Appendix C

State of New York Insurance Department

Hurricane Loss Analysis - Homeowners

Prepared by Applied Insurance Research, Inc.
for The State of New York Insurance Department

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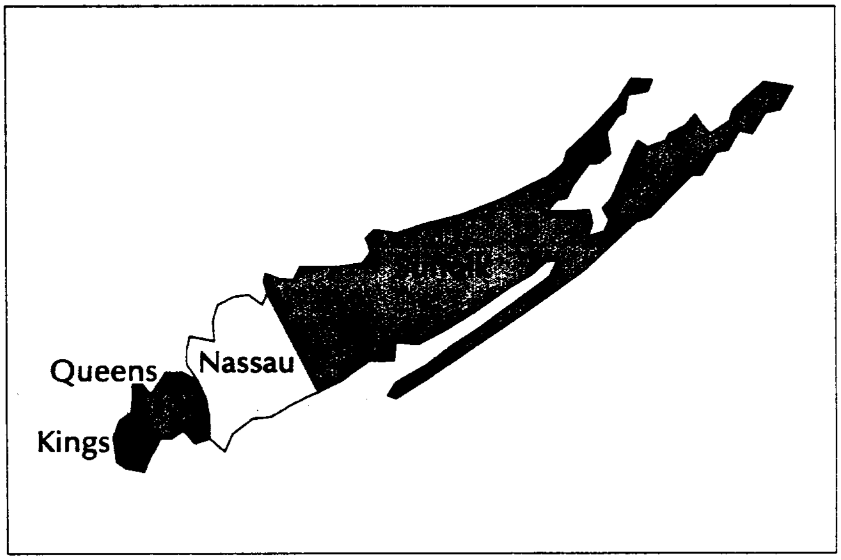
APPLIED INSURANCE RESEARCH

Boston · London · Seattle

Purpose

The State of New York Insurance Department (The Department) requested that Applied Insurance Research (AIR) provide an analysis of catastrophe losses to homeowner policies in Long Island, New York. Specifically, AIR was engaged to provide estimates of industry losses in Kings, Nassau, Queens, and Suffolk counties at various deductible levels and for various storm strengths at landfall, as defined by Saffir-Simpson category. Average annual aggregate loss estimates for the industry are presented with no deductible, a flat $1,000 deductible per policy, and at levels of 2 and 3 percent of building coverage deductibles per policy.



Distribution and Use

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Limitations

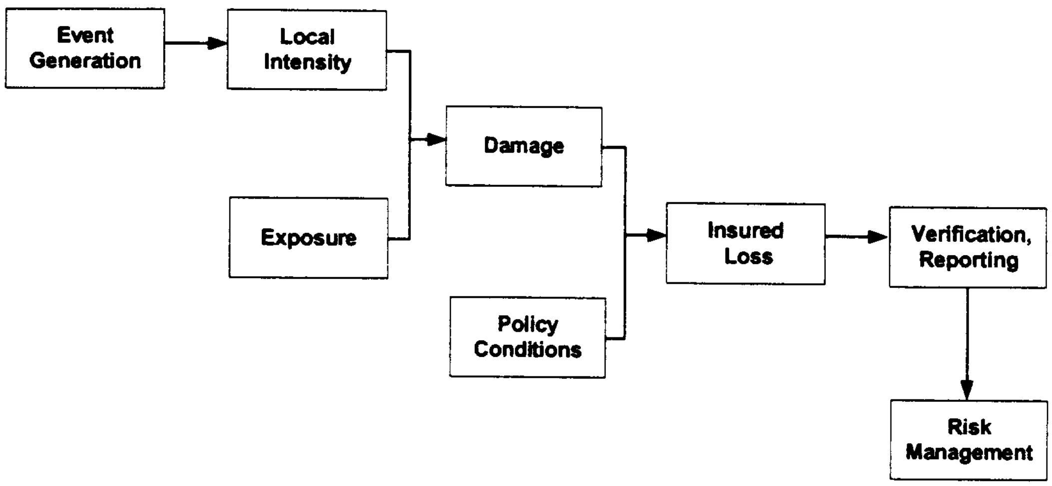
The loss estimates reported here were generated by AIR's sophisticated hurricane simulation model of weather-related natural hazards. This model is state-of-the-art and incorporates current knowledge in meteorology, wind engineering, and other related disciplines.

