

HAIL PREVENTION: CONCEPTUAL MODEL



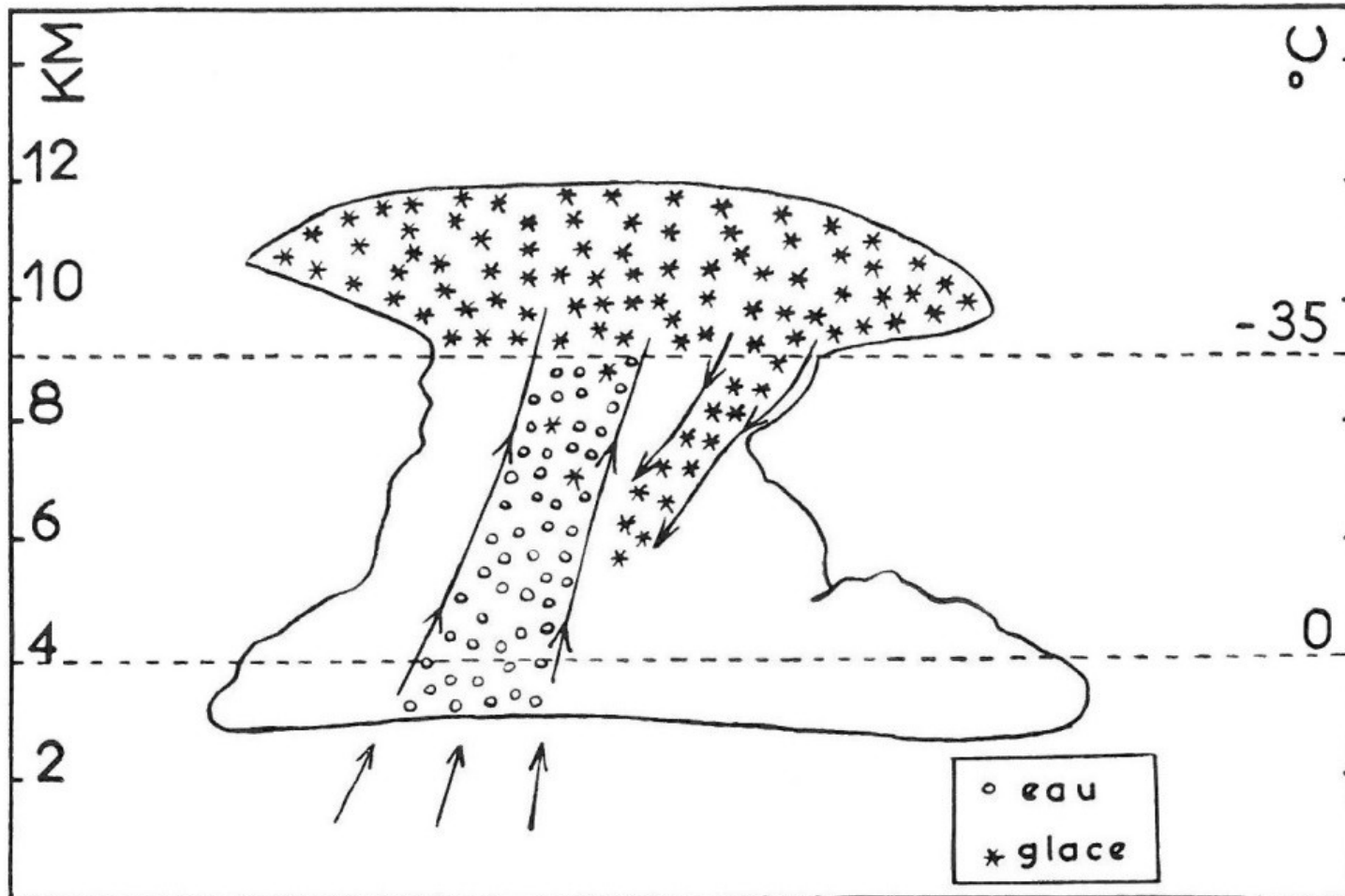
Professeur Jean DESSENS
Physicien, Conseiller scientifique de l'ANELFA



