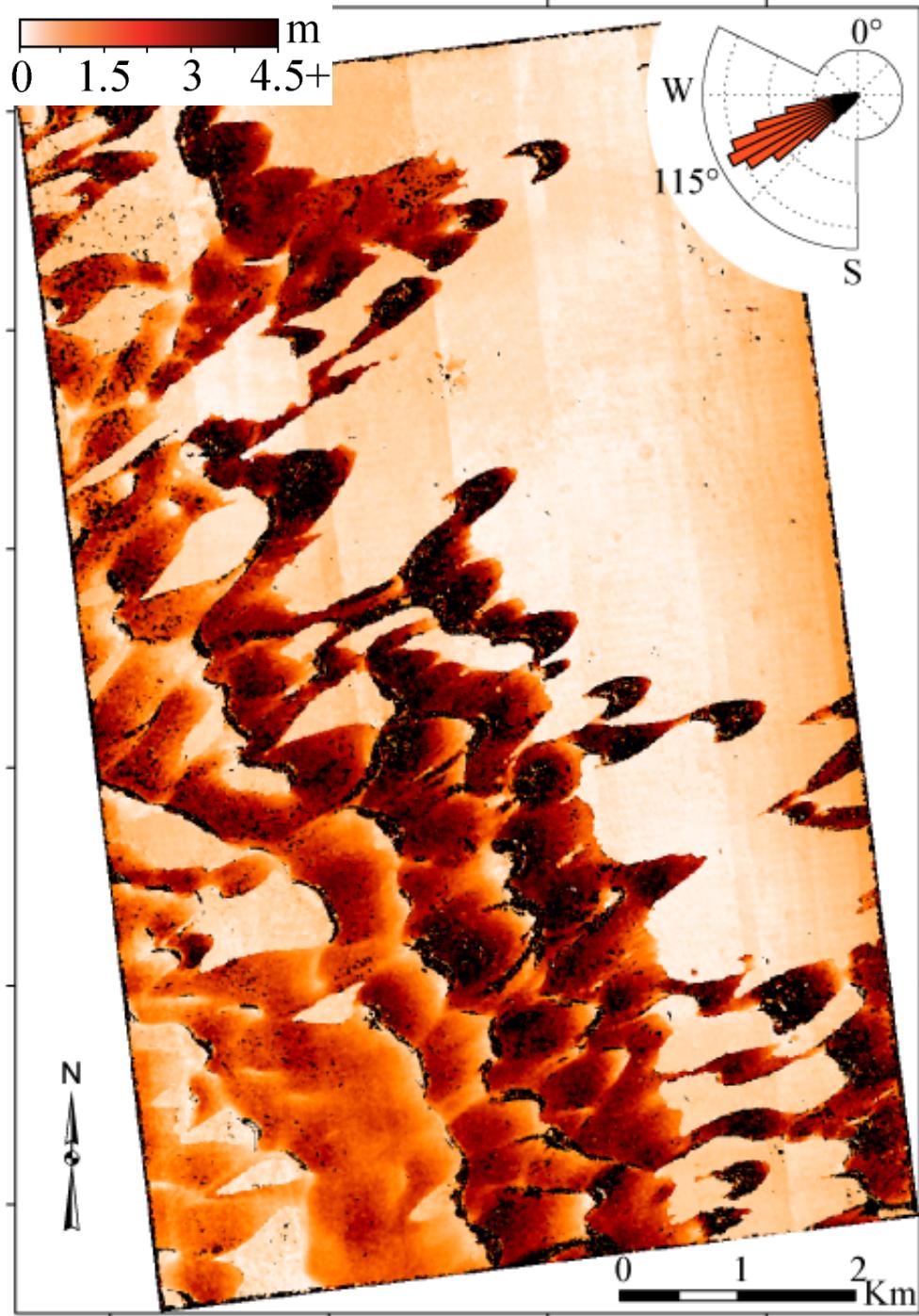
85m

Data & Processes



Registration & Correlation





The whole dune field is subject to ripple migration

Can we infer sand flux and dunes migration rates?

