

IMPACT STUDY OF THE MILLAU BRIDGE INFLUENCE ON THE LOCAL LIGHTNING OCCURENCE

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CONTEXT

Lightning usually strike grounded tallest objects because they tend to considerably enhance the local vertical electric field due to their elongated shape.

On another hand, tall objects are likely to trigger lightning themselves leading to upward lightning

DOES THE MILLAU BRIDGE INFLUENCE ON THE LOCAL LIGHTNING DENSITY AND WHY IT SHOULD ?

3 reasons :

1

Culminating at **343 m** above the ground level

2

Located in one of **the most lightning active region** in France

3

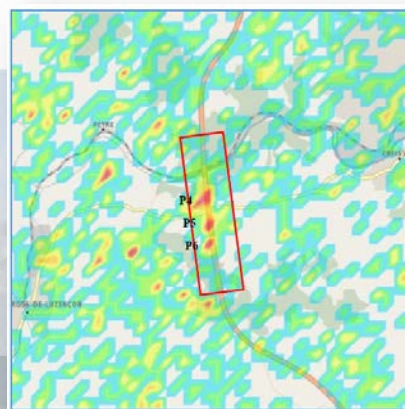
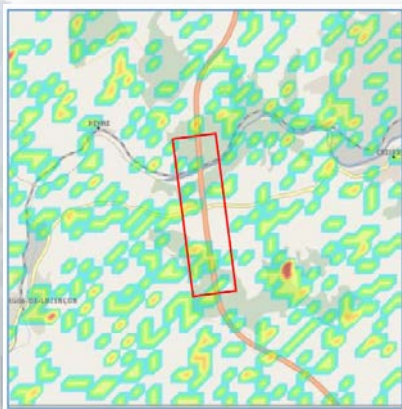
Some **evidences exist** like pictures

METHOD AND DATA

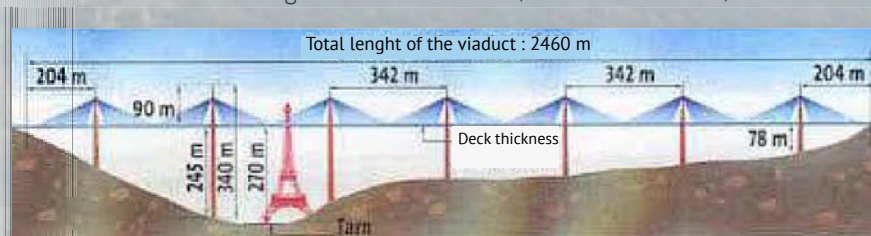
A 20 years statistical study on lightning activity in the vicinity of the Viaduct of Millau, based on lightning data from Météorage' LLS to check :

- The evolution of the local lightning density on periods
 - 1995 to 2001 : the bridge was not yet constructed
 - 2002 to 2003 : the piers were under construction
 - 2005 to 2015 : the bridge is in operation
- The type of lightning occurring on the bridge (upward/downward)

RESULTS AND COMMENTS



The local density before the bridge was constructed (01/1995 - 12/2001) and after the bridge was constructed (01/2005 - 12/2015)



Surprisingly, not the tallest masts are related to hot lightning spots !

It is possible to identify some patterns related to upward lightning like :

- Presence of a strong + CG flash some milliseconds in advance
- Presence of several strokes (within a couple of millisecond) on one or several masts

BASED ON THESE PATTERNS, IT TURNS OUT :

- 18 multi-stroke flashes were detected on the masts of the 'Millau Bridge' between 2005 and 2015
- 10 were just preceded by a strong + CG (like on the photography)
- 2 exhibited simultaneous strokes on several masts

As a result, 66% of the multi-stroke flashes attaching to the masts are expected to be upward lightning.

Again, most of the attachments are not on the tallest masts, P4 representing 30% of them (right in the middle of the bridge).

No upward lightning was detected during the piers construction.

CONCLUSIONS

- This study aimed at demonstrating the impact of the "Millau Bridge" on the local lightning activity.
- The analysis of the stroke density showed :
 - a visible enhancement of lightning activity in particularly on 3 central masts, probably because they are free from the natural protection of the surrounding hilly terrain.
 - several lightning strokes occurred either on the piers or on the nearby cranes during their construction.
- An interesting result showed the height of the masts is mainly involved in the enhancement of the lightning density and particularly because the masts trigger upward discharges. However, no relation was found between this enhancement and the height of the piers.
- The proportion of discharges triggered by the masts are estimated to range between 45% to 60% of all discharges. Interesting to note : no upward lightning flash was detected when the piers were being erected.