



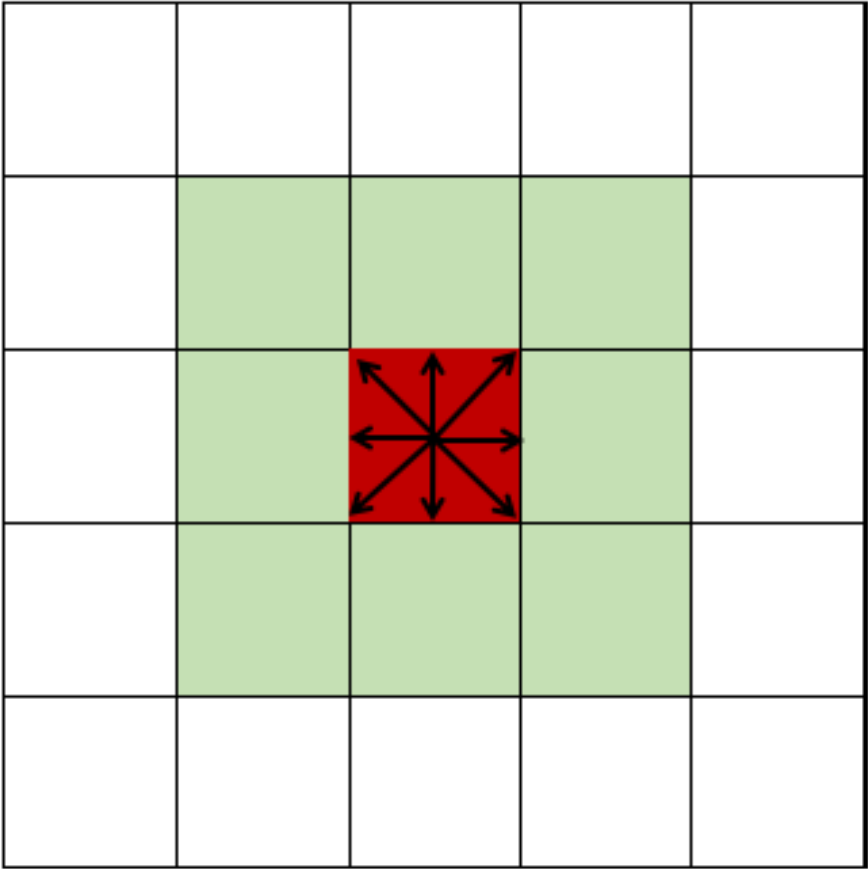
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A cellular automata model for wind-driven fires

Mariana Oliveira, Bárbara Mota, Joana G. Freire, Sílvia A. Nunes and
Carlos C. DaCamara

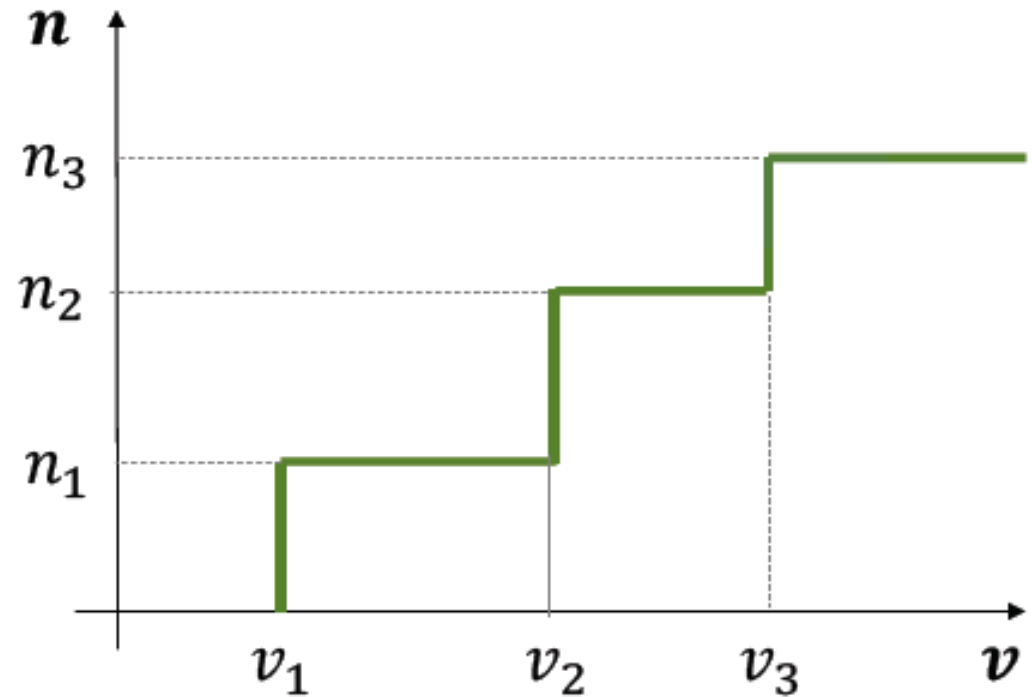
Cellular automata



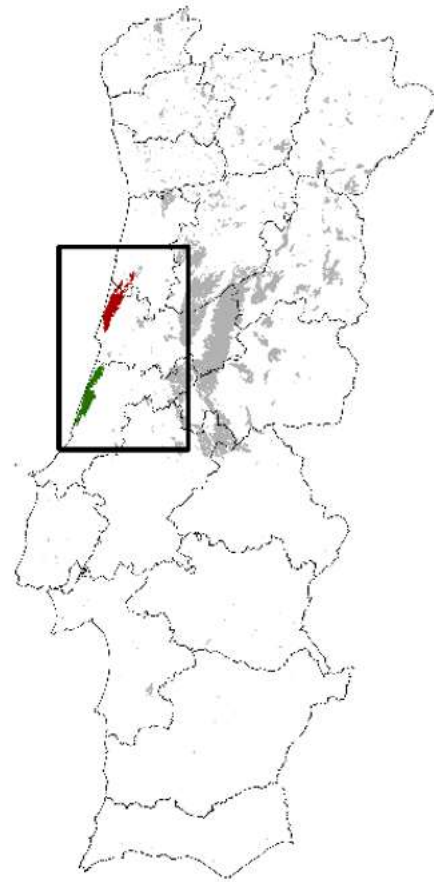
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
Wind rule - Spotting

n	v (cm / s)
$n_1 = 1$	$v < 5$
$n_2 = 3$	$5 < v < 8$
$n_3 = 4$	$8 < v < 10$
$n_4 = 5$	$v > 10$



