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Explicit Numerical Approximations for a Pricing Weather Derivatives Model

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Abstract : Weather Derivatives are financial instruments used to cover non-catastrophic weather events and can be expressed in the form of standard or plain vanilla products, structured or exotics products. The underlying asset, in this case, is the weather index, such as temperature, rainfall, humidity, wind, and snowfall. The complexity of the Weather Derivatives structure shows the weakness of the Black Scholes framework. Therefore, under the risk-neutral probability measure, the option price of a weather contract can be given as a unique solution of a two-dimensional partial differential equation (parabolic in one direction and hyperbolic in other directions), with an initial condition and subjected to adequate boundary conditions. To calculate the price of the option, one can use numerical methods such as the Monte Carlo simulations and implicit finite difference schemes conjugated with Semi-Lagrangian methods. This paper is proposed two explicit methods, namely, first-order upwind in the hyperbolic direction combined with Lax-Wendroff in the parabolic direction and first-order upwind in the hyperbolic direction combined with second-order upwind in the parabolic direction. One of the advantages of these methods is the fact that they take into consideration the boundary conditions obtained from the financial interpretation and deal efficiently with the different choices of the convection coefficients.

Keywords : incomplete markets, numerical methods, partial differential equations, stochastic process, weather derivatives
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