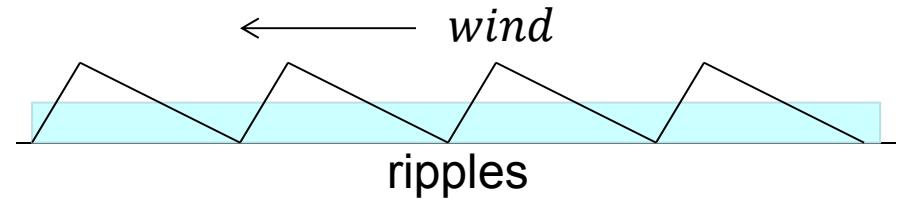
Ripples displacement amplitude

Sand flux and dune migration rate

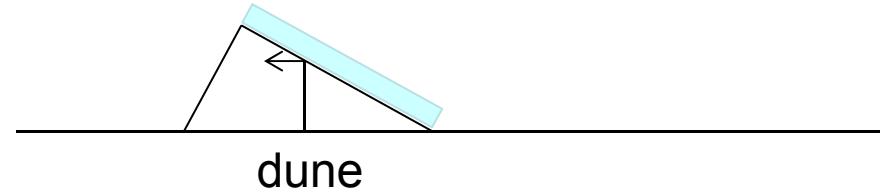
$$Q_{total} = Q_{reptation} + Q_{saltation}$$

$$Q_{total} = (1 + \lambda) \cdot Q_{reptation} \quad (Q_{saltation} = \lambda \cdot Q_{reptation}; Andreotti, 2004)$$

$$Q_{reptation} = \frac{1}{2} \cdot H_{ripple} \cdot V_{ripple} \quad \leftrightarrow$$



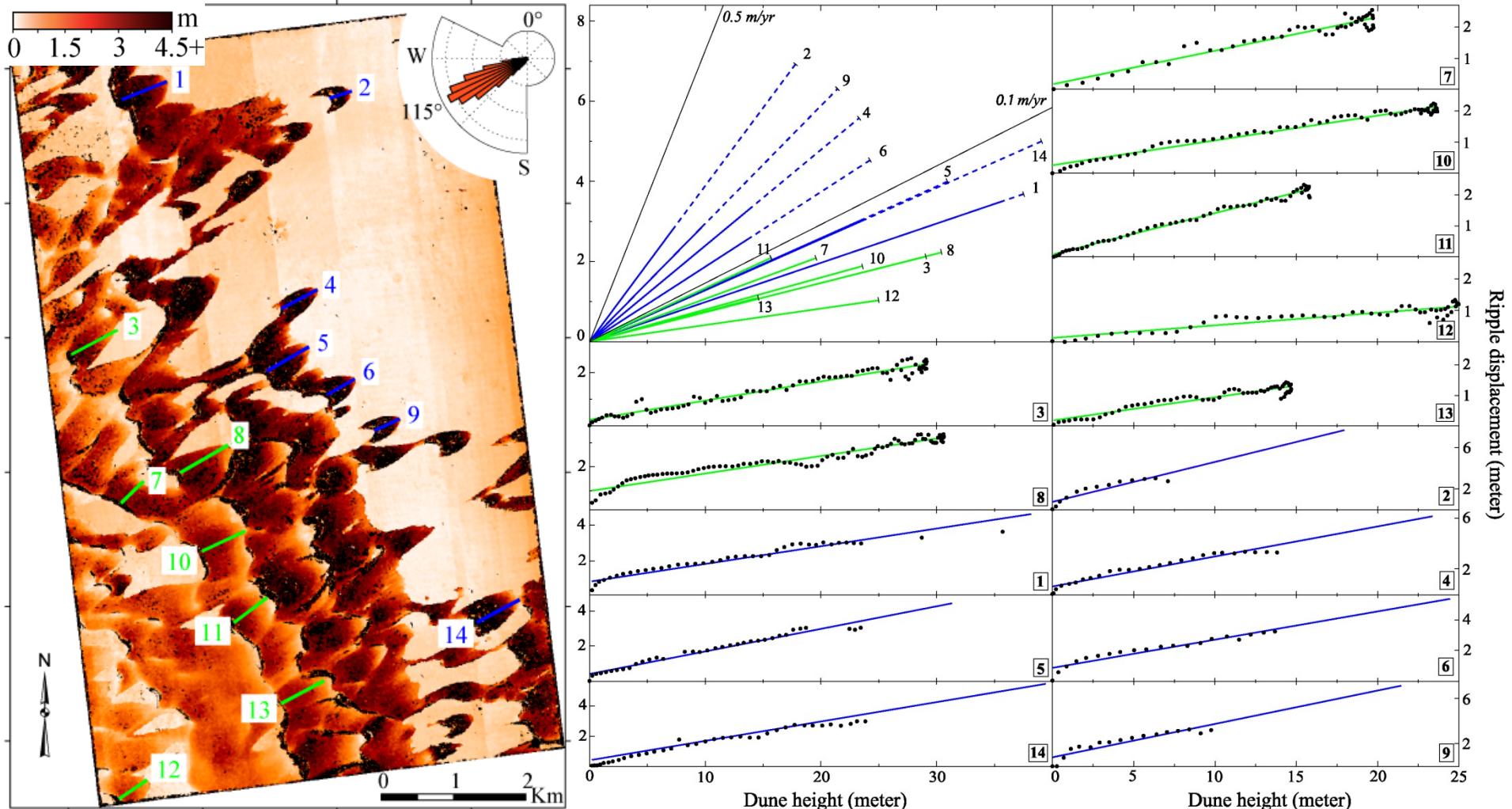
$$Q_{total} = H_{dune} \cdot V_{dune} \quad \leftrightarrow$$