Case studies

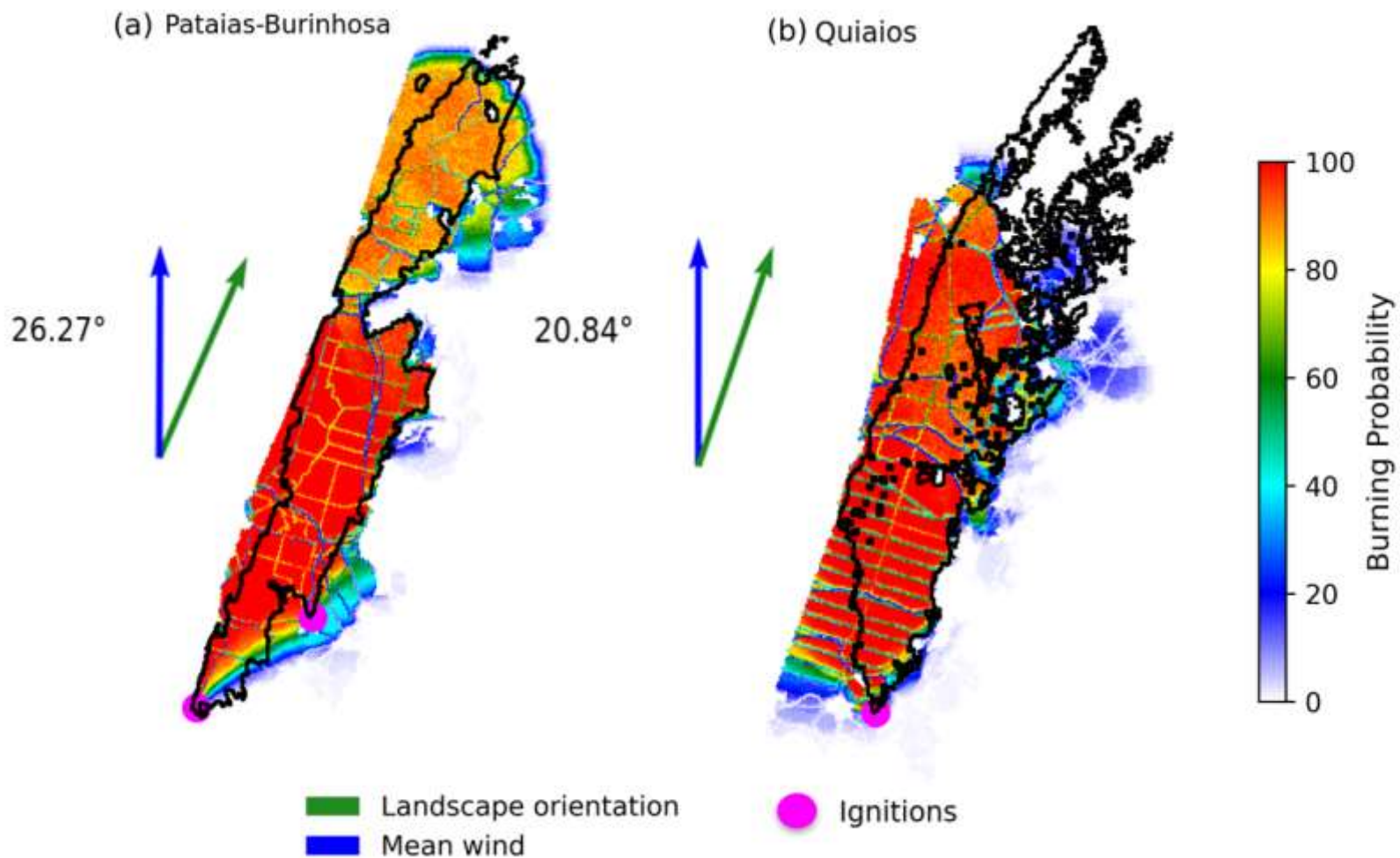


-  Pataias-Burinhosa
-  Quiaios
-  2017 Burnt areas



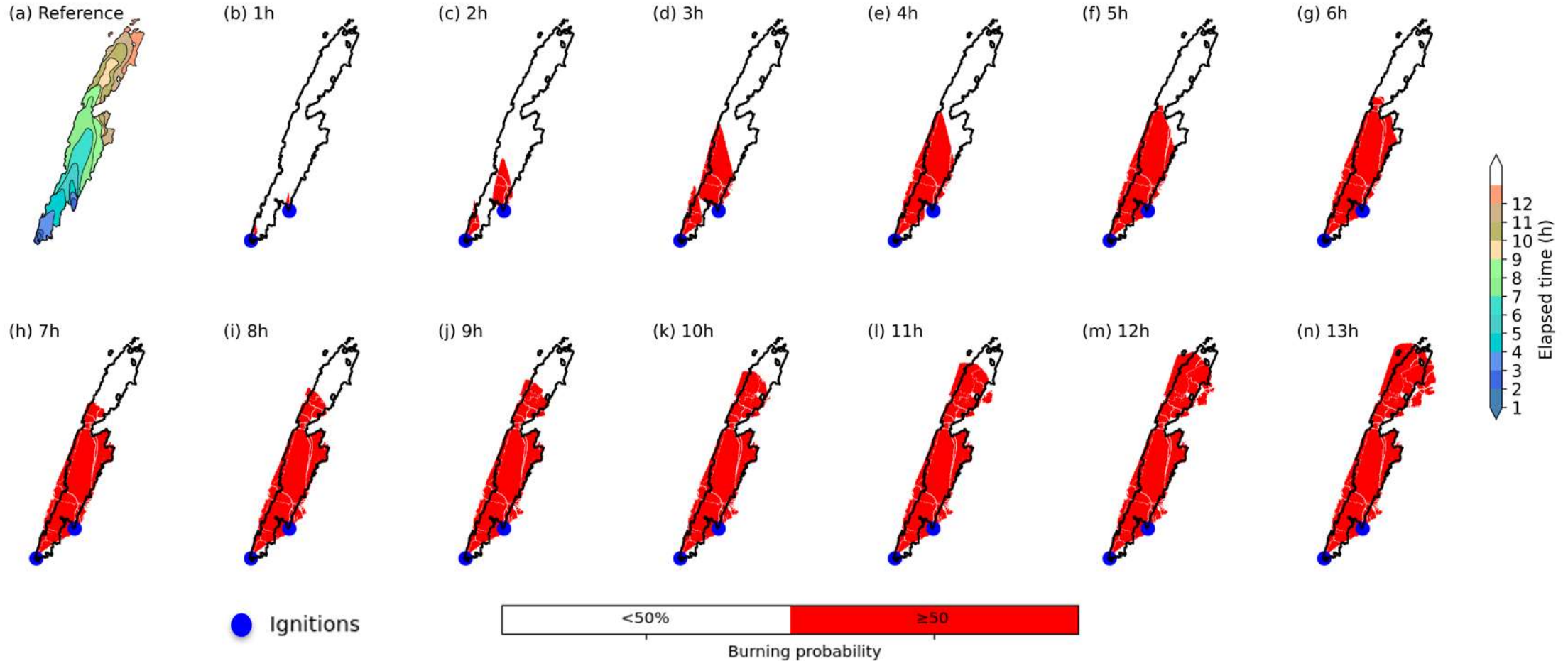
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Results - Burning probability maps