Although the simulation methodology is a superior technique for estimating potential catastrophe losses, it does have certain limitations. The methodology is based on mathematical/statistical models that represent real-world systems. As with all such models, these representations are not exact. The resulting loss estimates should be used only as one source of information with respect to potential hurricane losses.

AIR Catastrophe Simulation Models

AIR deploys state-of-the-art modeling technology based on sophisticated stochastic simulation procedures and powerful computer models of how hurricanes behave and act upon the man-made environment. The hurricane model undergoes a continual process of review, refinement, enhancement, and validation, and new models continue to be developed for additional perils and regions of the globe. The vigilance of the AIR multidisciplinary team of experts ensures that the models incorporate the latest advances in the scientific, engineering, and mathematical fields pertinent to their ongoing development.

The diagram below illustrates the component parts of the AIR hurricane model.



The event generation component of the model determines the frequency, magnitude, and other characteristics of potential hurricanes by geographic location. This requires, among other things, a thorough knowledge of the geological and/or topographical features of a region and an understanding of how these features are likely to influence the behavior of a hurricane. It also requires a painstaking familiarity with the characteristics of historical events within the region of interest.

After the model probabilistically generates the characteristics of a simulated hurricane, it propagates the event across the affected area. For each location within the affected area, local intensity is estimated. The intensity experienced at each site is a function of the magnitude of the event, distance from the source of the event, and a variety of local conditions. AIR researchers base their calculations of local intensity on actual observations and theoretical relationships among the variables.

AIR scientists and engineers have developed mathematical functions called damageability relationships, which describe the interaction between buildings, both their structural and nonstructural components as well as their contents, and the local intensity to which they are exposed. These functions relate the mean damage level as well as the variability of damage to the measure of intensity at each location. Because different structural types will experience different degrees of damage, the damageability relationships vary according to construction and occupancy. The AIR model estimates a complete distribution around the mean level of damage for each local intensity and each structural type, and from there constructs an entire family of probability distributions. Losses are calculated by applying the appropriate damage function to the replacement value of the insured property.

Founded on scientific theory and comprehensive databases, the AIR hurricane model is validated and calibrated through extensive internal and external peer review, postdisaster field surveys, detailed client data from actual events, and overall reasonability and convergence testing. The AIR hurricane and other windstorm models have been used by the insurance industry since 1987. These models are well known for their reliability and the credibility of the loss estimates generated by the models. The AIR hurricane model is approved by the Florida Commission on Hurricane Loss Projection Methodology, having met all standards established by the Commission. The AIR hurricane model has also been used by the Florida Hurricane Catastrophe Fund since the Fund's inception.

Description of Analysis

Since actual industry data was not available from The Department to estimate industry losses, AIR used its proprietary database of insured property values to estimate total insured property losses. This database reflects the total replacement cost of property exposures in the United States. For more detail on how this database was developed, please see Appendix A. Insured loss estimates are based on certain assumptions regarding insurance to value and the percentage of total properties that are insured.

For this analysis, AIR simulated 100,000 years of hurricane experience and superimposed this information on exposures representing homeowner policies as of 1997. At The Department's request, this study is limited to homeowner policies and does not include exposures for tenant and condominium policies. AIR estimated industry loss for the following four counties in New York state: Kings, Nassau, Queens, and Suffolk. AIR used a 100,000-year simulation in order to ensure that the model converges at the county level.