$$V_{dune} = \frac{(1 + \lambda) \cdot H_{ripple}}{2} \cdot \frac{V_{ripple}}{H_{dune}}$$

that requires: $D_{ripple} = k \cdot H_{dune}$

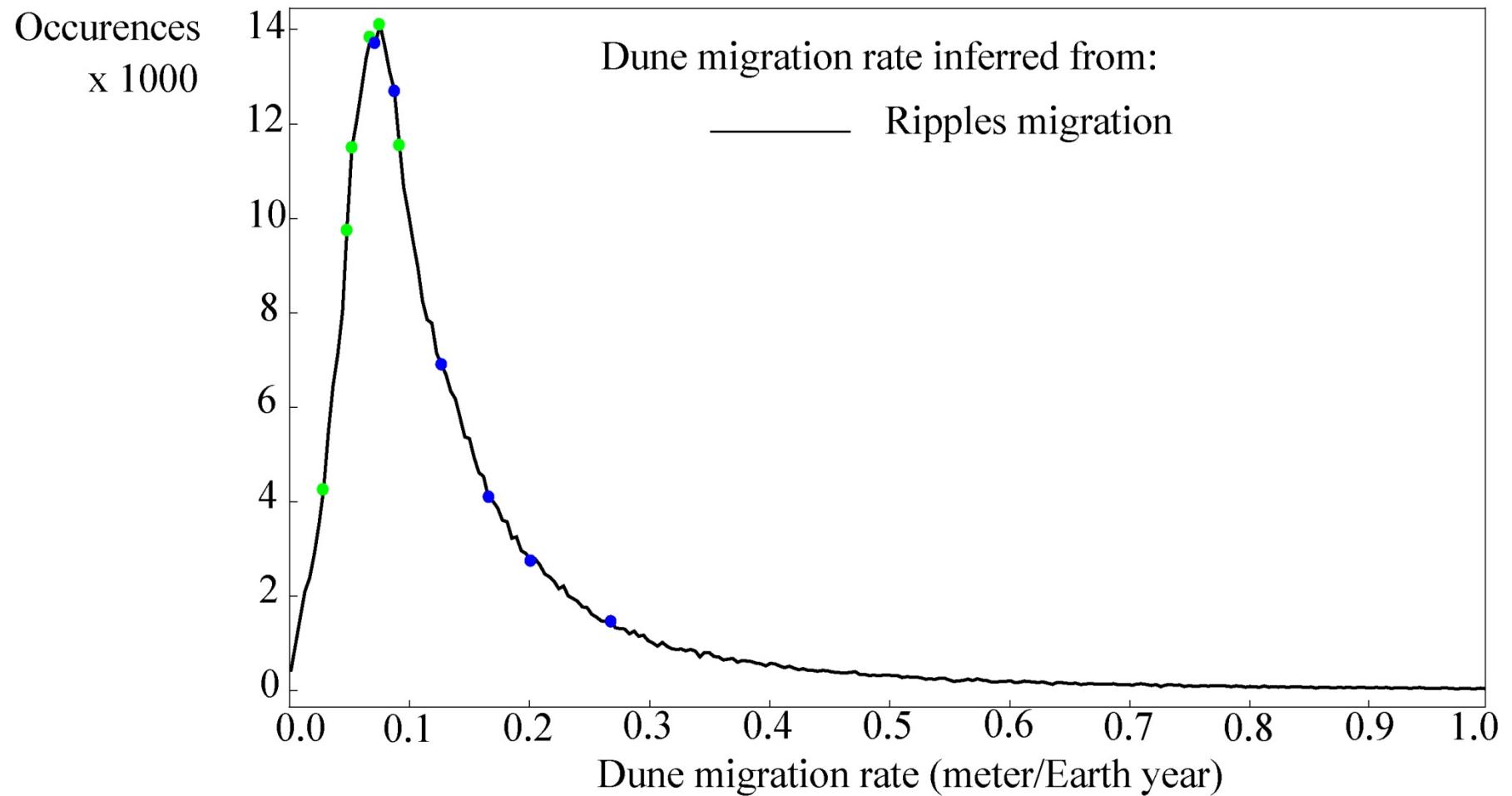
Linear relationship between ripple migration and elevation on dune