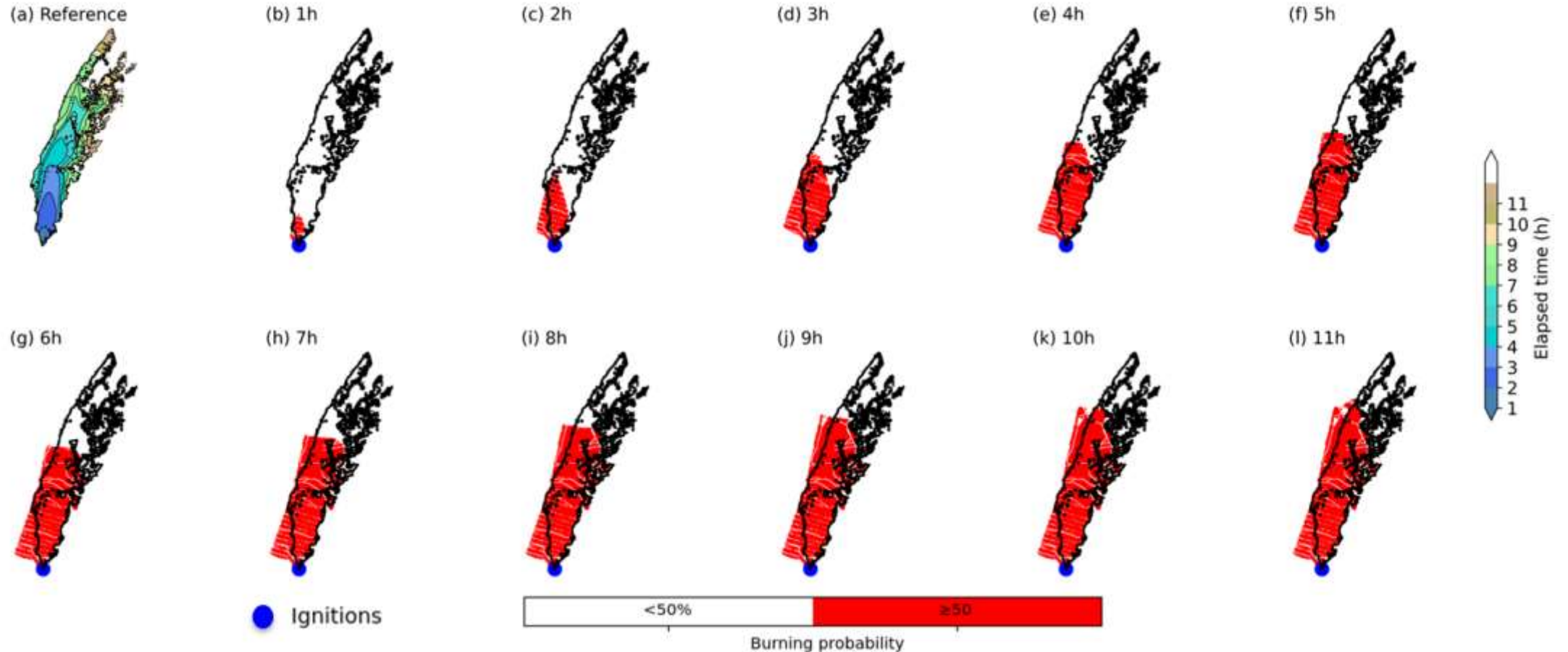


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