

# **Holländische Deiche und Finanzkrisen**

**Paul Embrechts**

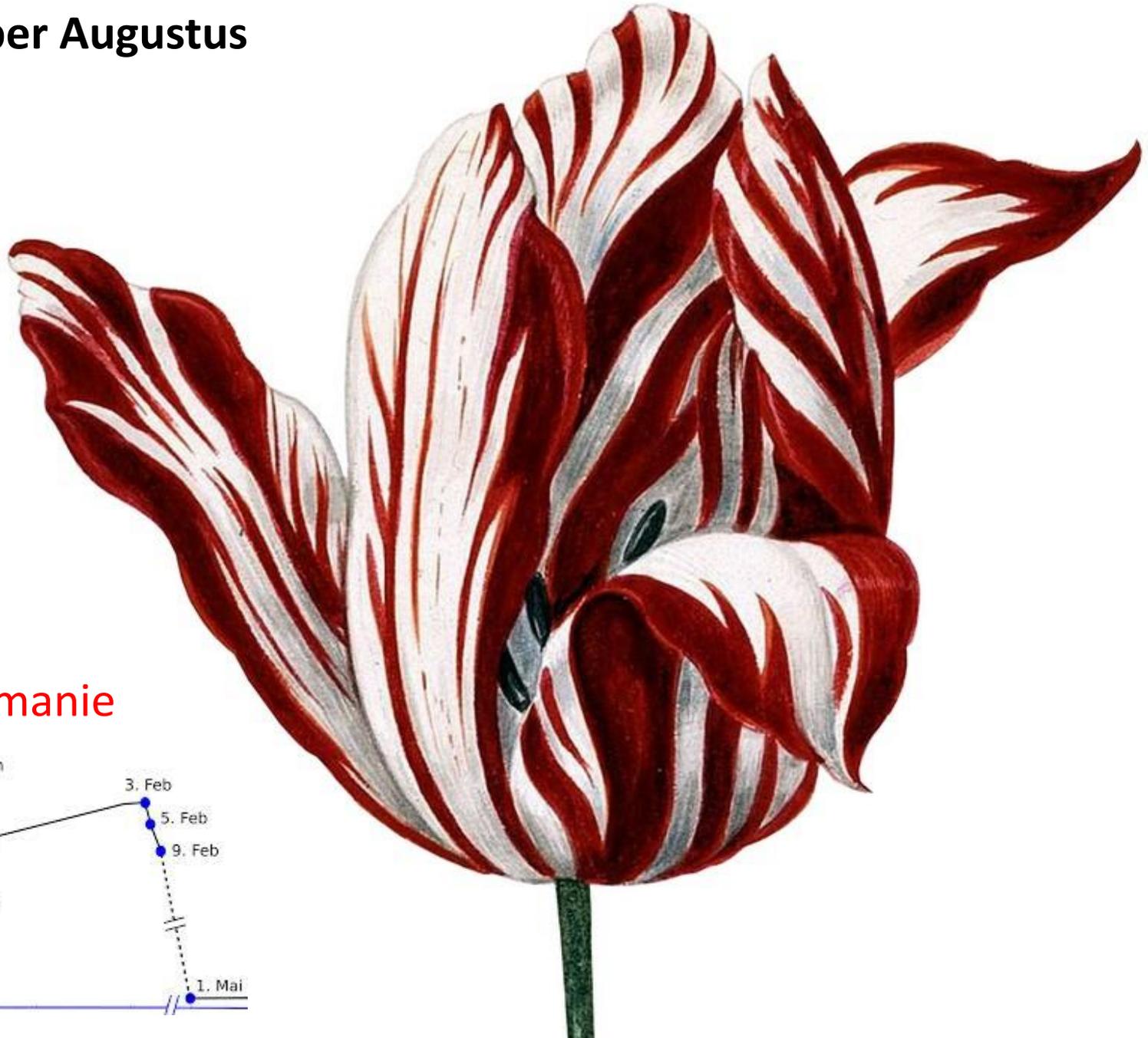
**RiskLab, Departement Mathematik  
und ETH Risk Center**

**Emeritenstamm, Winterthur, 27/1/2020**

**Semper Augustus**



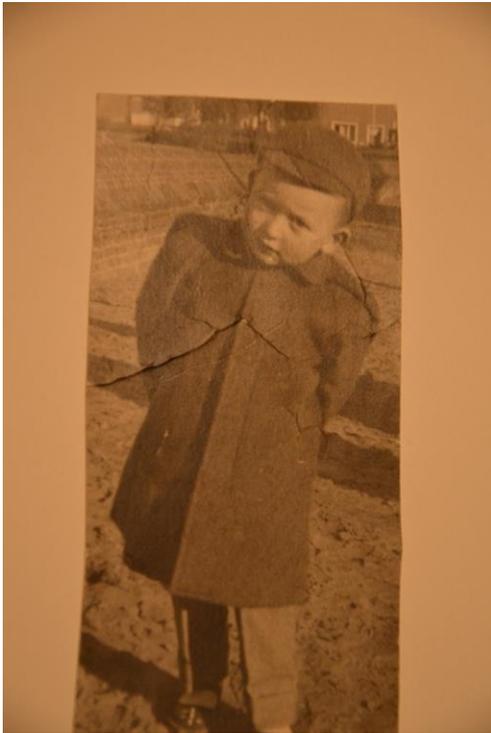
# Semper Augustus



## Tulpenmanie



# Schoten (Antwerpen) in Belgien



Schoten (Antwerpen)  
Geb. **3/2/1953**

Relevanz?

