**The endemic and epidemic potential of dengue on the island of Madeira**

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**First dengue outbreak (2012)**

- 3rd October 2012: 2 dengue infections reported
- Following months: >2000 cases, ~50% confirmed
- Virus: serotype 1, close to viruses from Venezuela
- Decline in cases was correlated with temperature

**Mediterranean climate:**
- Autumn, spring & summer: temperatures above 20°C
- Winter: temperatures remain near 15°C

**Tourism**
- The main driver of its economy, with millions of airline passengers per year

**Island of Madeira (Portuguese territory):**
- Approximate area of 750 squared kilometres
- Roughly with the same latitude as central Morocco
- Located at ~1000 Km from continental Europe
- Mountainous landscape
- Population distributed along the coast
- Funchal harbours - half the inhabitants

**Exploring Madeira’s epidemic and endemic potential:**

\(3A\) using average temperatures for 2002-2012 (blue), the model proposes a significantly smaller epidemic potential for the island compared to 2012

\(3B\) using average temperatures for 2002-2012 (blue), the model proposes a significantly smaller epidemic potential for the island compared to 2012

\(3C\) using average temperatures for 2002-2012 (blue), the model proposes a significantly smaller epidemic potential for the island compared to 2012

**Data fitting and population dynamics of 2012’s outbreak:**

**Temperature-driven parameters**
- Transition rate from aquatic to adult vector life-stages
- Mortality rate of aquatic & adult vector life-stages
- Intrinsic oviposition rate of adult vector life-stage
- Axenic incubation period of adult vector life-stage
- Hi-to-V probability of transmission
- V-to-H probability of transmission

**MCMC estimated parameters:**
- Time point of first human case
- Vector (aquatic) carrying capacity
- Linear scaling of vector life-span & incubation period

**To date, neither the conditions that have allowed for this epidemic nor the potential for future outbreaks have been studied.**

**To address this, we developed a Markov chain Monte Carlo (MCMC) ento-epidemiological approach:**

**General perspective:**
- We have shown that the 2012 dengue outbreak in Madeira was predominantly self-limited, driven to extinction by naturally decreasing temperatures rather than human intervention.
- There is nonetheless a major risk for epidemic outbreaks, with their likelihood raised in periods of increased travel from dengue-endemic countries during the summer months.
- However, the actual climatic conditions appear to be a constraining factor for endemicity as transmission is expected to be limited between Nov. & May.

- The implementation of the measures suggested by the European Council for Disease Control (4) are therefore critical for the future control of dengue’s entry into the European continent via this route.

**References:**
3. Lambrechts et al., PNAS (2011)