In order to evaluate results on the basis of storm strength, AIR evaluated the simulated hurricanes and their associated loss estimates by first separating them into two groups: hurricanes of Saffir-Simpson category 1 and 2 at landfall, and hurricanes of Saffir-Simpson category 3, 4, and 5 at landfall. Note that a hurricane's landfall is not necessarily located in the counties included in this analysis. Simulated hurricanes that made landfall outside of these counties, or in states other than New York, may have caused considerable losses in these counties. All such loss estimates are included in this analysis.

AIR used the model to measure the impact of deductibles on losses for counties included in the analysis. Loss estimates are based on industry exposures on a ground up basis, (without deductibles), and at the following three deductible levels: a fixed deductible of

$1,000 per policy, and at 2 and 3 percent of building insured limits. All deductibles were applied on a combined basis over all building, contents, appurtenant structures, and loss-of-use coverage amounts for each policy.

Results of Analysis

Based on exposure information and methods discussed above, the AIR hurricane model estimated 100,000 years of simulated hurricanes. Results of these estimated hurricanes are described below.

Long-term Average Hurricane Loss

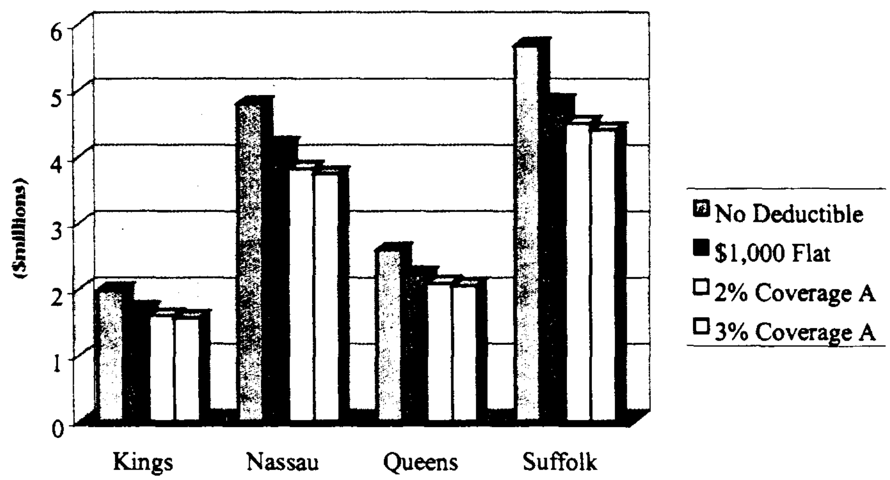
Average annual aggregate loss is the sum of losses over all simulated years divided by 100,000. Below is a table showing average annual aggregate losses by county, by storm strength, and by deductible scenario. Results have been shown for two separate categories: storms with a Saffir-Simpson category of 1 and 2 at landfall, and storms with a Saffir-Simpson category of 3, 4, and 5 at landfall. Under all deductible scenarios, Suffolk county has the highest average annual aggregate loss for all storm strengths. On average, stronger storms at landfall (Saffir-Simpson categories 3, 4, and 5) generate average annual aggregate losses 4 to 5 times greater than the weaker storms at landfall (Saffir-Simpson categories 1 and 2).

Average Annual Aggregate Homeowner Loss by County And Deductible Level for Saffir-Simpson Group ($thousands)