Hilversum Radio, Samstag **Januar 31, 1953**, in den Radio-Nachrichten von 18 Uhr wurde landesweit folgender Wortlaut ausgestrahlt:

- **(KNMI)**: “Über dem nördlichen und westlichen Teil der Nordsee wütet ein schwerer Sturm von Nord-Nord-West. Das Sturmgebiet breitet sich weiter über die nördliche und östliche Nordsee aus.” ...
- **Kurz nach Mitternacht**, um 00:44 Uhr des **1. Februar** 1953, war Fluthochstand, drei Stunden später entwickelte sich eine **Springflut**.
- Um 03:24 Uhr wurde in Vlissingen der höchste Wasserstand mit **4.55 Metern über N.A.P.** gemessen.
- Insgesamt brachen in dieser Nacht 89 Deiche auf einer Strecke von 187 Kilometern.



**31/1 – 1/2/1953 Flutkatastrophe**  
Insgesamt kamen bei der Katastrophe  
2408 Menschen ums Leben ( ... )

# Nieuwekerk a/d IJssel (- 6.76 m unter N.A.P.) Schielands Hoge Zeedijk



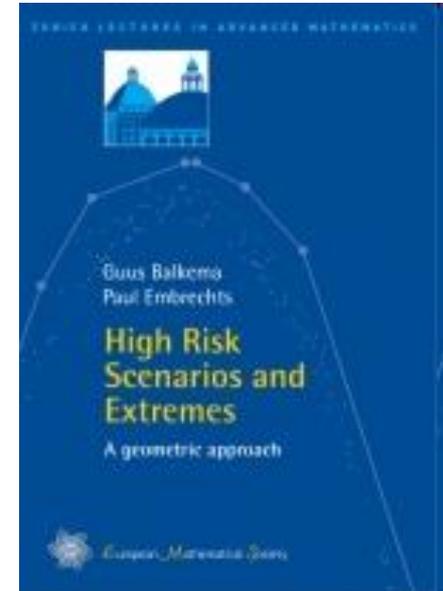
Schoten

↑ 1953: N.A.P. + 4.55 m



PE

N.A.P. (\*)



Guus Balkema

\* Amsterdamer Normalnull

Aber wie ist eine solche  
Katastrophe in Zukunft zu vermeiden?



## Mandate for the **First Delta Committee**:

“... which **hydraulic engineering works** should be undertaken in relation to those areas ravaged by the storm surge, (and) also to consider whether **closure of the sea inlets** should form one of these works ...”

(**February 1953**, Dutch Minister of Transport and Public Works)

## Abschlussdeich Zuiderzee (1918-1933)

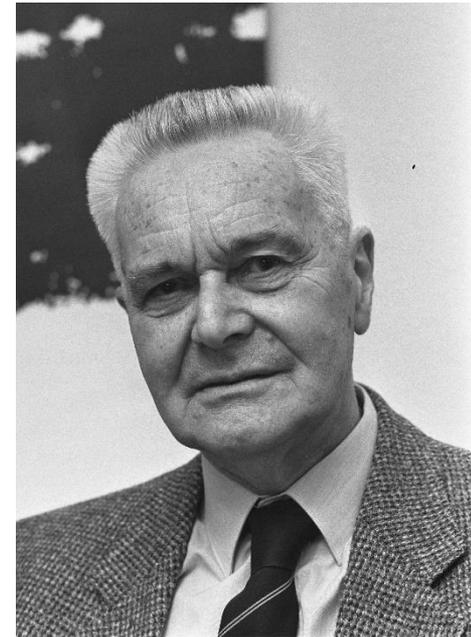


H.A. Lorentz  
(1853-1923)  
Theoretischer  
**Physiker**  
Nobel (1902)

## Delta(1)werke (1953-1986)



David van Dantzig  
(1900-1959)  
Mathematiker  
**Statistiker**



Jan Tinbergen  
(1903-1994)  
Mathematiker  
**Ökonom**  
Nobel (1969)



# Ein Beispiel: Der Oosterscheldeweehr (\*)



(\*) In 1995 erstellte die American Society of Civil Engineers eine Liste der Sieben Wunder der modernen Welt:

**#2 “Die Deltawerke und Zuiderzeewerke”**



## Der Oosterscheldeweehr “Neeltje Jans”



1960 bis 4/10/1986(!)

# Der Oosterscheldeweehr



Sturmflutwehr aber ...



