

Application Variance Reduction Techniques to Pricing Weather Derivatives

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The complexity of numerical computation in financial, weather derivative theory and practice has increased enormously, putting more demands on computational speed and efficiency. Numerical methods are used for a variety of purposes. These include the valuation of securities, the estimation of their sensitivities, risk analysis, and stress testing of portfolios. The Monte Carlo method is a useful tool for many of these calculations. A derivative security, such as a call option, is a security whose payoff depends on one or more of the basic securities. Using the assumption of no arbitrage, financial economists have shown that the price of a generic derivative security can be expressed as the expected value of its discounted payout. This expectation is taken with respect to a transformation of the original probability measure known as the equivalent martingale measure or the risk-neutral measure. The same situation exist in the area of pricing weather derivatives.

On the other hand the Monte Carlo method lends itself naturally to the evaluation of security prices represented as expectations. In effect, this method computes a high dimensional integral - the expected value of the discounted payout over the space of sample paths. Monte Carlo becomes increasingly attractive compared to other methods of numerical integration as the dimension of the problem increases. Different variance reduction techniques have been developed to increase precision of numerical calculation . In theory of Monte Carlo methods existed following well known classical variance reduction techniques. Control variate approach, the antithetic variate method, moment matching, importance sampling, and others have been introduced in finance applications.

In the presentation we will describe more detailed theoretical foundation of each variance redaction techniques with connection of weather derivatives which applied for the calculation weather options and give the results of numerical experiments .