



**ERGO Center of
Excellence in Insurance**

Eine Einrichtung der TUM gefördert von der ERGO Group

Ausschreibung für eine Praxis-Masterarbeit im Bereich Finanz- und Versicherungsmathematik: „Natural Catastrophe Modelling for Marine insurance“

Insurance companies buy natural catastrophe reinsurance cover to be protected against perils like storm, flood and earthquake. In severe events, these perils trigger significant insured losses in a wide geographical area at the same time. The necessary protection decisions of the management of insurance companies are supported by outputs from vendor models of specialized NatCat modelling companies such as RMS or AIR or by own internal models.

Storm surge (“Sturmflut”) as a peril is not an insured peril for the standard property insurance policies in Germany (e.g. “Wohngebäudeversicherung”) and hence assessed as a side peril only without detailed analysis on its accumulation impact. However, Storm surge is insured in the United Kingdom as well as in Marine insurance (“Transportversicherung”) where loss or damage of ships, cargo, terminals and goods in various storage locations is covered.

ERGO is one of the leading Marine insurers in Germany with insured values in Hamburg, Bremerhaven, Emden, Rotterdam and Antwerp and at various other locations along the North Sea coast. Unfortunately, there is no explicit stochastic NatCat model available to determine the loss accumulation potential arising from extreme storm surge events affecting several locations. In order to understand the occurrence probability and loss potential of a worst-case scenario for such events, the K.A.R.L. (“Köln.Assekuranz.Risiko.Lösungen”) solution models a 200-year metrological storm surge event combined with a catastrophic failure of coast protection measures. However, it remains challenging to accurately specify dependencies between losses in different locations in an accumulation scenario and the marginal distributions of coast protection failure events (as no such event has been observed historically).

The aim of this Master thesis is to use methods from the field of multivariate extreme value theory in order to model the exposure of ERGO’s Marine portfolio in a storm surge accumulation scenario. Data on the underlying portfolio and insights into the current modelling approach will be provided.

Classically, the analysis of extreme flood events has given rise to the mathematical field of extreme value theory (EVT). For the problem at hand, the methodology of EVT will be used to analyze both the underlying marginal distribution of water levels for extreme storm surge events and the dependence of such events at different locations along the North Sea coast. Sources regarding the methodology include:

- De Haan & De Ronde (1998). *Sea and wind: Multivariate extremes at work*. Extremes, 1(1), 7–45.
- De Valk, (1994). *Selection of storm events and estimation of exceedance frequencies of significant wave height for five north sea locations*. H1931.
- Embrechts, Klüppelberg, & Mikosch (2013). *Modelling extremal events: For insurance and finance*. Springer Science & Business Media.

Note: This thesis is offered in cooperation with ERGO including its subsidiary Köln Assekuranz, thus it will include the opportunity to collaborate with and present your results to their experts in Düsseldorf and Cologne. An internship at ERGO (in Düsseldorf or via home office due to the coronavirus situation) as part of your thesis is appreciated, but not required.

Are you interested in this Master thesis? Please send your application to:

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