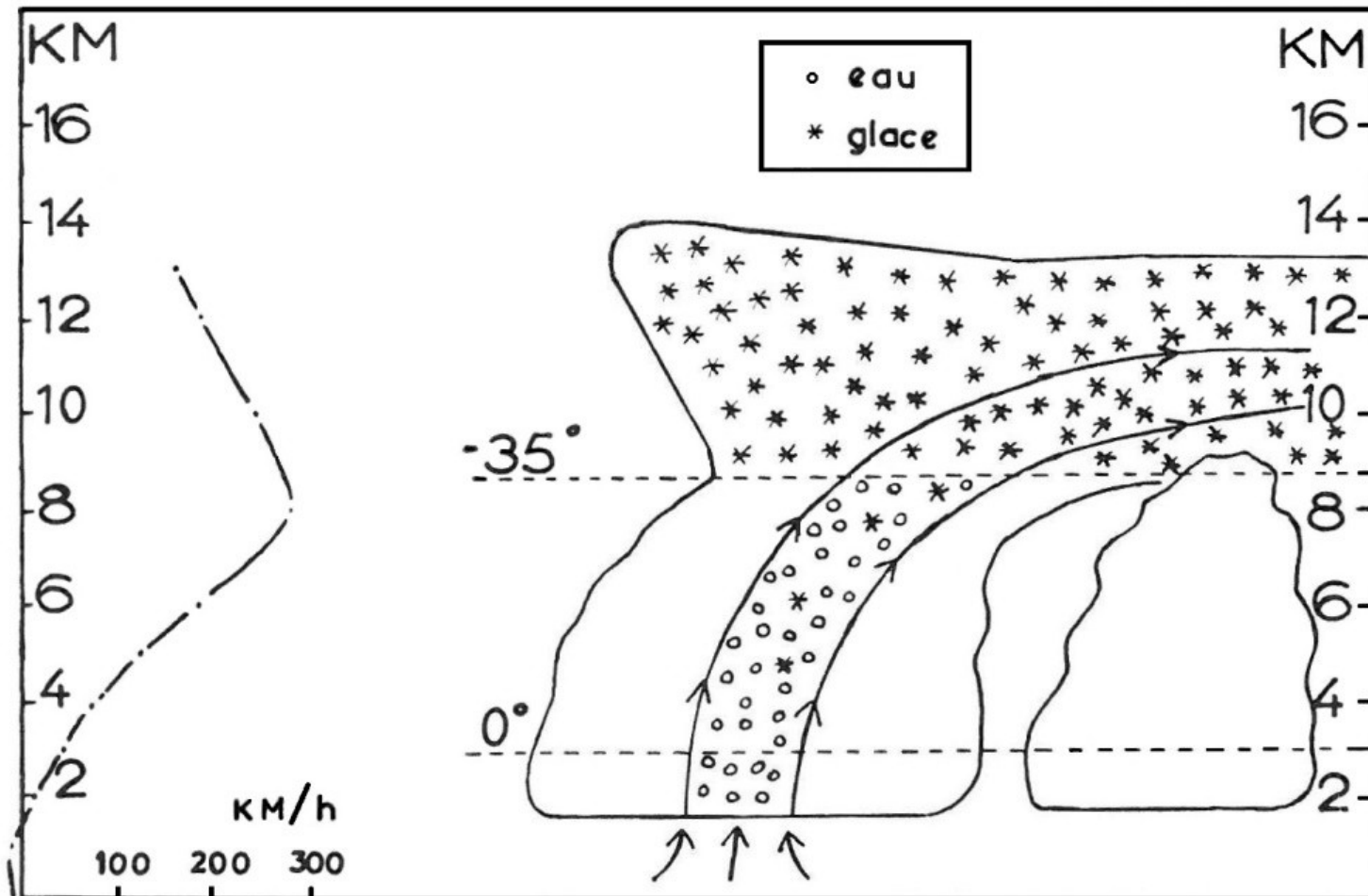
**Association Nationale d'Etude et de Lutte
contre les Fléaux Atmosphériques**



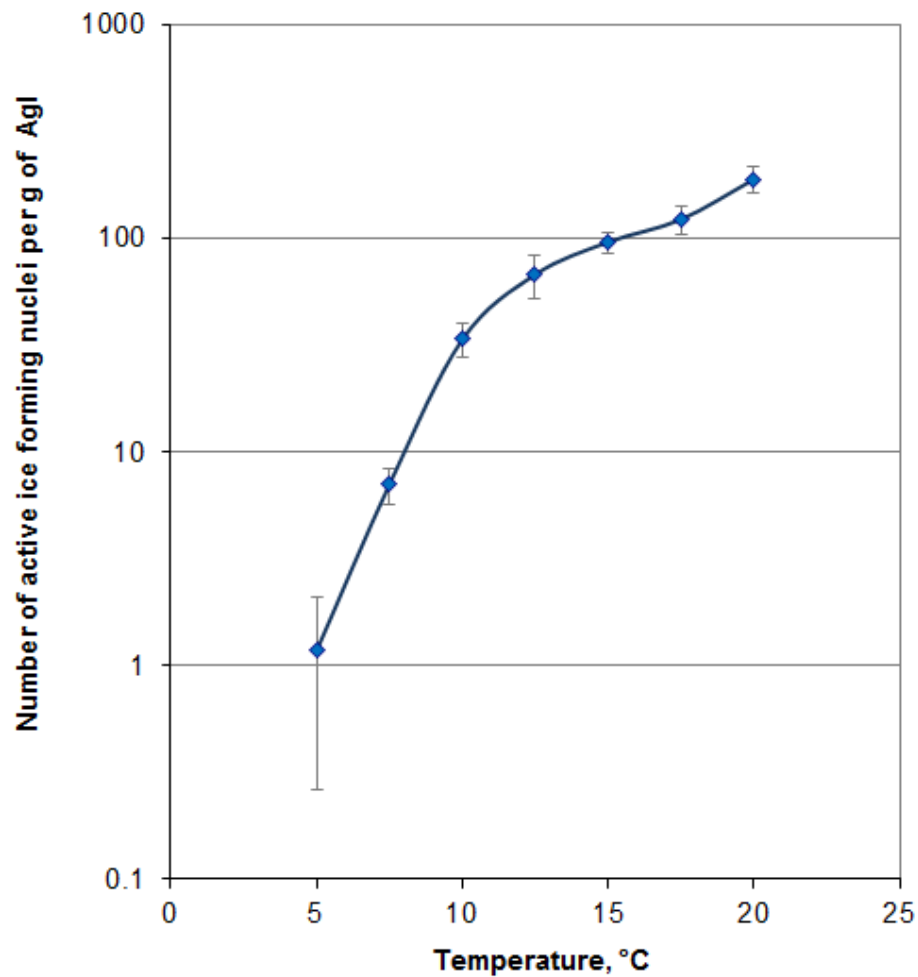
ORDINARY THUNDERSTORM



TYPICAL HAILSTORM



ICE FORMING NUCLEI PRODUCTION (silver iodide)



