

# A 10-Year climatology of hail in France: towards an estimate of the hail hazard

According to France Assureur, hail damage in France in 2022 is estimated at more than €6.5 billion, i.e. more than half of all climate-related damage in 2022, or 60% of all hail damage accumulated between 2013 and 2021. This record-breaking year is in line with the growing concern about hail in France among public and private stakeholders. Despite its increasing impact on society the hail hazard in France remains largely unstudied at the national level, with a single 20x20 km hail risk map produced up in 1998 by F. Vinet using economic data (insurance) and measurements (hailpad). Hail hazard is poorly studied in France due to the great difficulty of observing or modelling hailfall, which are highly localised in time and space. The emergence of social networks since the late 2000s has led to a proliferation of potential hail observers across France. These new data, combined with insurance data, make it possible to study hail at a level of resolution never before seen in France.

The main objectives of our study are therefore to update the geographical assessment of the hail hazard in France, while improving the granularity of the existing geographical hail assessment. To this end we studied the hail hazard in terms of frequency and maximum diameter at the municipal level (average 16 km<sup>2</sup>), using hail reports (Keraunos, European Sever Weather Database) and insurance data (Generali France, around 5% market share) over the period 2013-2022.

Our study thus provides a resolution 25 times finer than that of Vinet and reveals a southwest - northeast axis dividing France into two halves: the lower half is heavily affected by hail while the upper half is less affected. It also highlights 3 main geographical areas with the highest hail hazard. The Massif Central stands out as the main hail-prone area in France, with a notable maximum in its northern part. The Bordeaux-Paris axis comes second, with a local maximum in the southwest Atlantic. In third place comes the Provence-Alpes-Côte d'Azur region, particularly in the Pre-Alps and Pre-Atlantic massifs. There also seems to be a correlation between orography and areas of high hail hazard, particularly noticeable in the Massif Central and Pre-Alps regions, but this needs to be further investigated.