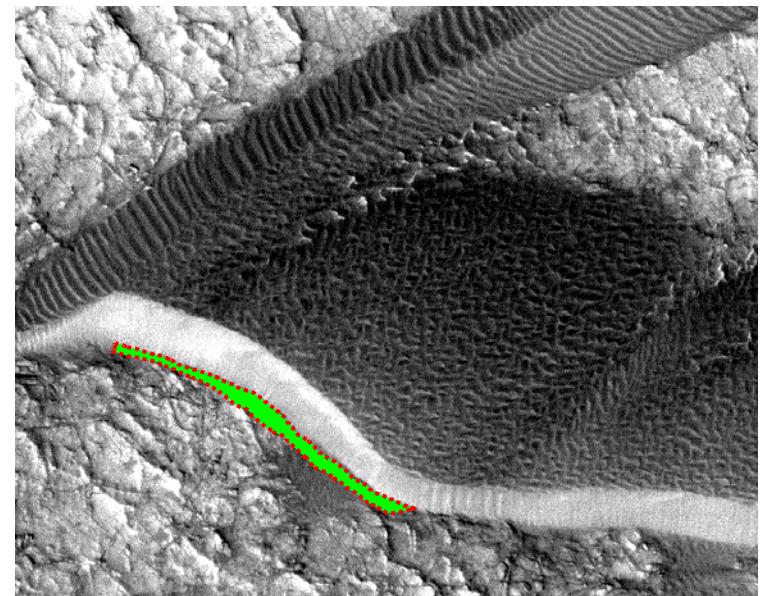
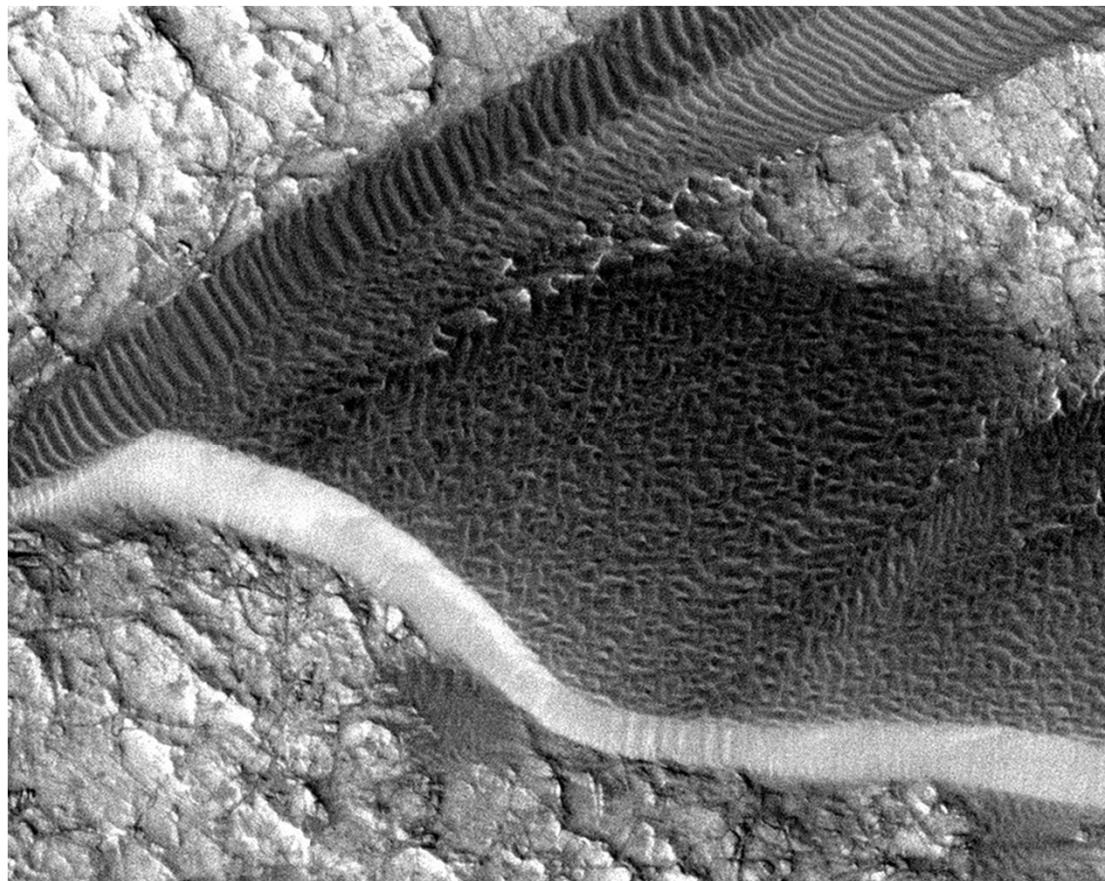