EVALUATIONS OF VERTICAL TRANSPORT OF ICE-FORMING PARTICLES PRODUCED BY GROUND-BASED GENERATORS

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VERTICAL TRANSPORT

ABSTRACT

The study presents theoretical evaluations of concentration of ice-forming particles produced by ground generators up to heights where the particles can activate to crystals and contribute to cloud microphysical processes. Different mechanisms of particle ascent are considered. The evaluations show that particles generated by ground generators can reach levels lead of $-5/-6^{\circ}\text{C}$ isotherms with concentrations up to 10^6 particles/ m^3 . According to the current concepts, this amount of ice-forming particles could be sufficient to apply surface generators both for purposes of precipitation enhancement as well as hail prevention. By regulating the duration, productivity, number and location of ground generators, one can increase the amount of seed particles at necessary height levels, which enables to regard ground particle generation as a tool for precipitation enhancement and hail prevention.

Keywords: Cloud microphysical processes, Ice-forming particles, Hail prevention

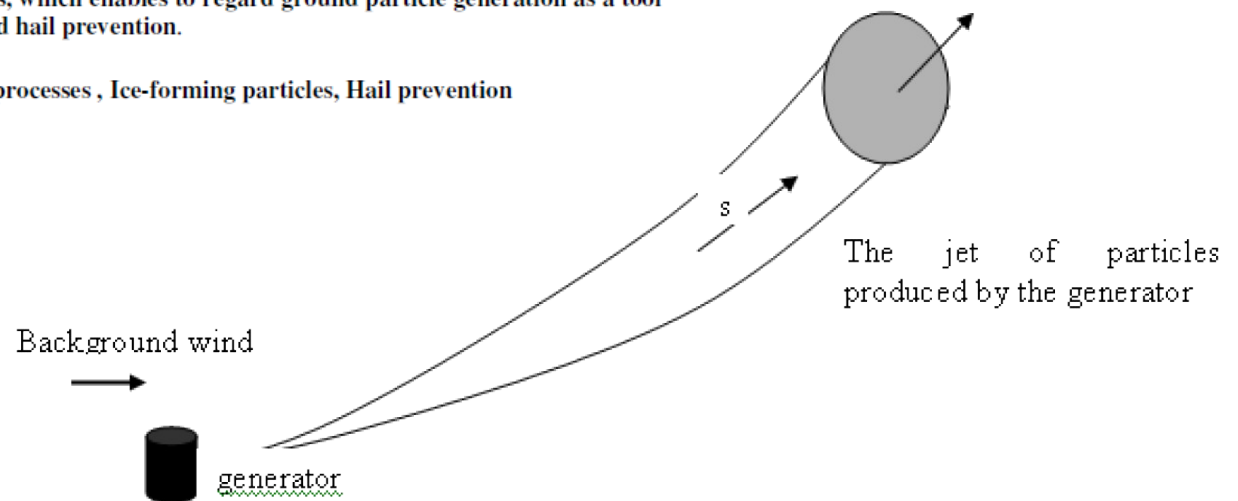


Figure 4. Schematic pattern of a particle jet ascending against the background of a horizontal wind (side view)

