3.1 Research objectives

The crop insurance programme in India is not considered to be too successful (Parchure, 2002). One of the reasons could be lack of a study into the kind of product, which would appeal to those who would take the insurance, i.e. the farmers.

Relative to traditional insurance products, weather derivatives have several advantages. However, these would be realised only if a detailed analysis is done of the needs of the potential buyers. One of the limitations, however, is the issue of basis risk, wherein the measure of the weather parameter at the location of the holder of the weather derivative may be different than the measure at the weather station specified for measuring it. The intensity of this problem needs to be studied.

As the weather derivative market in India is at a nascent stage, a pilot study into the appeal of these products to the farmers, the kind of products they would look forward to, and the willingness to pay to invest in weather derivatives would yield a lot to the design of these products.

Objective - 1

The major objective of this research is to, first theoretically estimate the amount that a typical farmer might be willing to pay for weather-risk hedging and the magnitude of the basis risk, which is considered an important limitation for these products. We would then empirically evaluate the appeal of weather derivative products to farmers and their willingness to invest in these products in order to hedge weather related risks, through a survey.

Besides depth and liquidity, one of the major contributors to the success or failure of a derivatives market is the regulatory framework (Hathaway, 1998). The emergence of a new market has to be accompanied by policy and legislative issues specifically protecting these markets from anti-gambling laws.
Research objectives and methodology

Notwithstanding that, all these regulatory and policy frameworks have to be flexible enough to allow the emerging market to grow, rather than stifling it with stringent rules.

In India, a lot of work was done on the regulatory frameworks for derivatives trading by a SEBI Committee set up in November 1996, under the chairmanship of Dr LC Gupta and by a group in 1998 under the chairmanship of Prof J R Varma.

**Objective - II**

The second objective of this research is to study the policy and regulatory framework for derivative trading in India and see how these could be adapted for weather derivatives trading in the Indian context.

A limited amount of work has been done in the area of pricing of weather derivatives. The few existing models for weather derivatives are based on modelling the degree days. Although temperature would be an important factor in pricing of weather derivatives in India, rainfall is probably a more relevant index. The need of the hour is to have a simple, easily understood and transparent system of pricing of weather derivatives, so that subscribers get a sense of understanding and a sense of fairness in the product.

**Objective - III**

The third objective of the research is to study existing models for pricing weather derivatives and to study how they could be adapted for Indian conditions.

This would go a long way in being able to price contracts which would have payouts depending on temperature / rainfall.

3.2 Methodology

The research into the prospects and challenges for weather derivatives in India, has been done in three parts.
Part I

Since about one-fourth of India's GDP comes from the agricultural sector, this sector has been used for the study. Besides theoretical studies into the issues involved, an empirical study into farmers' opinions into the various issues involved as well as their willingness to pay for such a product like weather derivatives, has been done.

The empirical framework of the study attempts to bring out farmers' preferences vis-à-vis various services related to hedging of crop yield through stated preference techniques. It then uses the contingent valuation technique to value their willingness to pay for such products. The steps followed are outlined in Figure 3.1.

The sample was chosen such that there would be representatives of farmers who had, earlier, opted for crop insurance schemes and those who had not, within the area chosen for the study.
The questionnaire finally designed covered questions that concern

- Demographics of the sample (age, education, family size, income etc.)
- Type of losses suffered, attributable to weather
- Awareness of weather risk issues
- Awareness of weather risk hedging methods
- Willingness to invest in weather derivatives to hedge weather risks
- Preferences for various types of weather derivative products

A bidding game is used in the questionnaire to determine yes or no responses to various bids for weather derivative pricing. A Random Utility model is used, and logit and probit estimations are done using LIMDEP software.

Part II

This was an exploratory study of the policy and regulatory framework under which the existing trading in derivatives in India takes place. Extensions could then be drawn for trading in weather derivatives, with an emphasis on the aspects which would differentiate weather derivative trading from that in other derivatives.

To cite an example, the FCRA Act (1952) defines goods as something which is deliverable. Due to this stringent definition, commodity exchanges are unable to deliver weather derivatives (Ravi Kumar, 2006).

Since weather derivatives trading has been in vogue for the last few years in the international markets, the regulations and policy aspects which exist in those exchanges were studied in order to extend the lessons learnt, to the Indian context.

The International Organization of securities commissions (IOSCO) has been providing international best practices and perspectives on derivatives markets. The IOSCO framework identifies the objectives of regulation in the securities and derivatives market – market efficiency and integrity, customer protection/fairness and financial integrity (IOSCO, 1996). These three objectives were kept in mind while studying the existing policy and regulatory frameworks for derivatives trading in India, and while considering recommendations for weather derivatives trading.
Part III

Traditionally, financial derivatives are priced using “no-arbitrage models” such as the Black-Scholes pricing model (Black and Scholes, 1973), which requires the underlying equity index to be traded. Since any weather index we discuss, will not be traded, no-arbitrage models cannot be directly applied to price weather derivatives.

There are, however, many models put forth for weather derivatives. Most of these are pricing models with payouts depending on temperature. Usually, historical data is used to suggest that the evolution of temperature is based on a stochastic process.

The Indian scenario would possibly warrant the use of an index based not on temperature, but on rainfall or, alternately, a composite index based on temperature and humidity or temperature and precipitation.

The third part of the proposed research was a study of a few existing models for pricing of weather derivatives and to see if these could be adapted to use composite indexes.

This assumes importance because, once properly constructed index contracts are in place, efficient pricing would be required. More importantly, at least in the initial stages of introduction of weather derivatives, a simple and easily understood method of pricing would be required.