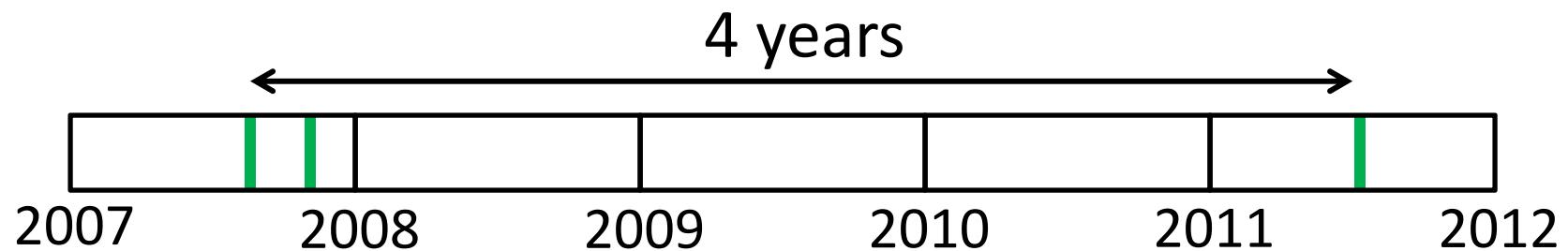
$$D_{ripple} = k \cdot H_{dune}$$