HORIZONTAL TRANSPORT

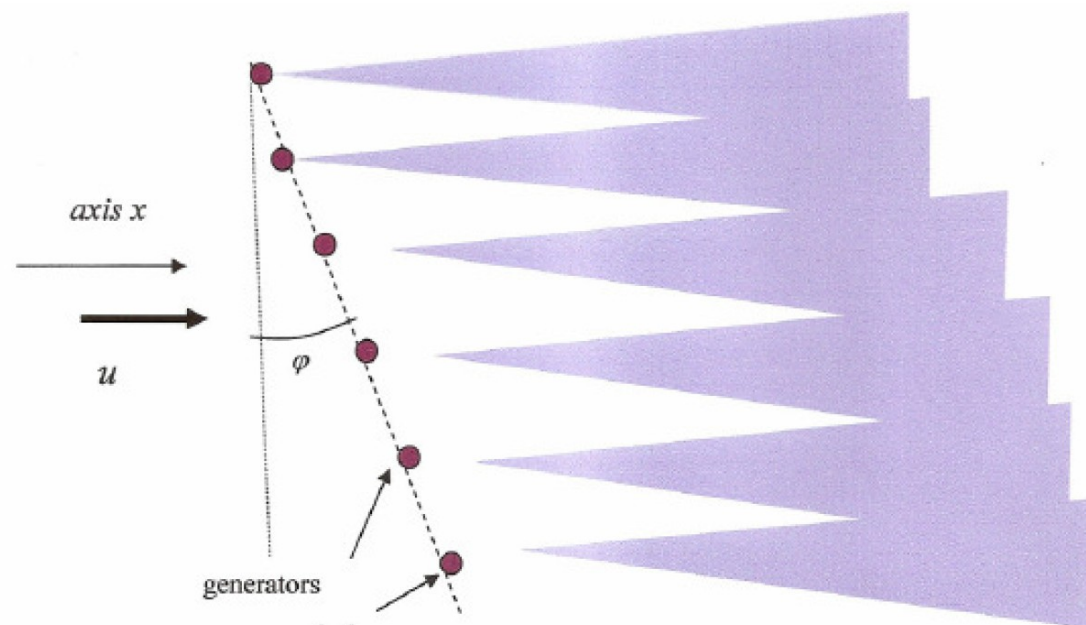