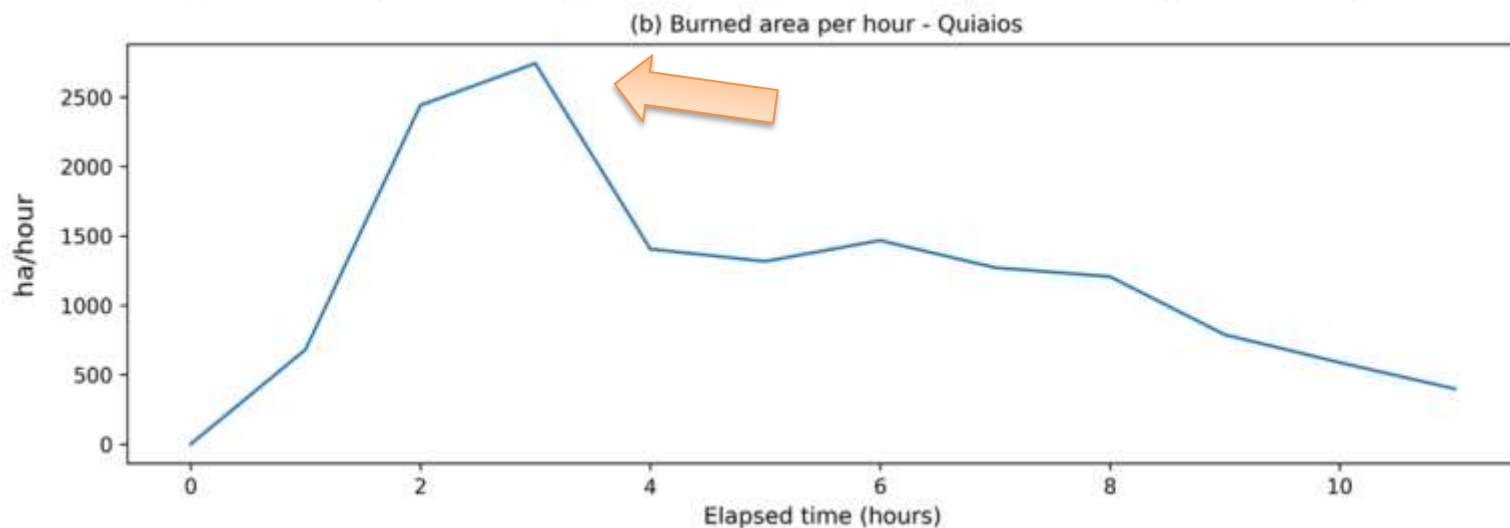
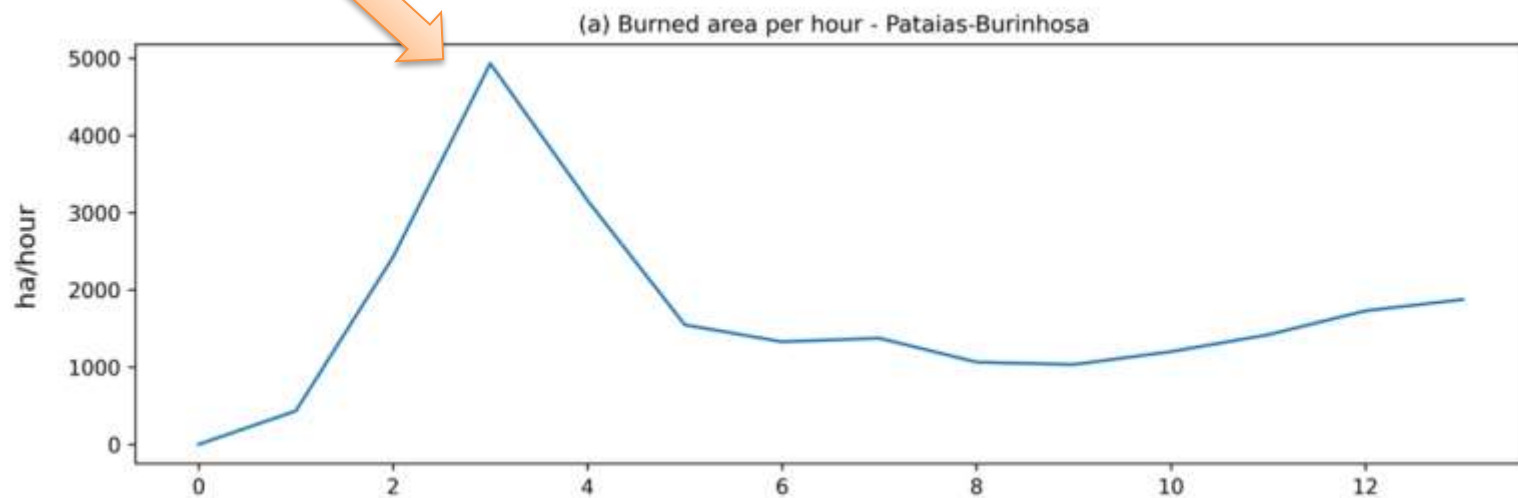
Pataias: Hourly evolution of simulated fire



