

Improving Seasonal Hurricane Predictions

Seasonal hurricane predictions are a new resource for the insurance industry. Dr Mark Saunders of TropicalStormRisk.com points out that skills are improving and that forecasts offer sound future potential for reducing risk and uncertainty.

Hurricanes rank above earthquakes and floods as the USA's costliest natural disaster. The annual damage bill in the continental US from hurricane and tropical storm landfalls 1926-2000 is estimated to be US \$ 5.1 billion (2000 \$). Substantial interannual variability exists in these losses - witness 1999 and 1997 with bills of US \$ 8.0 billion and just US \$ 0.15 billion respectively.

The development of seasonal weather prediction is an innovation in meteorology. While conventional day-to-day weather forecasts have little value beyond a week, seasonal forecasts have the potential to give useful information many months ahead. Skilful long-range forecasts of seasonal US and Caribbean hurricane strike numbers would benefit insurers and reinsurers, as well as society and government by reducing the risk and uncertainty inherent to varying active and inactive tropical storm seasons.

Despite the obvious advantages that seasonal hurricane predictions can bring, the scientific technology remains at an early stage of development. Confidence in seasonal forecast accuracy needs building before insurance and reinsurance executives will employ them routinely in business decisions. The purpose of this commentary is to show the growing insurance interest in such forecasts, the increasing skills on offer, and the potential for further prediction improvement.

TropicalStormRisk

The inception of TropicalStormRisk.com (TSR) is an example of the growing interest and support insurance and risk management companies are giving to hurricane forecasting. TSR aims are to:

- Improve the accuracy and lead-time of seasonal tropical cyclone forecasts using new statistical and dynamical model techniques.
- Forecast landfalling events in addition to overall basin activity.
- Extend forecasts to new territories (eg southeast Asia and Queensland).
- Benefit business, government and society by reducing risk and uncertainty.

The TSR scientific grouping comprises climate physicists, meteorologists and statisticians at UCL (University College London) and the Met Office. The TSR sponsoring companies comprise the Royal and Sun Alliance insurance company, the Benfield Group, a leading independent global reinsurance and risk advisory company, and Crawford and Company, the world's largest independent provider of diversified services for insurance companies. These companies feel the forecasts offer real value since sharing forecasts with clients increases risk awareness and enables risk mitigation strategies to be developed. The sponsors also feel that supporting innovative research with long-term potential is sound public relations.

Prediction Skills

The true proof of a forecast is its long-term track record, but how can you judge the accuracy and usefulness of the TSR seasonal forecast models which have been operational only since 1998. One good result does not mean that the method is foolproof any more than one bad result means that it is useless. Even forecasts with limited skill can have useful commercial value. If a forecast is better than climatology (ie long-term average) only 6 years out of ten, an investor in a portfolio of weather derivatives should make money.

The skill of a forecasting model can be assessed by hindcasting, ie by computing what the model would have predicted in prior years had it been available at that time. A rigorous hindcast for say the 1990 hurricane season is built solely using data up to and including 1989; a hindcast for 1991 is

built only using data through 1990. The TSR web site (<http://tropicalstormrisk.com>) provides rigorous hindcast skill values, as a function of lead month, averaged for 1986 to 2000, for various storm and landfall strike categories in the Atlantic, Caribbean, NW Pacific and Australian-region basins. For Atlantic hurricanes, seasonal forecasts have useful skill from early April. This skill increases steadily as the main hurricane season start of 1st August approaches.

The TSR seasonal forecasts for the 2001 Atlantic season – now nearing its completion - have proved successful. The current seasonal activity for 2001 is 13 tropical storms with 7 of these being hurricane force and 3 intense hurricane force. These numbers are 10-20% above the 1991-2000 10-year average activity levels and match closely the TSR predictions for 2001 first made in November 2000 and updated in early June, July and August 2001. This success follows other accurate seasonal predictions for the 2000 NW Pacific typhoon season and the 2000/01 Australian cyclone season.

Future Prospects

The outlook is bright for further improvements to seasonal hurricane prediction skill. The progress to date has been rapid but considerable research and development is required for seasonal forecasting to achieve its full potential. For example, many of the basic mechanisms that determine the level of seasonal predictability are poorly understood. As the seasonal prediction skill for El Niño Southern Oscillation and tropical Atlantic and Caribbean sea temperatures – the main environmental factors influencing Atlantic hurricane activity – improve, so will the predictability of seasonal hurricane activity. Furthermore, since hurricane activity is affected by intraseasonal variations occurring on timescales from ~ 1 week to 6 weeks ahead, improved understanding and prediction of these intraseasonal variations will also benefit seasonal prediction skill.

In summary, seasonal hurricane skill is already significant at leads of a few months. There are sound grounds for expecting this skill to improve and extend as scientific understanding deepens. Enterprising insurance executives will be well advised to monitor developments in seasonal forecasting over the next few years.

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