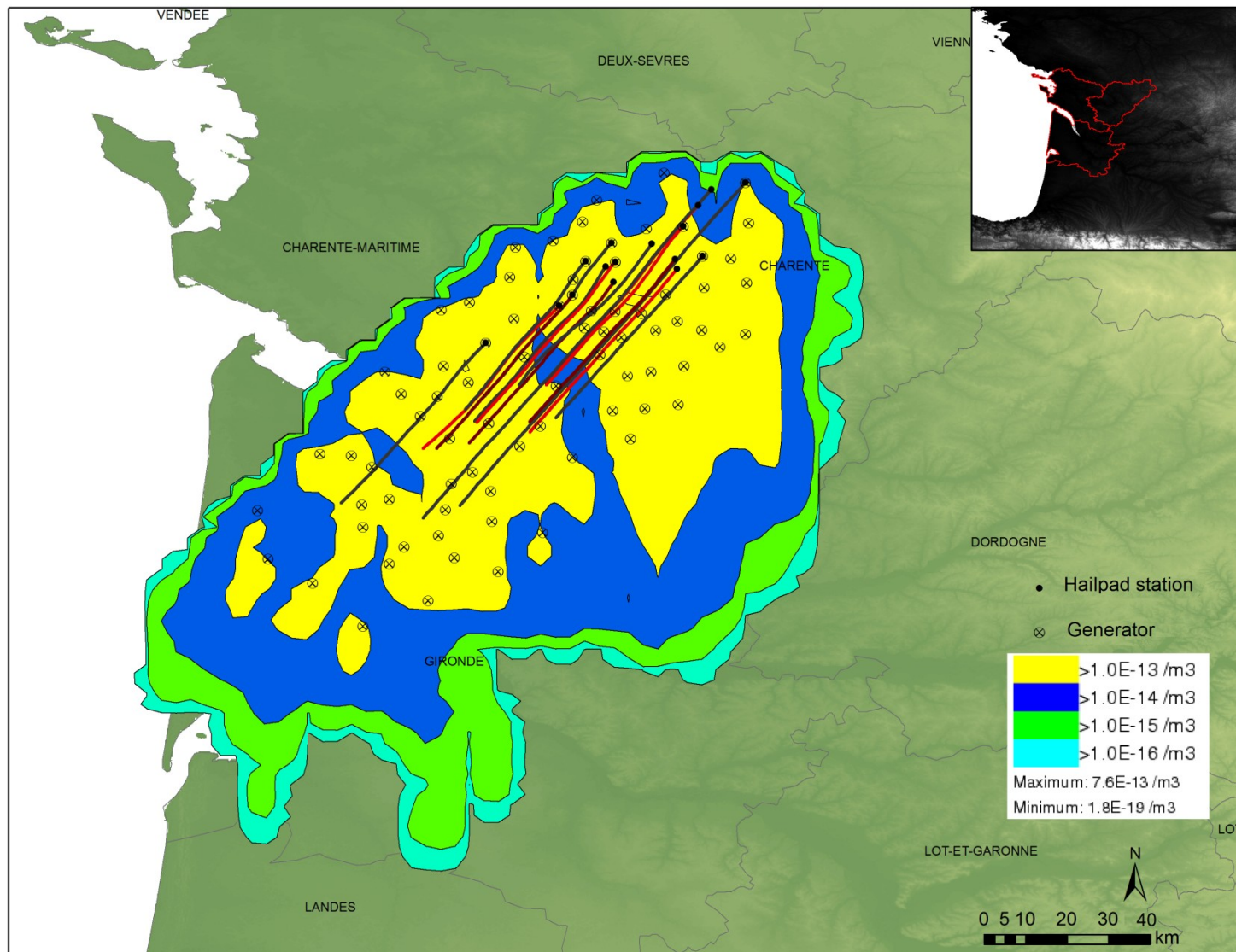
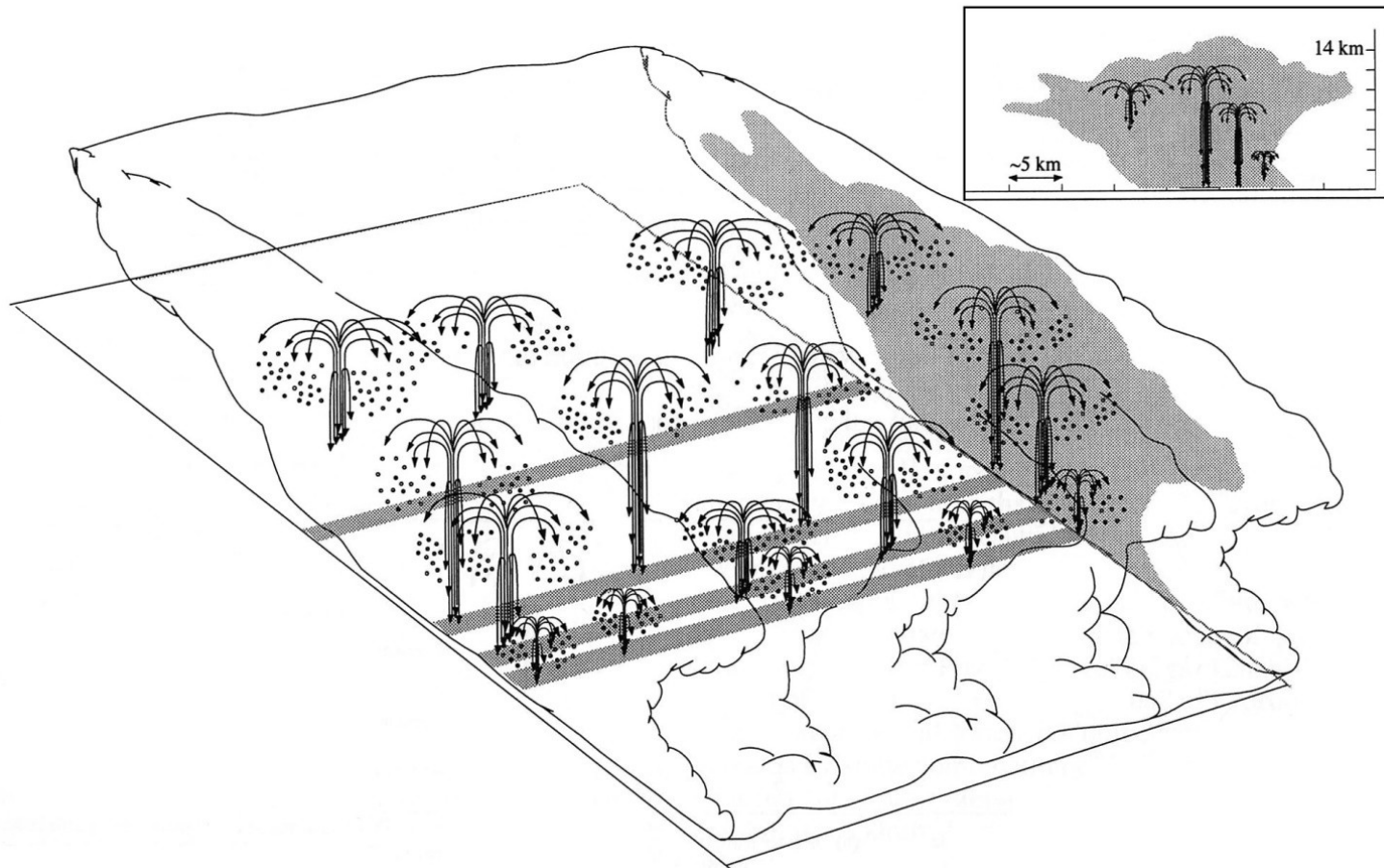