Quiaios: Hourly evolution of simulated fire

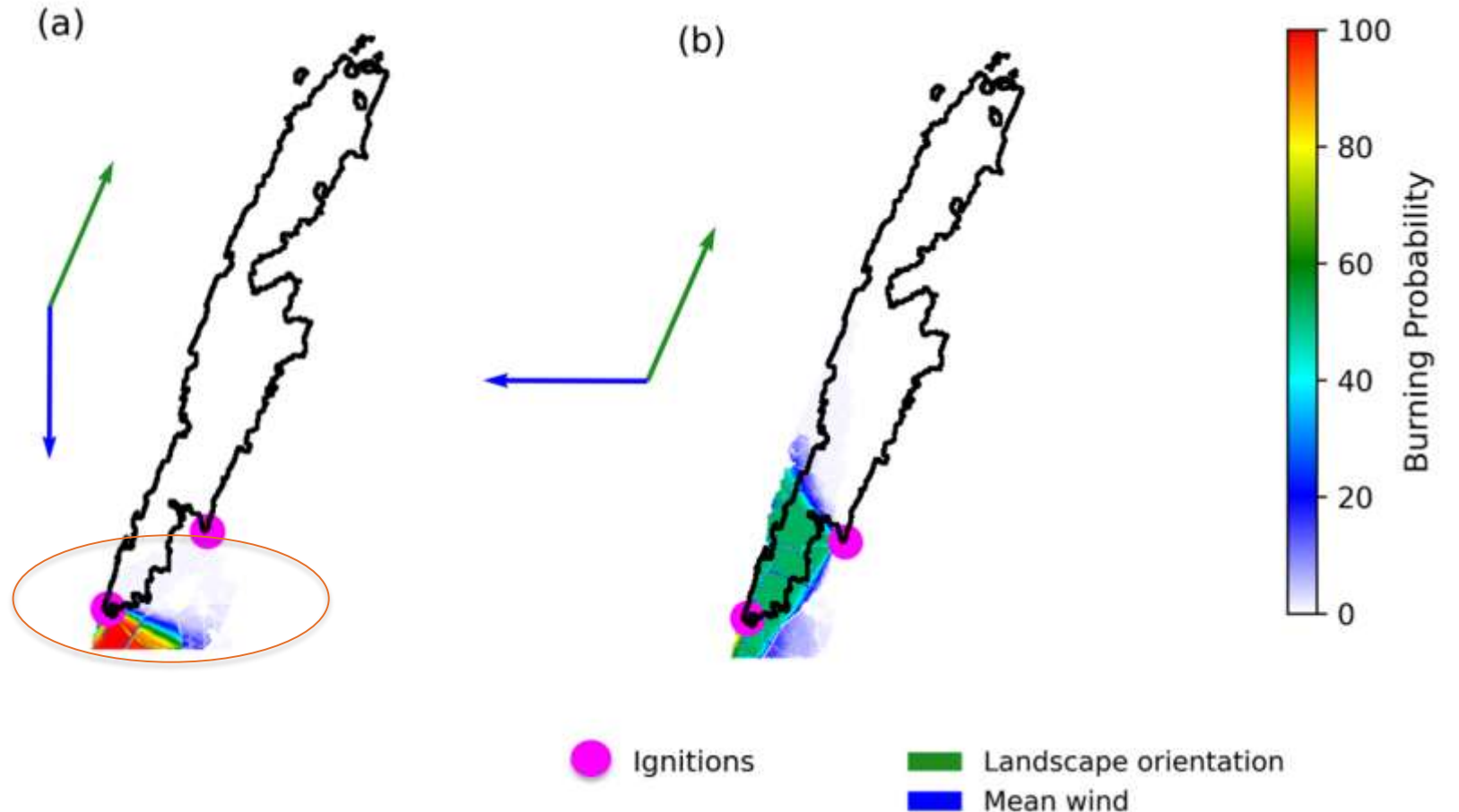


Case studies: Hourly evolution of burning



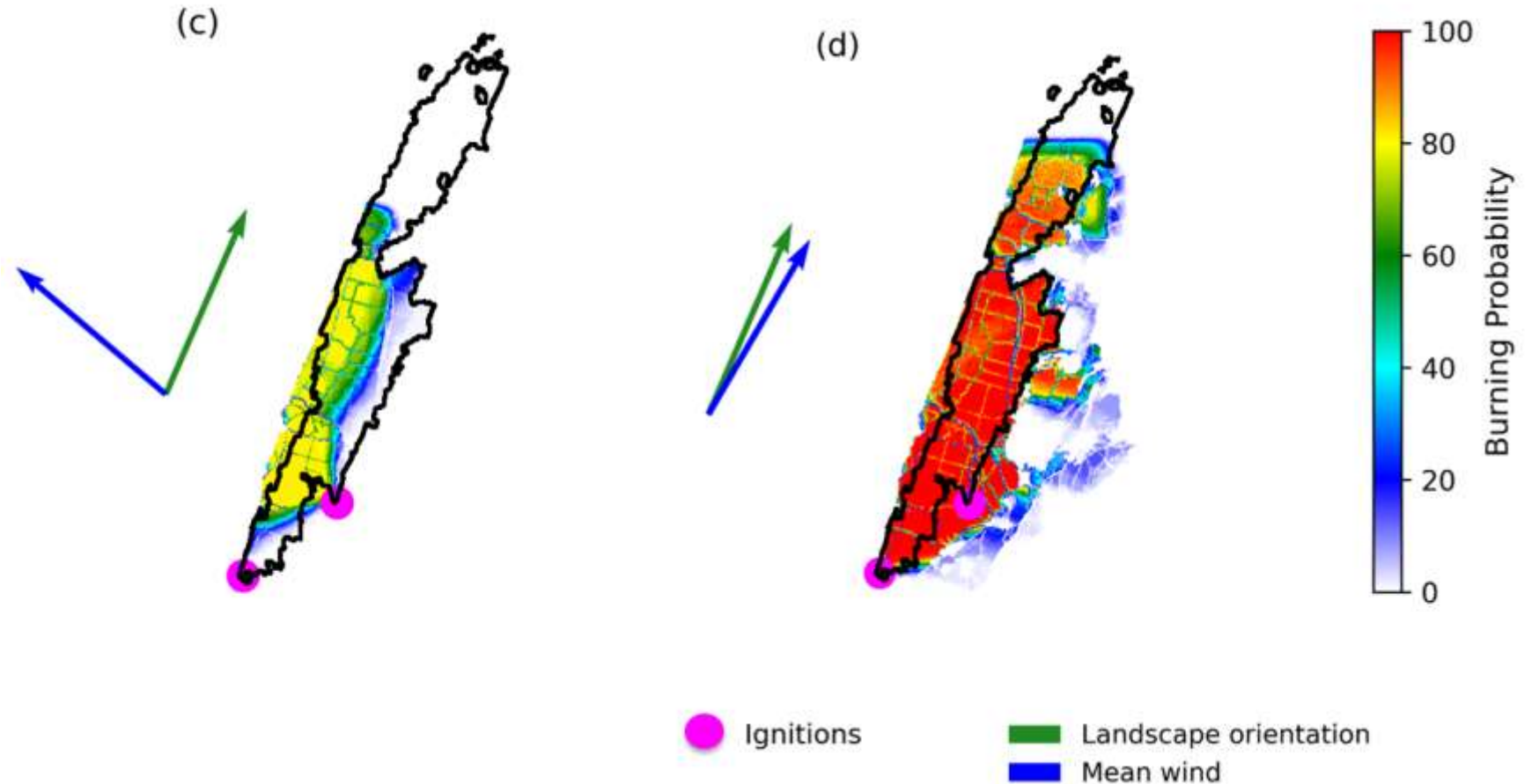
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Pataias: sensitivity of burned area to wind direction