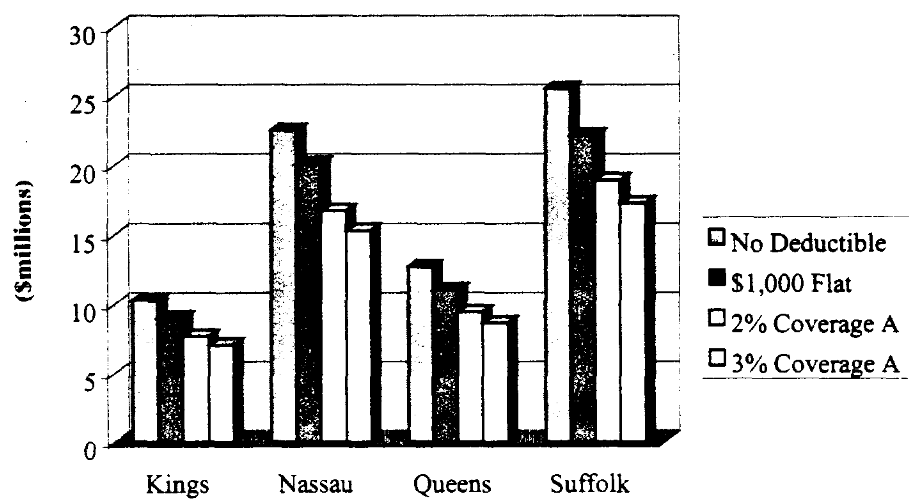
Saffir-Simpson Group	County in New York	No Deductible	Flat $1,000 Deductible	2 percent Coverage A Deductible	3 percent Coverage A Deductible
Categories 1 and 2	Kings	1,987	1,708	1,600	1,570
	Nassau	4,793	4,178	3,820	3,740
	Queens	2,592	2,231	2,093	2,054
	Suffolk	5,674	4,835	4,498	4,395
Categories 3, 4, and 5	Kings	10,310	9,025	7,681	7,058
	Nassau	22,561	20,158	16,757	15,346
	Queens	12,724	11,078	9,424	8,656
	Suffolk	25,576	22,196	18,958	17,311

The graphs below depict the effect of different deductible levels on loss estimates for each county at the two landfall storm strengths.

Average Annual Aggregate Loss by County
Storms of Saffir-Simpson Category 1 and 2 at Landfall



Average Annual Aggregate Loss by County
Storms of Saffir-Simpson Category 3, 4, and 5 at Landfall



Probability Distributions of Hurricane Losses

Average annual loss amounts show the long-term expected amount of loss. The measure of risk from catastrophic losses is best gauged, however, by a thorough examination of the full probability distribution of losses. The exhibits in Appendix B show the estimated probability distributions of annual aggregate losses for homeowner policies in the New York State counties of Kings, Nassau, Queens, and Suffolk. For each county, two probability distributions of annual aggregate losses were calculated, one for each storm strength group (SS category 1 and 2 at landfall and SS category 3, 4, and 5 at landfall). Separate analyses were performed for losses with no deductible, a flat $1,000 deductible for each policy, and deductibles of 2 and 3 percent of building limits applied on a combined basis over all coverages per policy. The annual aggregate loss estimates show the probabilities of exceeding an amount of loss in any given year.

In the tables, probabilities of exceedance are expressed as return periods, which may be interpreted as follows.

10-year loss: Probability of exceedance, 0.100. The loss likely to be exceeded 10 percent of the time, or once every 10 years. It represents the 90th percentile of the annual loss distribution. In a 100,000-year simulation, it is the 10,000th worst simulated loss, being exceeded in 9,999 years.

20-year loss: Probability of exceedance, 0.050. The loss likely to be exceeded 5 percent of the time, or once every 20 years. It represents the 95th percentile of the annual loss distribution. In a 100,000-year simulation, it is the 5,000th worst simulated loss, being exceeded in 4,999 years.

50-year loss: Probability of exceedance, 0.020. The loss likely to be exceeded 2 percent of the time, or once every 50 years. It represents the 98th percentile of the annual loss distribution. In a 100,000-year simulation, it is the 2,000th worst simulated loss, being exceeded in 1,999 years.

100-year loss: Probability of exceedance, 0.010. The loss likely to be exceeded 1 percent of the time, or once every 100 years. It represents the 99th percentile of the annual loss distribution. In a 100,000-year simulation, it is the 1,000th worst simulated loss, being exceeded in 999 years.

250-year loss: Probability of exceedance, 0.004. The loss likely to be exceeded 0.4 percent of the time, or once every 250 years. It represents the 99.6th percentile of the annual loss distribution. In a 100,000-year simulation, it is the 400th worst simulated loss, being exceeded in 399 years.