Figure 5. The modification scheme utilizing a “chain” of particle-producing generators (top view).

SILVER IODIDE CONCENTRATIONS (Hysplit Model)

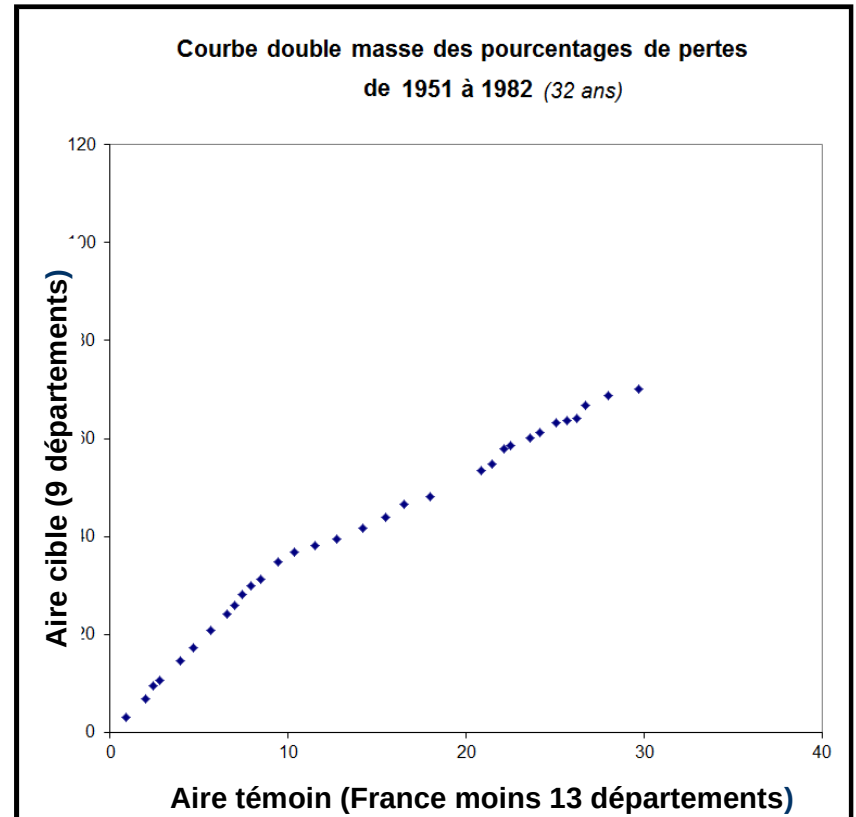
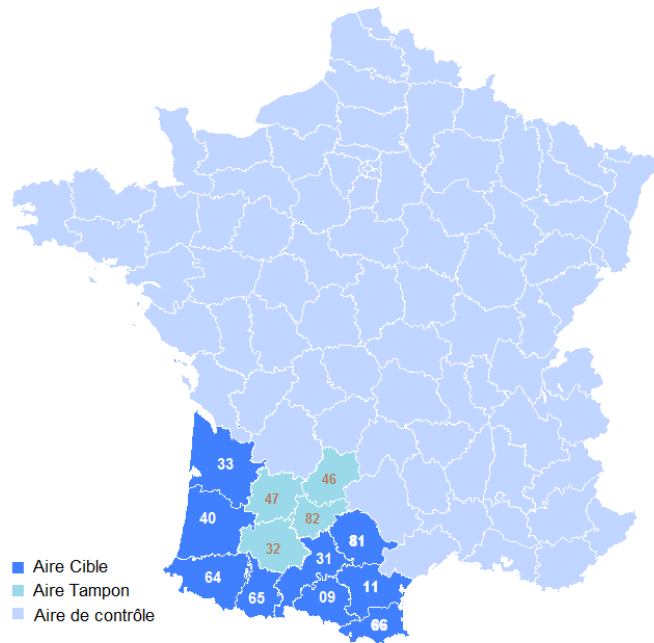


MULTICELLULAR STORM



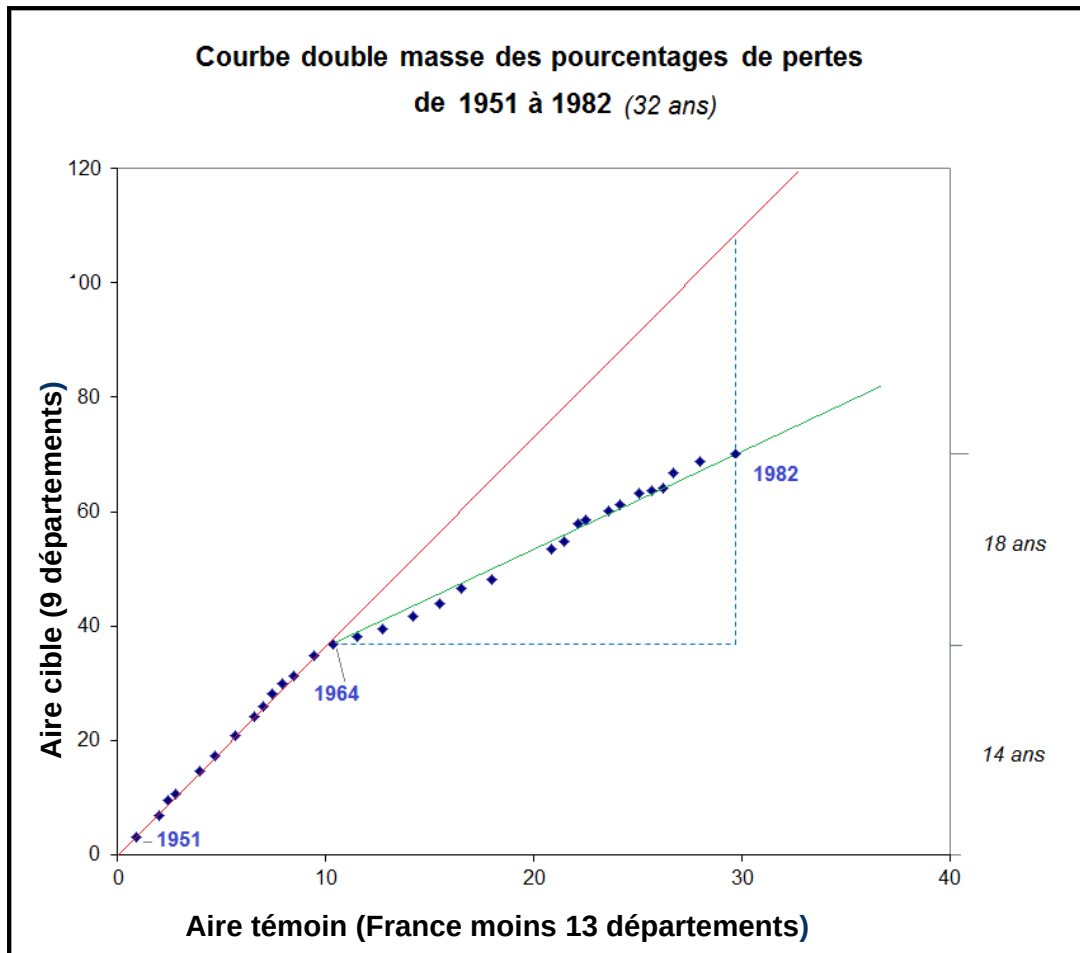
BULK CONTROL (Insurance data)