Ökologisch  
verantwortungsvoll

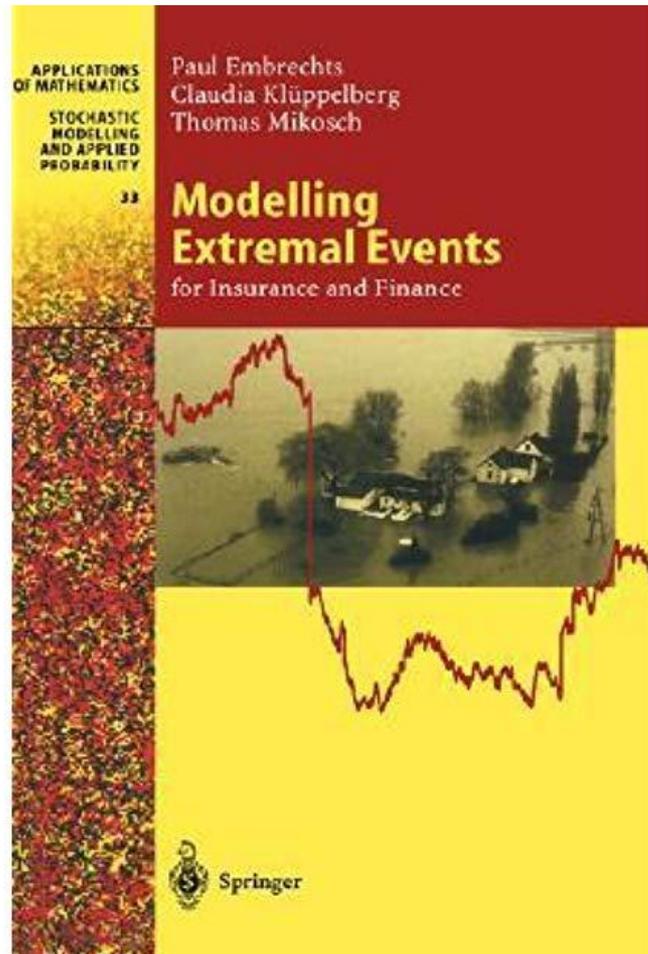
Königin Beatrix der Niederlande  
am 4. Oktober 1986:

“De stormvloedkering is  
gesloten. De Deltawerken zijn  
voltooid. Zeeland is veilig.”