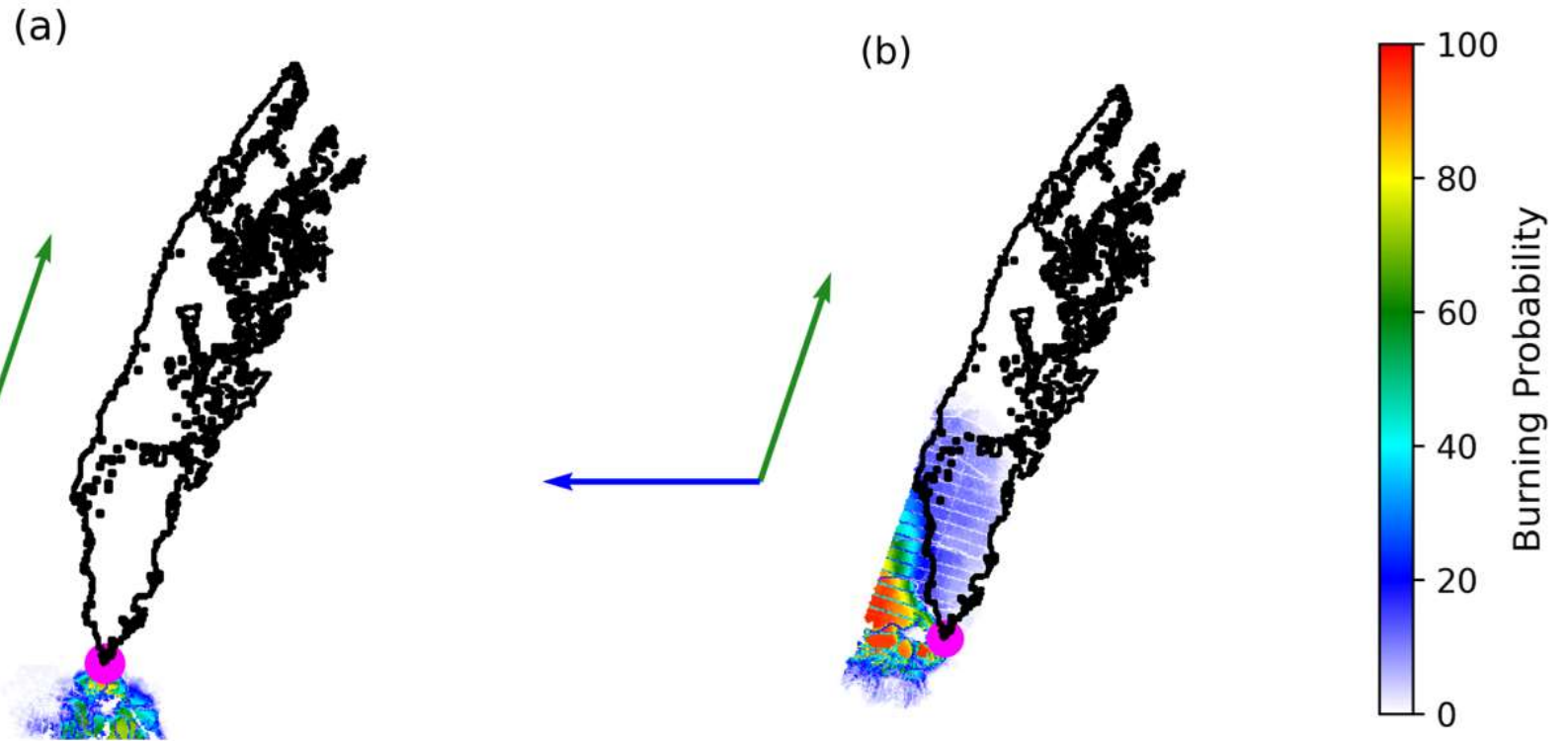
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Pataias: sensitivity of burned area to wind direction



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Quiaios: sensitivity of burned area to wind direction



● Ignitions

■ Landscape orientation

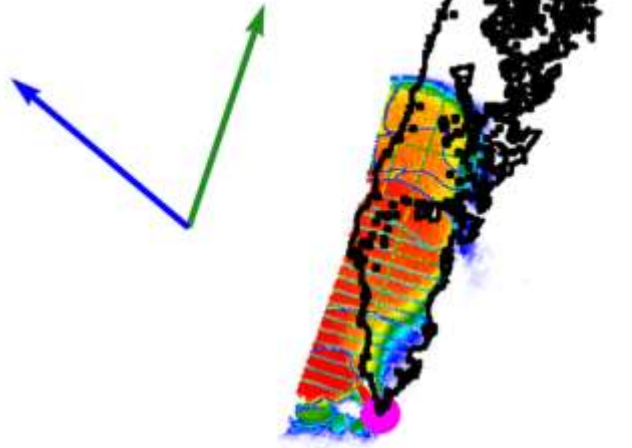
■ Mean wind



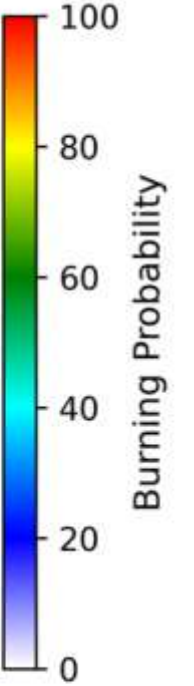
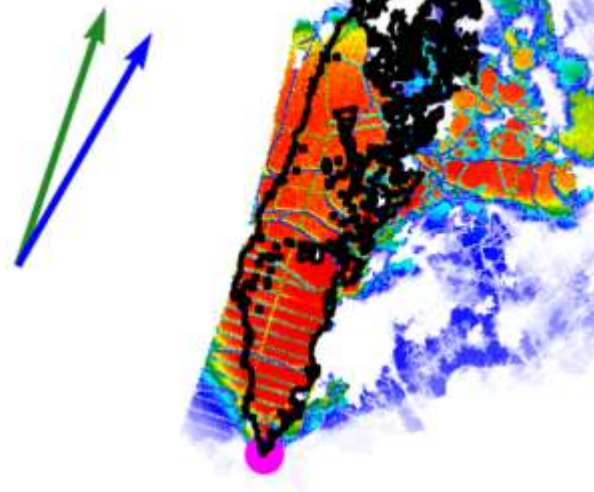
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Quiaios: sensitivity of burned area to wind direction