1986 >> Statistiques départementales annuelles des assurances :



BULK CONTROL (Insurance data)

1986 >> LOSS TO RISK RATIO

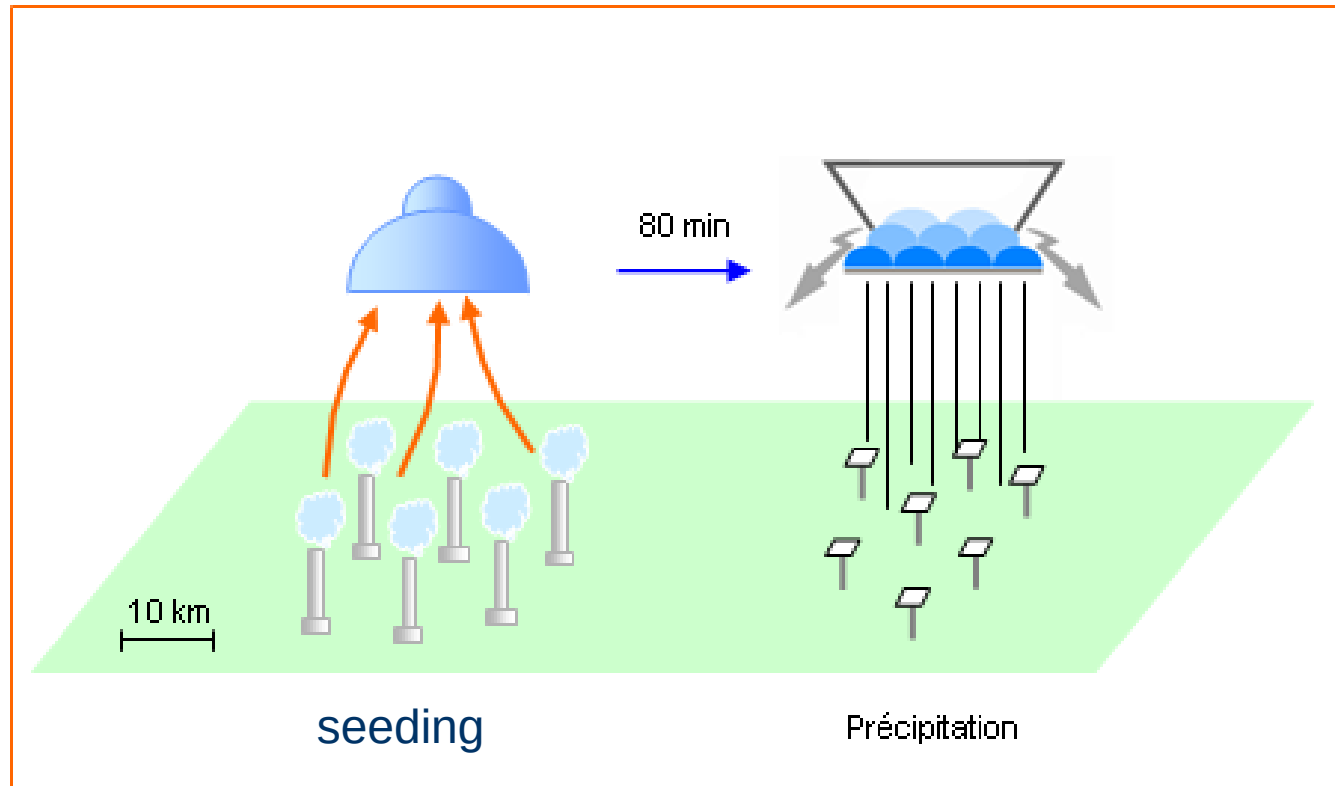


41% de diminution des pourcentages de pertes

Rapport du bénéfice au coût égal à 24 / 1

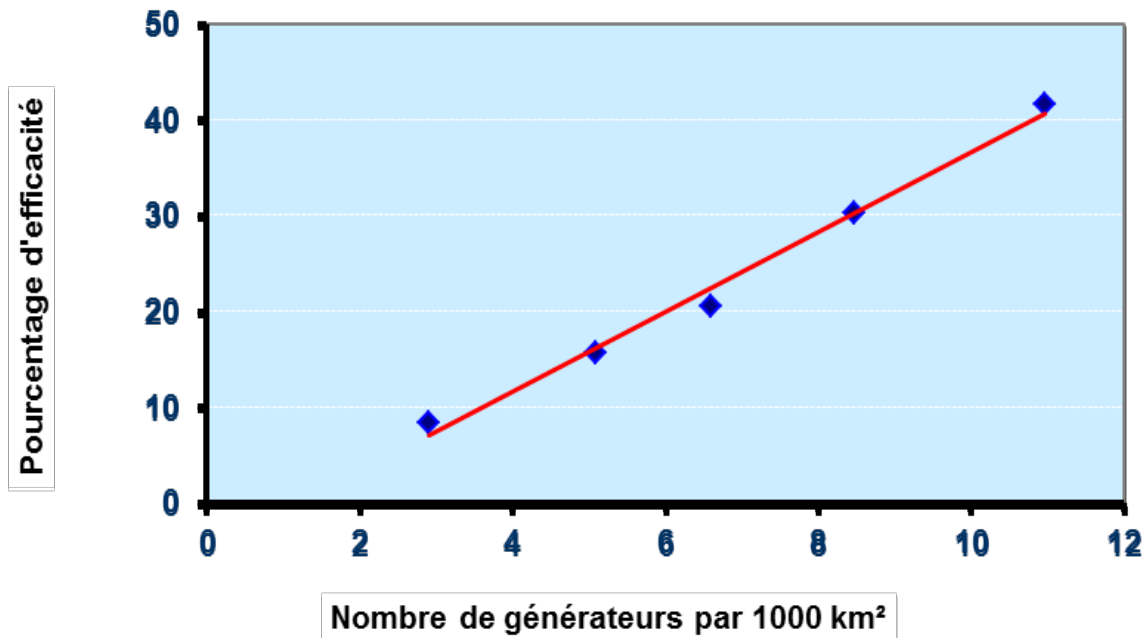
PHYSICAL CONTROL