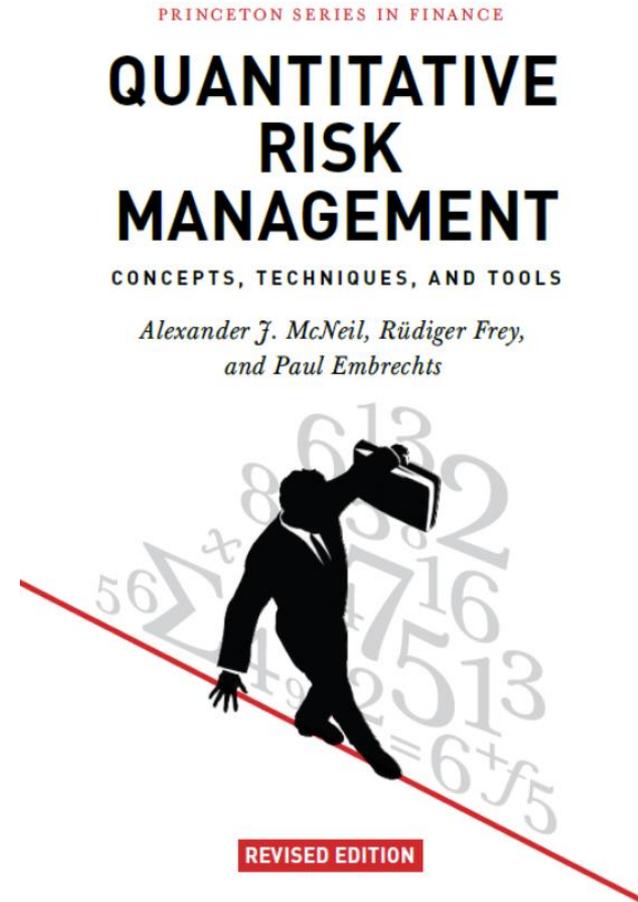


# Mathematische Forschung:

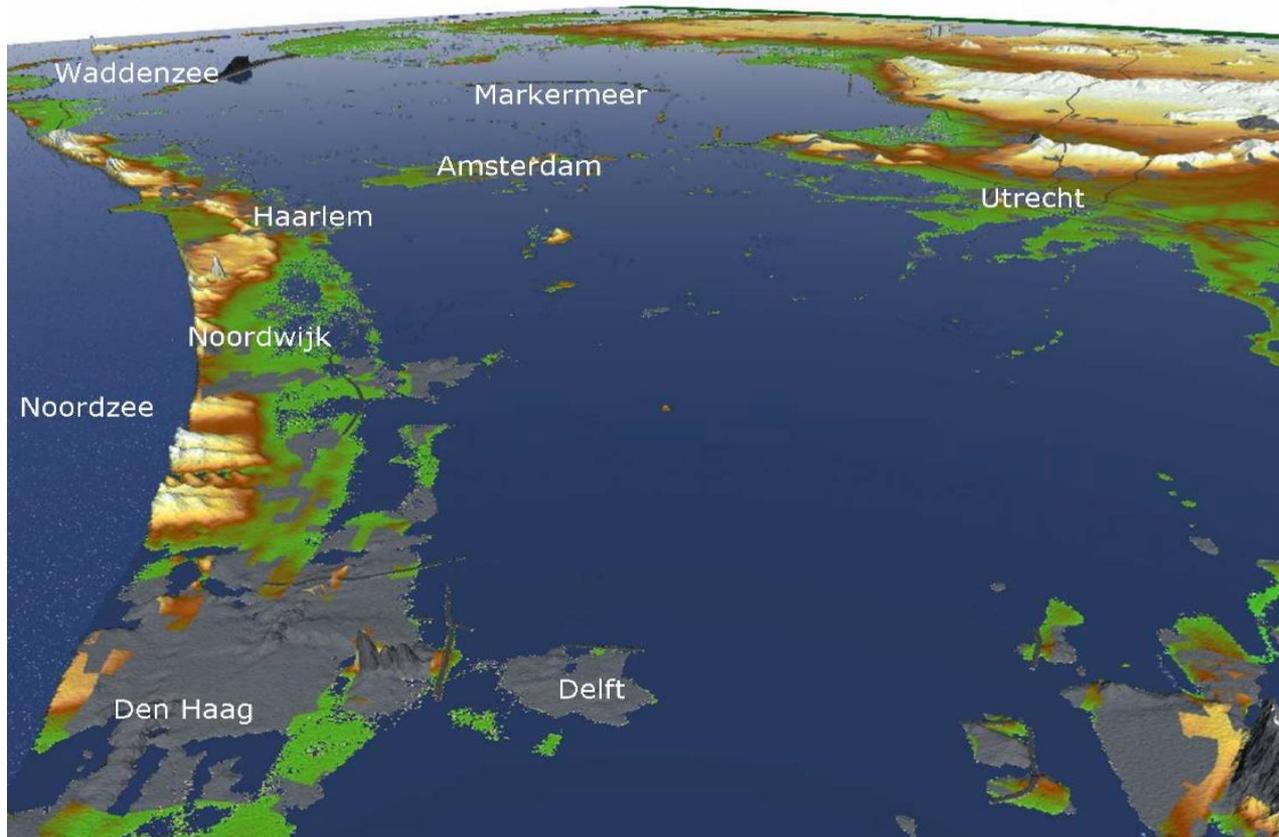
1997



2005 und 2015



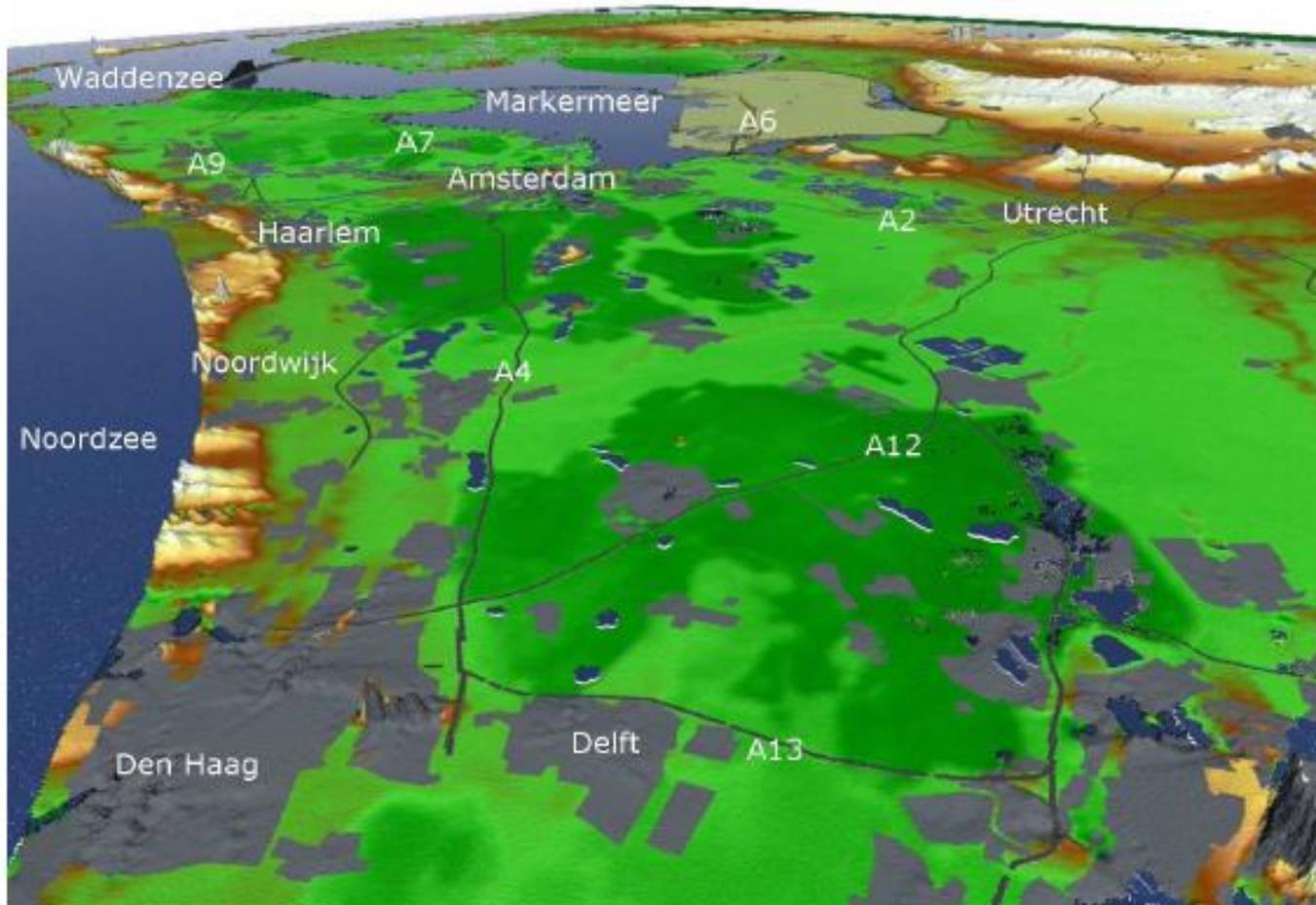
# Die Niederlande ohne Deiche



21% Bevölkerung  
26% Fläche

Henk van den Brink, KNMI, **Fighting the arch-enemy with mathematics** and **climate models**.

# Die Niederlande mit Deiche



Wie weiter: 1/10 000 → 1/100 000 ?  
Treibhausgase und Meereseerwärmung!

(Henk van den Brink, KNMI)

## Mandate for the **Second Delta Committee (2007)**:

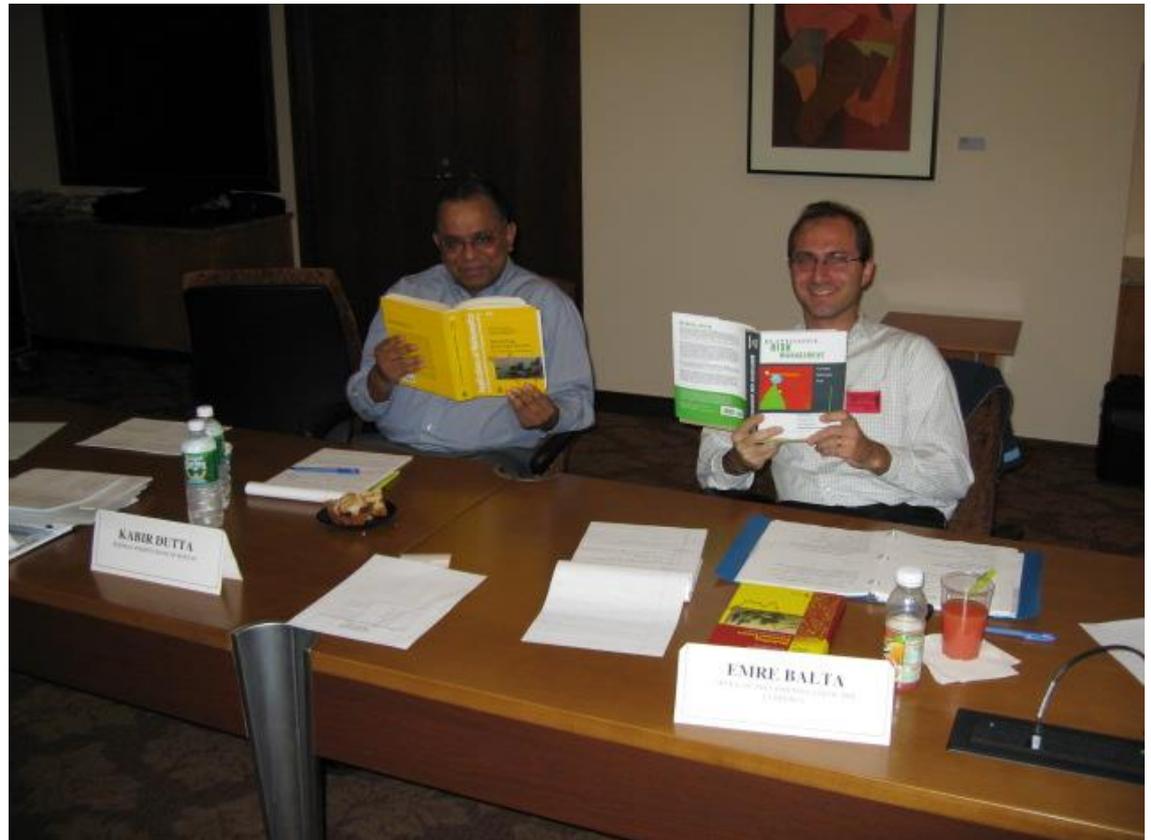
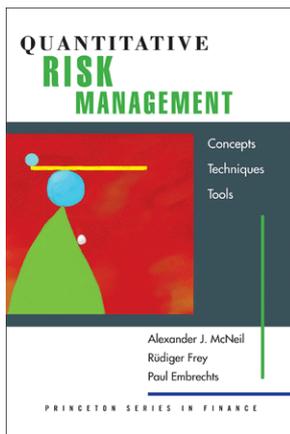
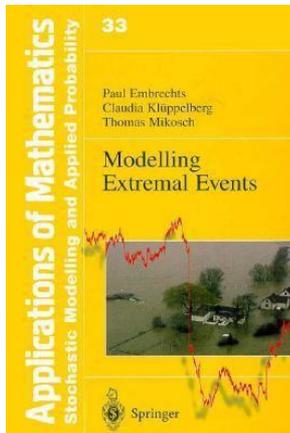
The government asked the Delta Committee to come up with recommendations on how to protect the Dutch coast and the low-lying hinterland against the consequences of **climate change**. The issue is how the Netherlands can be made climate proof over the **very long term**: safe against flooding, while still remaining an attractive place to live, to reside and work, for recreation and investment ... also **cyber risk**!