$$V_{dune} = \frac{(1 + \lambda) \cdot H_{ripple}}{2} \cdot \frac{V_{ripple}}{H_{dune}}$$

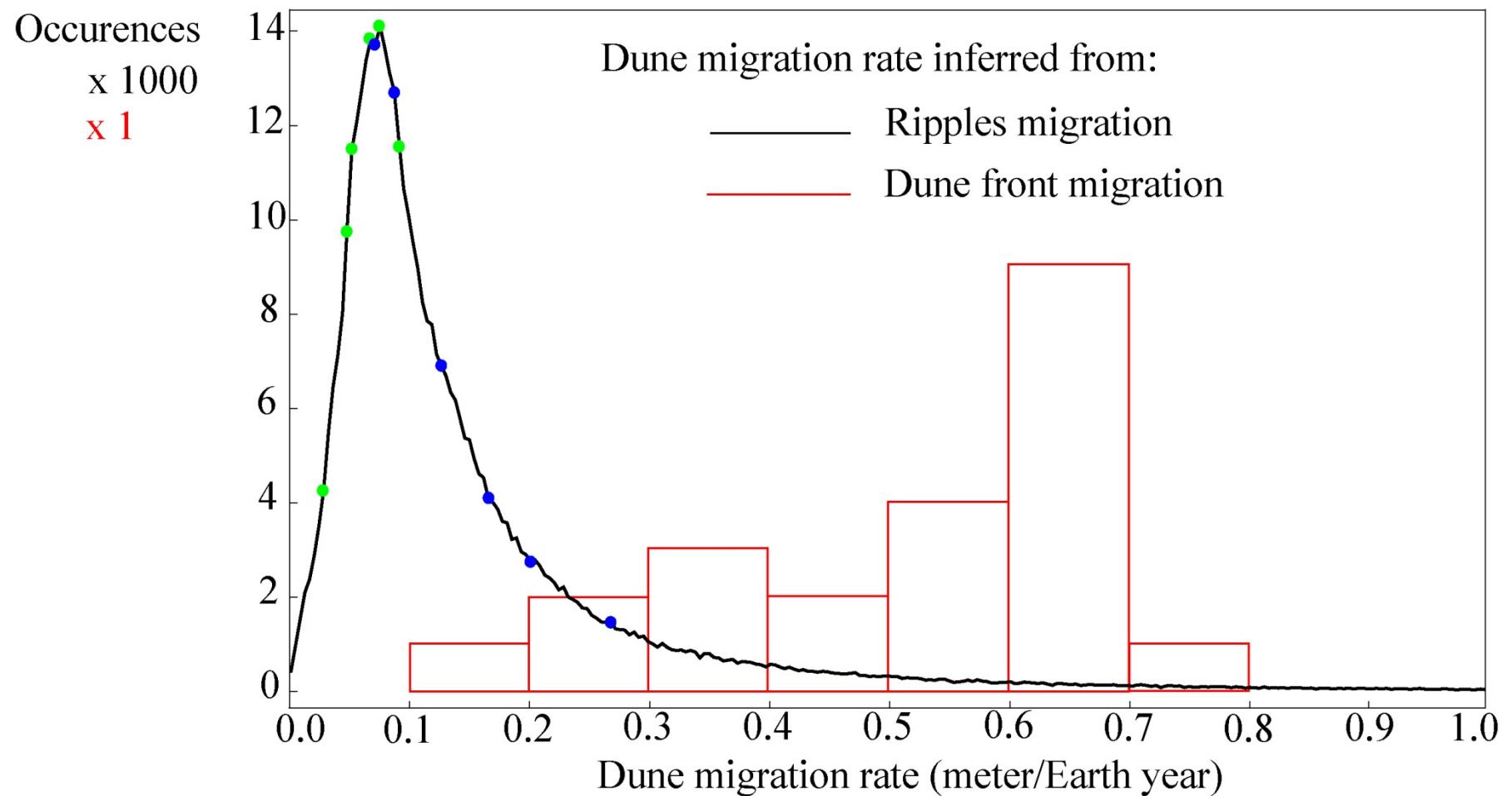
The mean dune migration rate derived from ripple measurements is around 10cm/year