1988 >> Physical hail measurement at the ground



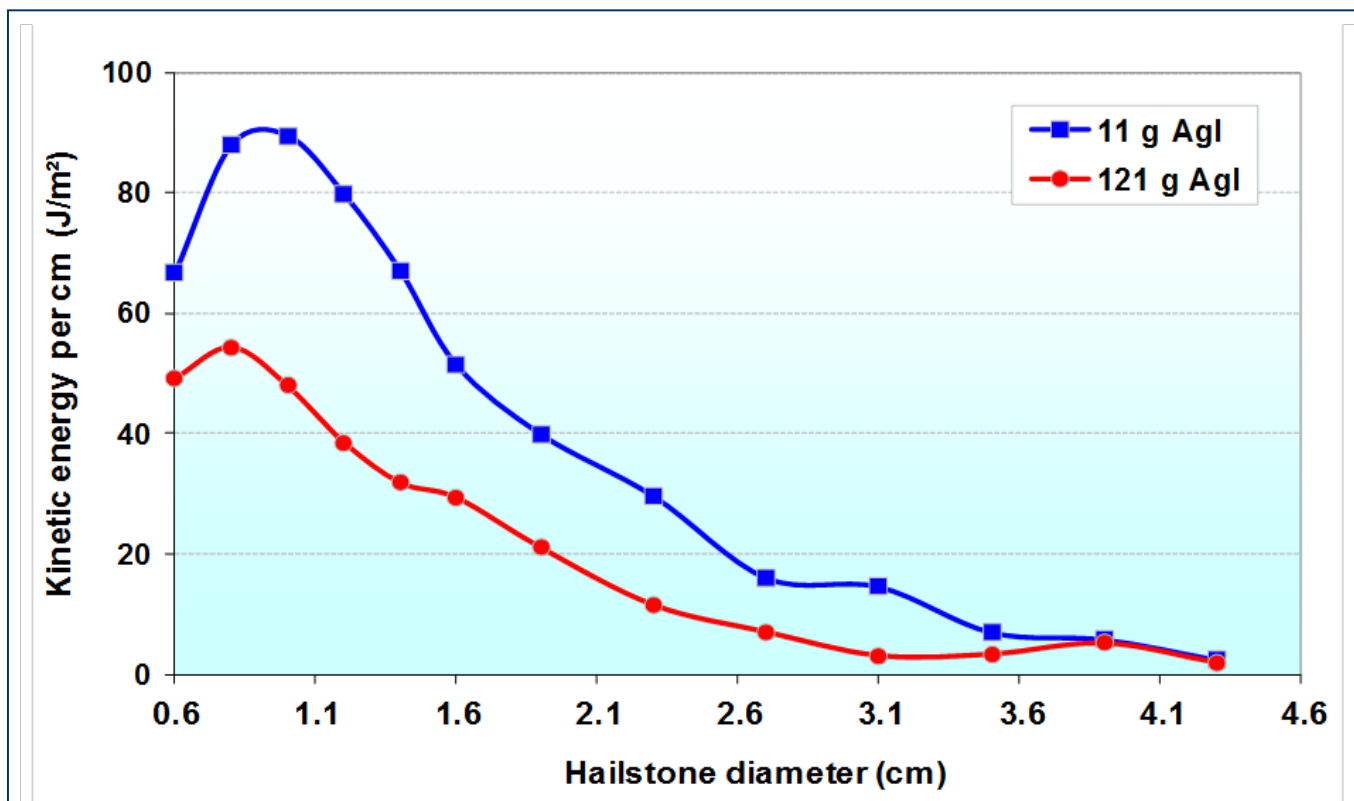
PHYSICAL CONTROL WITH HAILPAD

Efficacité moyenne d'un réseau de générateurs en fonction de sa densité



42% decrease of hailstones larger than 7 mm

PHYSICAL CONTROL (2009-2012)



48% decrease of kinetic energy