(c)



(d)



● Ignitions

■ Landscape orientation

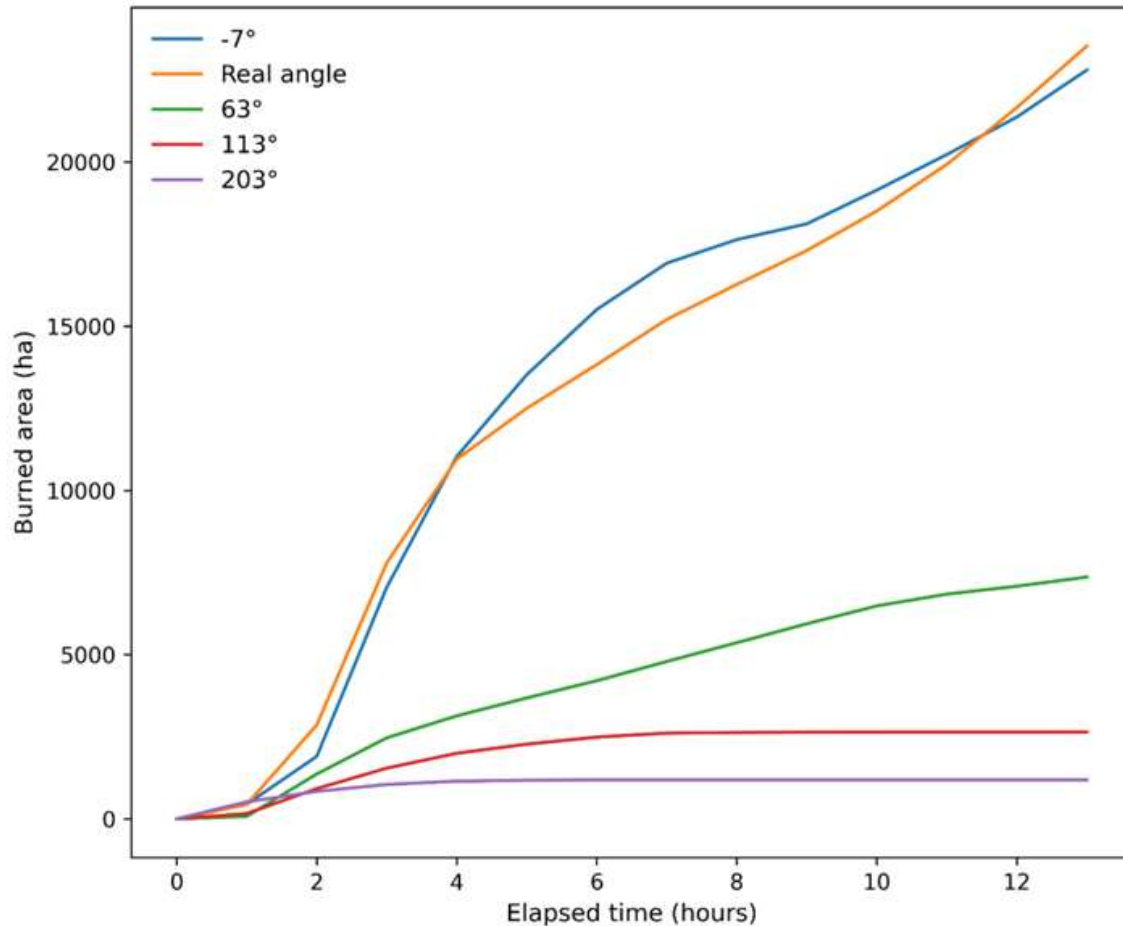
■ Mean wind



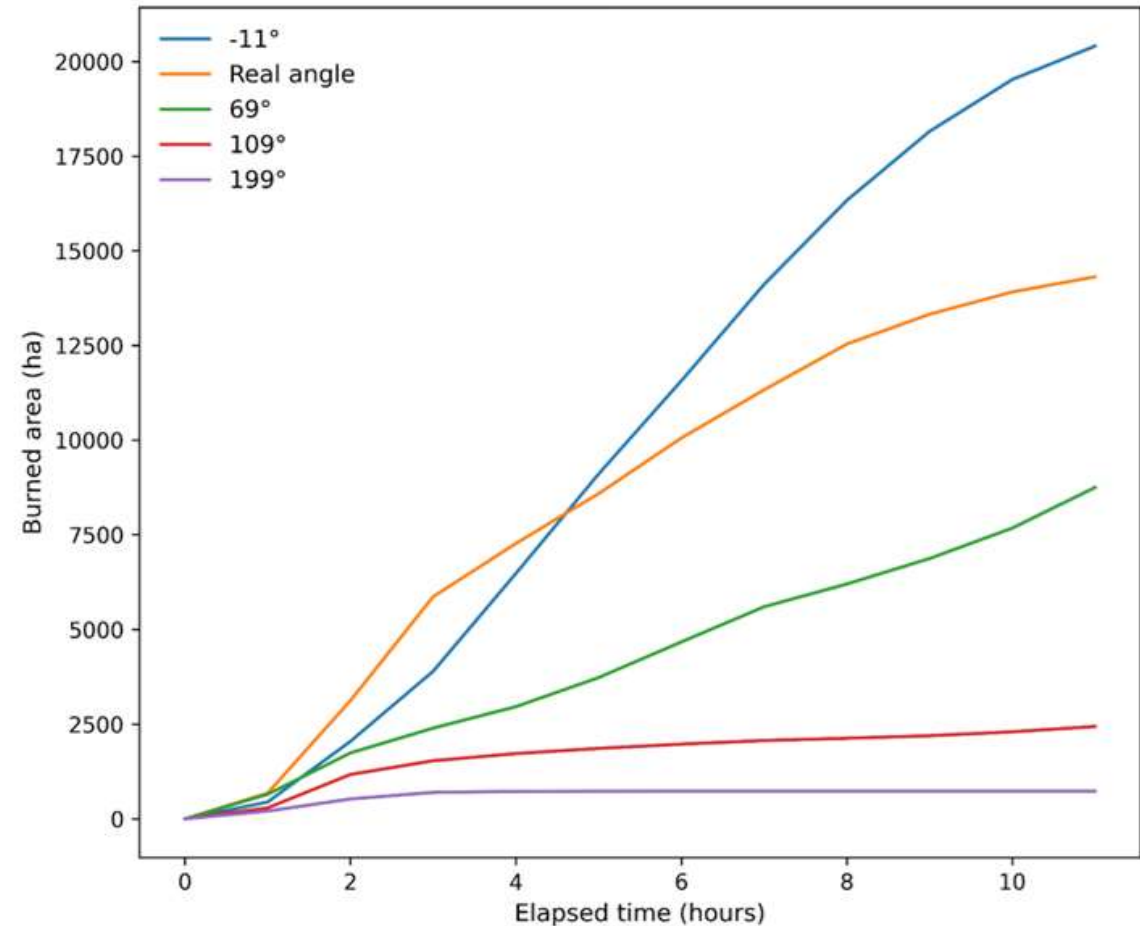
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Case studies: sensitivity of accumulated burned area to wind direction