500-year loss: Probability of exceedance, 0.002. The loss likely to be exceeded 0.2 percent of the time, or once every 500 years. It represents the 99.8th percentile of the annual loss distribution. In a 100,000-year simulation, it is the 200th worst simulated loss, being exceeded in 199 years.

1,000-year loss: Probability of exceedance, 0.001. The loss likely to be exceeded 0.1 percent of the time, or once every 1,000 years. It represents the 99.9th percentile of the annual loss distribution. In a 100,000-year simulation, it is the 100th worst simulated loss, being exceeded in 99 years.

Average loss: The long-term average loss is calculated by summing aggregate losses for all the simulated years and dividing by 100,000.

Since losses for each county are sorted independently, the event causing a particular return-period loss for one county may not be the same event causing the corresponding return-period loss for a different county, which may not be the same event causing the corresponding return-period loss for the four counties combined. Therefore, at any given estimated return period, the sum of the losses for the various counties does not equal the loss for the four counties combined at that same estimated return period.

Other Issues

In performing this analysis, certain assumptions were made with respect to exposures and losses. These assumptions and their potential impact are outlined below.

Level of Insurance

The AIR model uses industry property values that reflect the full replacement cost of the coverage. In calculating insured industry losses, adjustments are made on a gross basis for exposures that are not insured fully to value and for exposures that are not insured at all. These adjustments are typically made at the countrywide level. To the extent Long Island exposures differ from countrywide averages with regard to insurance-to-value and percentage of property insured, the results will vary. More detail can be incorporated in our analysis based on survey results if the state can provide such information.

Storm Surge

Loss amounts due to storm surge are not included in this analysis. Major flooding is often experienced in coastal areas in conjunction with hurricanes. After a storm it is difficult to estimate how much damage was due to wind and how much was due to water. While storm surge losses are not technically covered by standard residential policies, the AIR model can simulate storm surge losses and estimates that private insurers pay a small percentage of these losses. Because of very low elevations in certain geographical areas, storm surge may potentially contribute to loss amounts in Long Island.

Post Event Inflation – Demand Surge

Loss amounts due to demand surge are not included in this analysis. After a major catastrophe event, the forces of supply and demand come into play and prices may experience temporary inflation. This phenomenon is often referred to as demand surge. There are few historic data points by which to validate the impact of demand surge. The demand surge in Hurricane Andrew has been estimated to be 8-12%. Although AIR models can accommodate a demand surge function, the estimates in this analysis exclude the impact of demand surge.

Economic Loss

The estimates included in this report reflect insured losses. Estimates of total economic losses relative to insured losses range from 5 to 1 for small events to slightly less than 2 to 1 for severe events. For example, the insured losses from hurricane Andrew were approximately $16.5 billion. Estimates of total economic losses range from $25 to $30 billion.

NOTE TO READERS: *The following two appendices are part of the report prepared by Applied Insurance Research. They should not be confused with the four appendices that supplement the Temporary Panel's Report.*

Appendix A

AIR Database of Insured Property Values

AIR has developed unique, proprietary databases of numbers and values of residential and commercial properties by postal code for the United States, Canada, the Caribbean, and ten European countries. These databases are developed, maintained and enhanced through an ongoing process of data collection, synthesis, analysis, and validation. These databases are utilized within the AIR simulation models of hurricanes, tornadoes, hailstorms, other windstorms, winterstorms, and earthquakes, to develop the underlying natural hazard loss files that form the core of AIR's industry loss estimates.

For each country or region, demographic, statistical, and construction data is collected to the finest degree of resolution available. For example, U.S. data is collected at the five-digit zip code level. Much of this data is acquired annually from government statistical agencies or private firms that specialize in this type of information. For example, primary data sources in the United States include the U.S. Census Bureau, Dun & Bradstreet, Claritas, and R.S. Means. Most data sources update their information annually.

While our data sources are extensive, rarely is the exact information available for the geographical resolution required. Therefore, AIR has developed internal processes that turn the collected raw data for each county into the required exposure estimates. These processes include cross-verifying the information between sources, combining data from multiple sources, and performing appropriate allocations or aggregations of data.