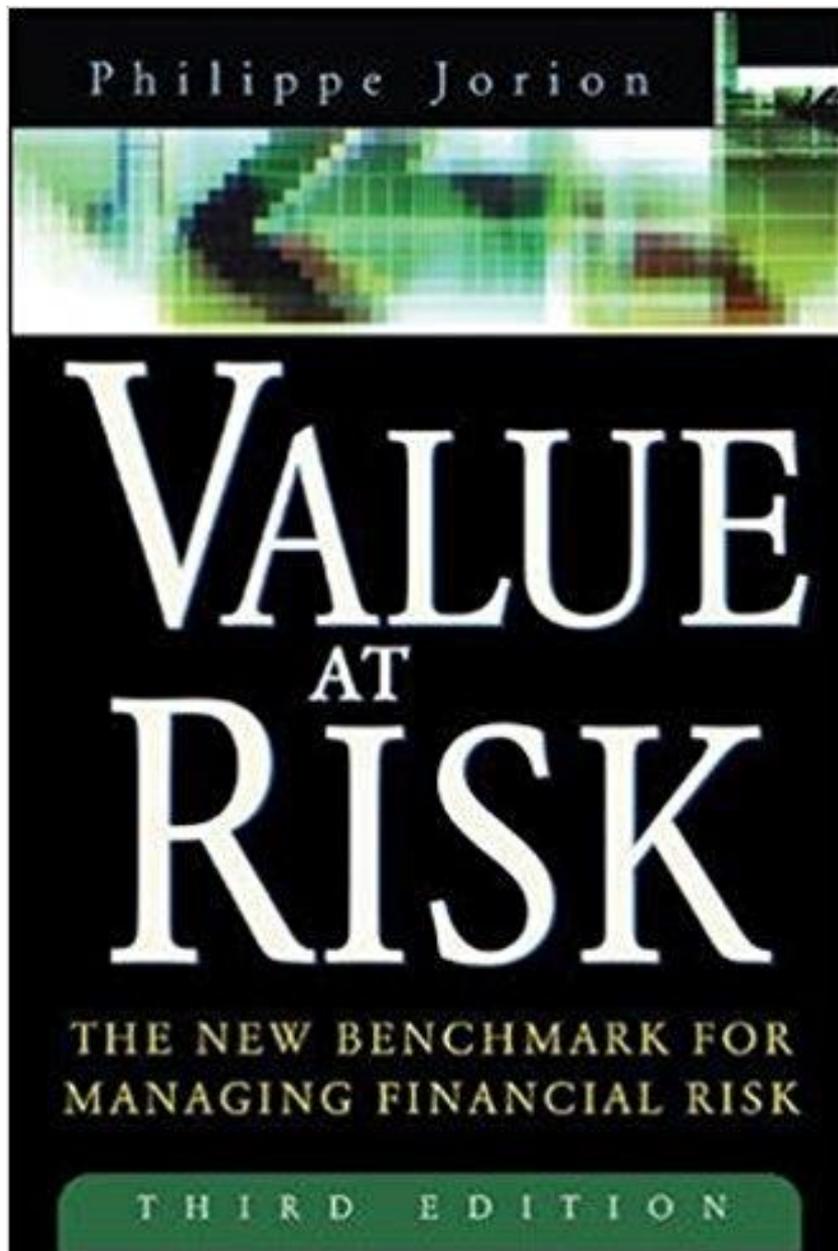
# Von Amsterdam nach **Basel**:



**Bank für Internationalen Zahlungsausgleich (BIZ/BIS)  
mit dem *Basler* Ausschuss für Bankenaufsicht (BCBS)**

# Federal Reserve Bank of Boston **course** on “EVT & relevance for OpRisk” (2005)





**VaR = Deichhöhe**

**(600 pages)**

# Value-at-Risk Risikomass

- Der Begriff **Wert-im-Risiko** oder englisch **Value-at-Risk** (VaR) bezeichnet ein Risikomass für eine Finanzposition, bspw. ein Portfolio von Wertpapieren #. **Der Value-at-Risk gibt an, welche Verlusthöhe innerhalb eines gegebenen Zeitraums mit einer gegebenen Wahrscheinlichkeit nicht überschritten wird. \***
- Ein **Value-at-Risk** von 10 Mio. EUR bei einer Haltedauer von 1 Tag und einem Konfidenzniveau von 99 % bedeutet, dass der potentielle Verlust der betrachteten Risikoposition von einem Tag auf den nächsten mit einer Wahrscheinlichkeit von 99 % den Betrag von 10 Mio. EUR nicht überschreiten wird. **Aber mit 1% ... !?!?**
- Das **Value-at-Risk** ist heute ein Standardrisikomass im Finanzsektor. \* Mittlerweile wird das Konzept auch in Industrie- und Handelsunternehmen für die Quantifikation diverser, meist finanzwirtschaftlicher Risiken, eingesetzt.