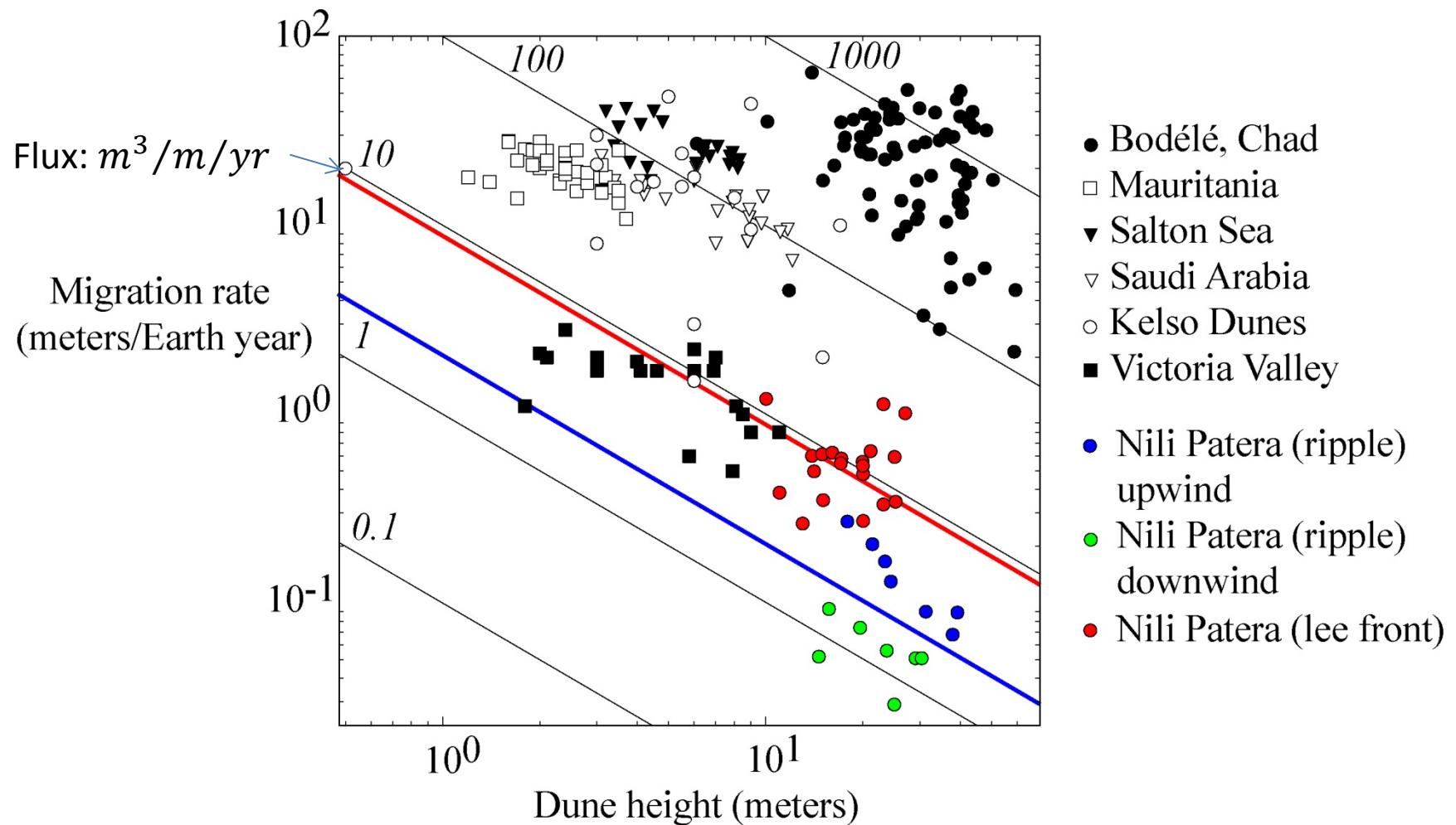
Dune migration rate measured from lee front advance



The mean dune migration rate derived from lee front measurements is around 60cm/year



Nili Patera sand flux is similar to the flux of Victoria valley dune field (antarctica)



Conclusion

- Nili Patera dune field is active, at equilibrium with current weather
- Its sand flux has been quantified and is similar to Victoria valley sand flux
- COSI-Corr methodology allows ripple migration monitoring. Can be applied to earth dune field