Finally, individual insurance company data is used to validate the AIR proprietary databases. It is important to note that we do not use our client company data to create our databases, but only to verify it. For example, in the U.S., the AIR client base accounts for over 40 percent of the total property market. This client data provides a large statistical sample against which our total estimated exposure figures can be tested.

In summary, the AIR databases of property values have been developed and refined over many years. They incorporate all available statistical, demographic, and construction data, and this data is updated annually. Validation tests using actual property value data consistently show that our methodology and exposure estimates are very reliable and credible.

Appendix B – Probability Distributions

Exhibit I

Industry Hurricane 100,000 Simulated Years by Saffir-Simpson Category

Kings County, New York

Probability Distribution of Annual Aggregate Losses*

(Estimated Long-Term Average Frequency of Occurrence)

Saffir-Simpson 1 and 2

Estimated Average Return Period (yrs)	No Deductible	$1,000	2% Coverage A	3% Coverage A
10	0	0	0	0
20	0	0	0	0
50	9,558	6,193	5,591	5,528
100	50,257	45,351	44,735	44,313
250	146,501	133,514	131,707	130,391
500	245,993	212,426	204,515	201,684
1,000	356,960	295,573	267,670	263,373
Estimated Average Aggregate Loss	1,987	1,708	1,600	1,570

Saffir-Simpson 3, 4 and 5

Estimated Average Return Period (yrs)	No Deductible	$1,000	2% Coverage A	3% Coverage A
10	0	0	0	0
20	0	0	0	0
50	44,246	39,090	38,515	38,155
100	238,526	206,354	199,830	197,806
250	695,062	572,625	442,892	403,626
500	1,175,032	999,800	749,877	636,247
1,000	1,718,585	1,513,985	1,186,651	996,521
Estimated Average Aggregate Loss	10,310	9,025	7,681	7,058

* In thousands.

Notes:

(1) Based on 1997 residential homeowner policy industry exposures.
Exposures for tenant and condominium policies are not included.

(2) Simulated loss amounts do not reflect any loss amounts due to storm surge.

Exhibit II

Industry Hurricane 100,000 Simulated Years by Saffir-Simpson Category

Nassau County, New York

Probability Distribution of Annual Aggregate Losses*

(Estimated Long-Term Average Frequency of Occurrence)

Saffir-Simpson 1 and 2

Estimated Average Return Period (yrs)	No Deductible	$1,000	2% Coverage A	3% Coverage A
10	0	0	0	0
20	0	0	0	0
50	31,554	26,795	25,850	25,573
100	136,957	126,653	124,809	123,586
250	350,594	313,678	300,261	297,174
500	563,071	483,140	437,774	431,367
1,000	773,301	656,943	544,731	528,463
Estimated Average Aggregate Loss	4,793	4,178	3,820	3,740

Saffir-Simpson 3, 4 and 5

Estimated Average Return Period (yrs)	No Deductible	$1,000	2% Coverage A	3% Coverage A
10	0	0	0	0
20	0	0	0	0
50	135,617	124.864	123,009	121,808
100	588,721	500.558	453,096	444,110
250	1,505,847	1,292.859	954,041	843,372
500	2,424,003	2,135,708	1,594,935	1,338,582
1,000	3,644,157	3,341,601	2,639,291	2,265,984
Estimated Average Aggregate Loss	22,561	20.158	16,757	15,346

* In thousands.

Notes:

(1) Based on 1997 residential homeowner policy industry exposures.
Exposures for tenant and condominium policies are not included.

(2) Simulated loss amounts do not reflect any loss amounts due to storm surge.