\* Deichhöhe

# Banken, Finanzsektor

\* FINMA

~ Wikipedia

# Hat es funktioniert? Die Finanzkrise 2006-2009!



# Recipe for Disaster: The Formula That Killed Wall Street

Felix Salmon 23. Februar, 2009

Wired Magazine

$$\Pr[T_A < 1, T_B < 1] = \Phi_2(\Phi^{-1}(F_A(1)), \Phi^{-1}(F_B(1)), \gamma)$$

J. Danielsson et al. (2001): **An academic response to Basel II**  
Financial Markets Group, London School of Economics.

(Mailed as an official response to the Basel Committee and  
published on its website as such) (17 pages)

→ PE website since 2001!

et al. = **Paul Embrechts**  
Charles Goodhart  
Con Keating  
Felix Muennich  
Olivier Renault  
Hyun Song Shin



THE LONDON SCHOOL  
OF ECONOMICS AND  
POLITICAL SCIENCE ■



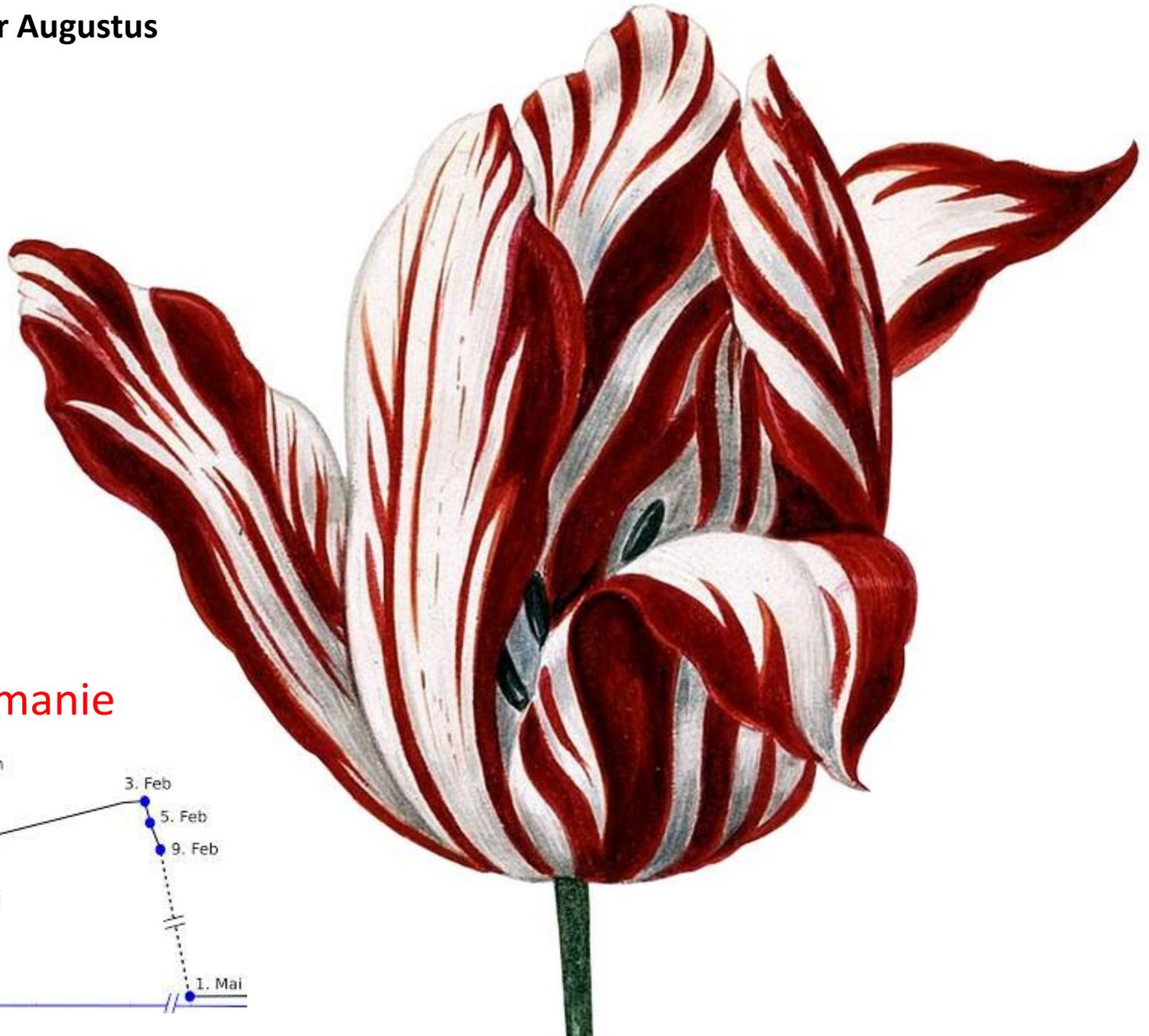
# Wir hatten gewarnt!

