RMS® CCRA® Training Program
Flood Modeling Exercise

ANSWER KEY

Learning Objectives:

The purpose of this exercise is to examine the spatial correlations inherent in modeling of flood risk, using four locations in the United Kingdom as examples. At the end of the exercise you will have learned:

- How correlation of flood losses is modeled through the stochastic event set
- How data quality (including geocoding resolution, occupancy, and number of stories) impacts flood risk assessment

In addition to the exposure overview included with this handout, you have been provided an Excel file *(Flood Exercise Results.xlsx)* containing all of the analysis data necessary to answer the questions.

Exposure Overview

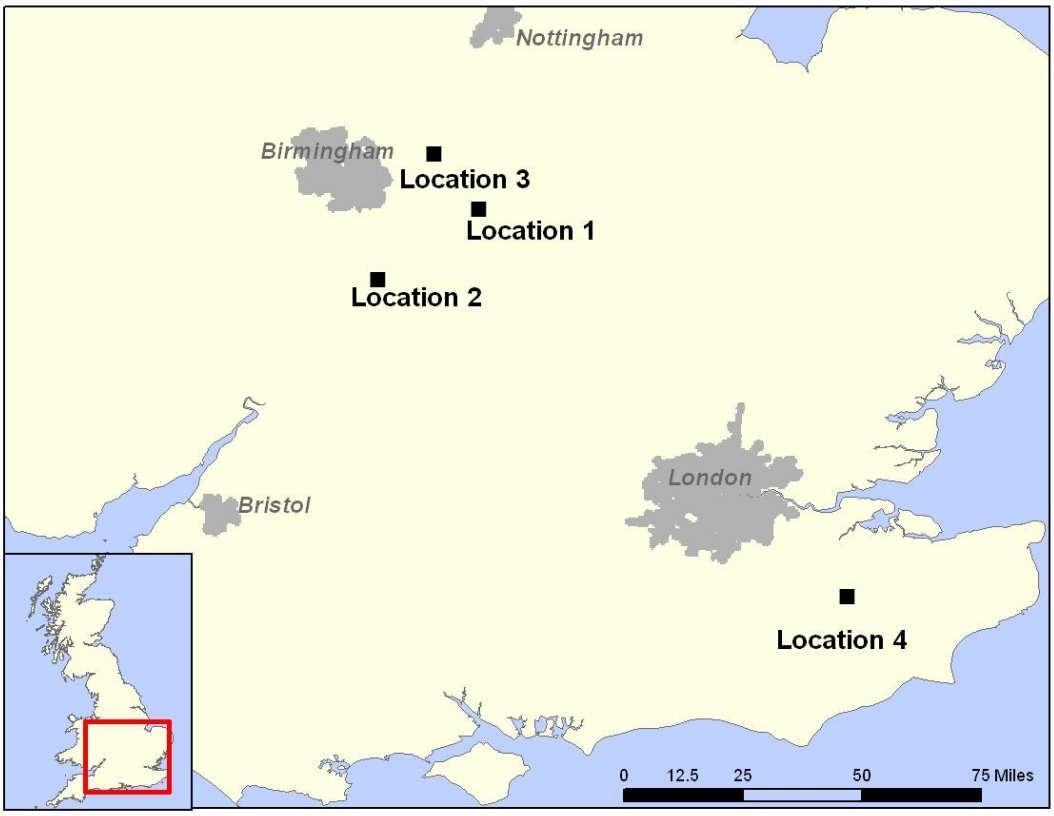
For this exercise, you will be examining flood analysis results for four locations in England. All locations are geocoded at high resolution (full postal code), and all have identical financial structures, as follows:

Building Value: £1,000,000
Contents Value: £250,000
Time Element Value: £100,000
Site Deductible: £500

You may assume that limits equal values (ITV=100%). Construction, Occupancy, Year Built, and Number of Stories are all unknown.

We have entered and run the four locations in the RMS U.K. River Inland Flood Model, and copied the RiskLink® output to the Excel file provided. An overview of each location is shown in the table and map that follow.

	Base Location 1	Location 2	Location 3	Location 4
City	Rugby	Stratford Upon Avon	Nuneaton	Tonbridge
County	Warwickshire	Warwickshire	Warwickshire	Kent
Postcode	CV21 1ES	CV37 8PW	CV10 0RX	TN12 9QX
CRESTA	CV	CV	CV	TN



Part 1: Correlation Between Locations

Assume you have already underwritten the base location, and you are now considering the three other locations to take on as additional risks within a hypothetical book of business. Review the various EP combinations, pure premium, and statistics provided in the Excel file on the Gross Results tab.

1. Which of the other locations (location 2, 3, or 4) provides the greatest diversification benefit at the 250-year and 500-year return periods? Explain your answer.

   Answer: *Location 4, which is the furthest from location 1 and on a different river system.*

2. Which of the other locations provides the least diversification benefit (i.e. is most highly correlated with the base location)?

   Answer: *Location 2.*

3. Which location is closest to the base location?

   Answer: *Location 3.*

4. Based on your answers to questions 1-3, list two factors that could explain the levels of correlation observed between the four locations?

   Answer: *Proximity and river system.*

Review the event loss table (ELT), which includes all events that generate loss for at least one of the four locations (Gross ELT tab), and then answer the following questions.

5. The ELT is sorted from highest to lowest loss, based on results for the base location (location 1). How is the level of correlation between locations evident through the ELT?

   Answer: *The lower the correlation the greater the difference between the losses from common events and other events.*

6. None of the four locations generate significant losses below the 100-year return period. Review the ELT for location 1 at losses in the 100-year return period range (~£200,000). What pattern do you observe? List at least one reason that could explain this pattern based on the anatomy of flood events.

   Answer: *Losses jump from* £1,126 to *£262,185. This dramatic "spike" in loss levels may be explained by the fact that an individual location may cross an elevation threshold for flood waters, and local flood defenses may be breached.*

Part 2: Data Quality

The following questions re-examine the analysis of the base location (location 1) under different assumptions. Pure premium and EP results under these varying assumptions are included on the Base Loc Data Quality tab.

7. How do the results for the base location change if we know that its occupancy is residential single-occupancy or multi-occupancy? What happens when we constrain multi-occupancy to three stories? What could explain these relativities compared to the unknown case?

   Answer: *Losses, particularly for contents, are higher for low-rise buildings vs. high-rise buildings because a larger percentage of the value is exposed to damage. Losses for single-occupancy are therefore higher than losses for multi-occupancy as the assumption is that multi-occupancy buildings may be high-rises. However, when we constrain the height of the multi-occupancy building to three stories, the losses increase when compared to multi-occupancy with an unknown height. The implication is that most multi-occupancy buildings are greater than three stories tall. In addition to building height, it is important to note that the nature of the contents can also make them more or less susceptible to damage.*

8. How do the results for the base location change if we only know the postcode sector (CV21 1)? What happens to the standard deviation?

   Answer: *The losses decrease dramatically when only postcode sector is known. The location under consideration is actually in the flood plain whereas most of the rest of the sector is outside the flood plain. The average risk for the sector is considerably lower than for the specific property due to its location in the flood plain.*

9. Based on the previous two questions, how would you prioritize data collection among these elements (geocoding resolution, occupancy class, number of stories) for the purpose of flood risk analysis?

   Answer: 1) *Geocoding resolution, 2) number of stories, and 3) occupancy class.*