Exhibit III

Industry Hurricane 100,000 Simulated Years by Saffir-Simpson Category

Queens County, New York

Probability Distribution of Annual Aggregate Losses*

(Estimated Long-Term Average Frequency of Occurrence)

Saffir-Simpson 1 and 2

Estimated Average Return Period (yrs)	No Deductible	$1,000	2% Coverage A	3% Coverage A
10	0	0	0	0
20	0	0	0	0
50	13,423	8,865	8,123	8,009
100	71,809	65,051	64,219	63,603
250	194,118	174,499	171,152	169,437
500	308,883	266,795	255,109	252,438
1,000	436,642	367,506	328,360	320,632
Estimated Average Aggregate Loss	2,592	2,231	2,093	2,054

Saffir-Simpson 3, 4 and 5

Estimated Average Return Period (yrs)	No Deductible	$1,000	2% Coverage A	3% Coverage A
10	0	0	0	0
20	0	0	0	0
50	61,964	55,900	55,179	54,655
100	303,243	262,334	250,964	247,124
250	887,901	732,435	573,038	520,000
500	1,465,065	1,246,337	955,485	815,067
1,000	2,184,533	1,921,435	1,538,956	1,315,597
Estimated Average Aggregate Loss	12,724	11,078	9,424	8,656

* In thousands.

Notes:

(1) Based on 1997 residential homeowner policy industry exposures.
Exposures for tenant and condominium policies are not included.

(2) Simulated loss amounts do not reflect any loss amounts due to storm surge.

Exhibit IV

Industry Hurricane 100,000 Simulated Years by Saffir-Simpson Category

Suffolk County, New York

Probability Distribution of Annual Aggregate Losses*

(Estimated Long-Term Average Frequency of Occurrence)

Saffir-Simpson 1 and 2

Estimated Average Return Period (yrs)	No Deductible	$1,000	2% Coverage A	3% Coverage A
10	0	0	0	0
20	977	305	171	167
50	72,133	64,453	63,386	62,769
100	190,870	170,809	165,128	162,691
250	381,176	323,386	300,464	293,188
500	513,091	424,897	377,613	364,405
1,000	639,181	519,211	445,893	428,067
Estimated Average Aggregate Loss	5,674	4,835	4,498	4,395

Saffir-Simpson 3, 4 and 5

Estimated Average Return Period (yrs)	No Deductible	$1,000	2% Coverage A	3% Coverage A
10	0	0	0	0
20	0	0	0	0
50	290,631	252,524	233,649	227,736
100	818,368	672,931	556,647	513,120
250	1,598,631	1,363,999	1,084,509	947,385
500	2,257,743	1,967,347	1,610,393	1,405,971
1,000	3,369,553	3,030,305	2,546,711	2,242,717
Estimated Average Aggregate Loss	25,576	22,196	18,958	17,311

* In thousands.

Notes:

(1) Based on 1997 residential homeowner policy industry exposures.
Exposures for tenant and condominium policies are not included.

(2) Simulated loss amounts do not reflect any loss amounts due to storm surge.

About Applied Insurance Research

Applied Insurance Research, Inc. (AIR) is the premier provider of global catastrophic risk assessment and management technologies to the insurance and financial service industries. Founded in 1987, AIR employs an impressive, highly trained professional staff spanning many disciplines and geographical regions of the world. Our scientists, engineers, mathematicians, actuaries, and software professionals continually enhance the state of the art technologies that we pioneered. More than 30 percent of AIR's professional staff hold Ph.D. credentials in their fields of expertise.

More than ten years of dedicated effort and experience have resulted in long-standing relationships with most of the world's leading property insurers and reinsurers and many other financial institutions. AIR's CATMAP® system is currently used by more than 80 reinsurers worldwide who represent approximately 85 percent of the total U.S. catastrophe reinsurance capacity. AIR's CATRADER® system is used by primary insurance companies, reinsurers, reinsurance and financial intermediaries. AIR also provides catastrophe loss analysis services to approximately 100 primary insurance companies, collectively representing over 50 percent of the total U.S. property market. AIR also provides catastrophe loss analysis services to 14 of the Coastal FAIR and Beach Plans in the United States, the Insurance Research Council, the Insurance Institute for Property Loss Reduction, and state agencies, such as the Florida Hurricane Catastrophe Fund and the Hawaii Hurricane Relief Fund.