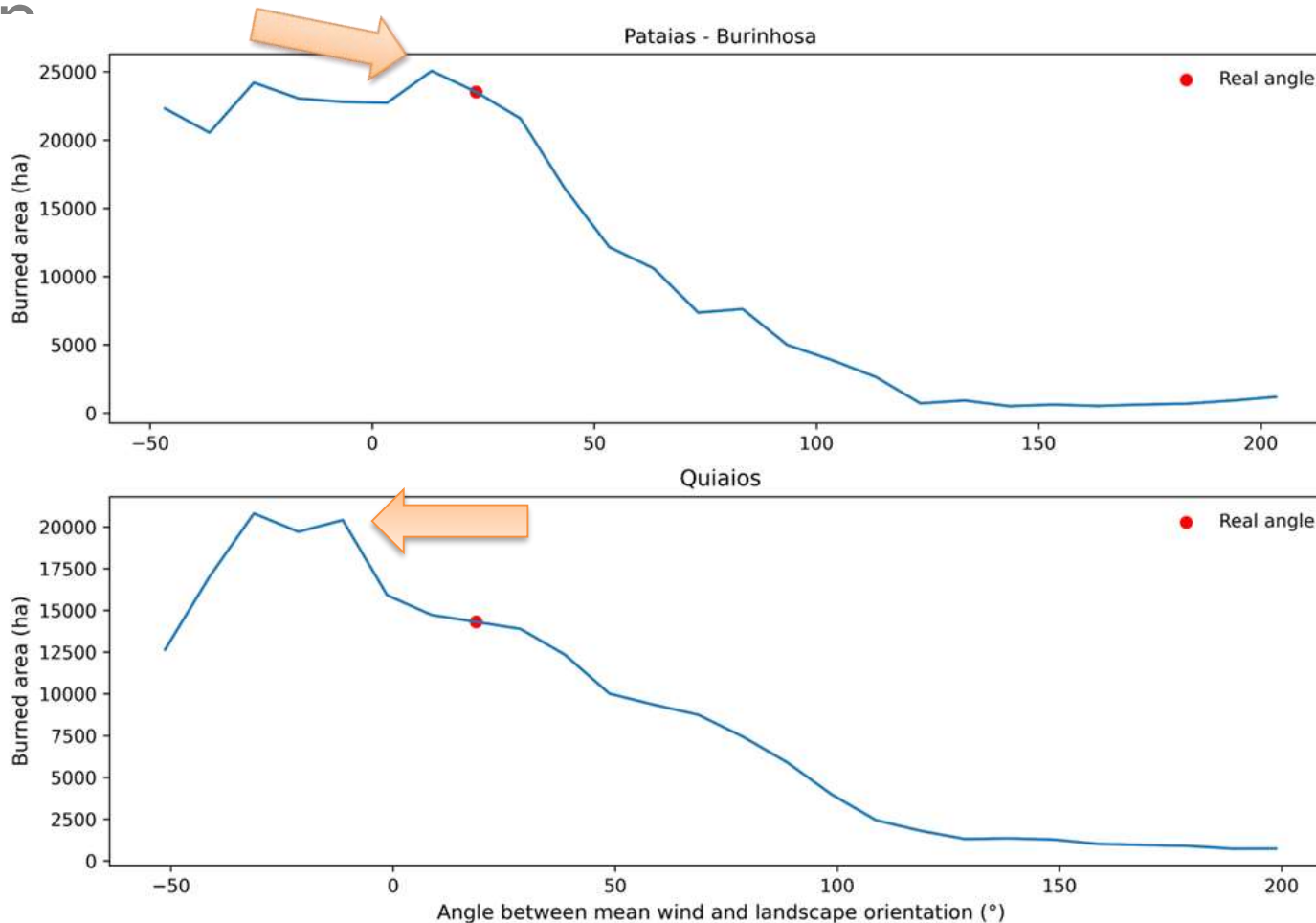
Pataias - Burinhosa



Quiaios



Case studies: sensitivity of total burned area to wind direction





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Conclusions

- It was observed that as the winds become **more easterly** and blow **more perpendicularly** to the **orientation** of the **vegetated patch**, the **burned area** tends to **decrease**.
- When the **wind direction** is in **close agreement** with the **orientation** of the **vegetated patch**, then a **maximum** value of **burned area** is reached
- Results obtained point to the **importance** of **wind direction** on **fire spread**, and suggest defining a **vector FWI** (with **direction** according to the **wind** and the **magnitude** of **FWI**)



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Thank you

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