Mai 2001 (!!): P. Embrechts et al. (LSE) → BCBS

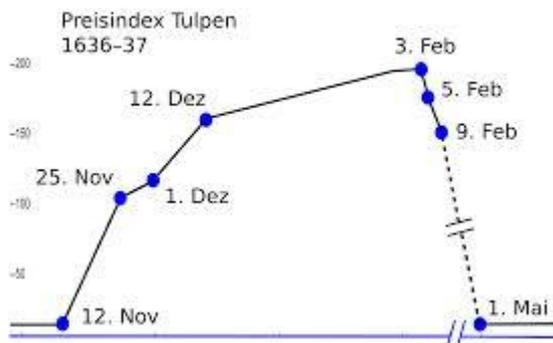
«An academic response to Basel II»

S.5: «Perhaps our most serious concern is that these proposals ... will enhance ... the susceptibility of the financial system to **systemic crises** ... **Reconsider before it is too late!**»

# Semper Augustus

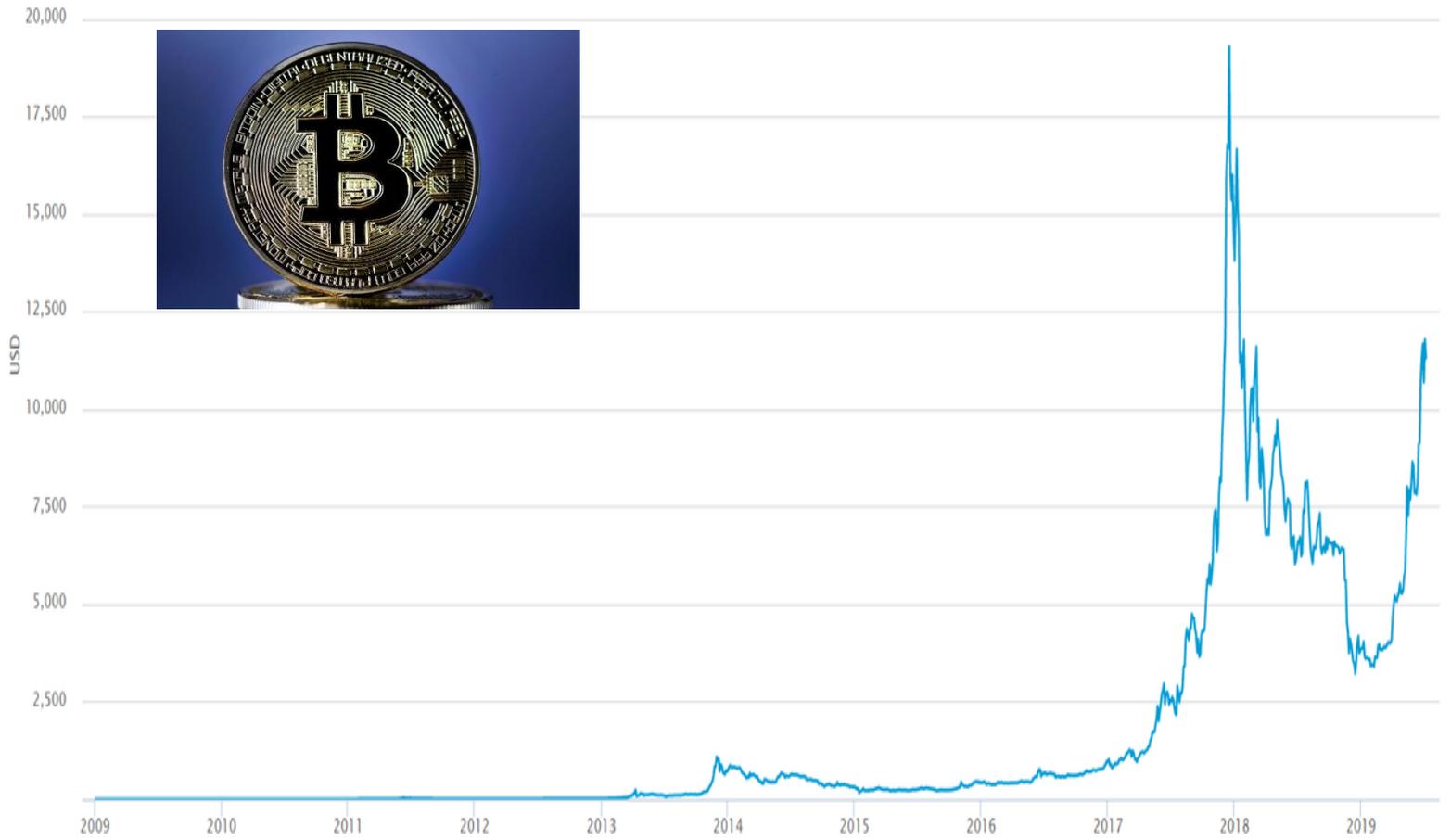


## Tulpenmanie



# Die Zukunft? ... Stichwörter:

- Bitcoin
- Cryptocurrencies (1000+)
- Stable coins
- Libra (Facebook)
- Blockchain, distributed ledger
- FinTech/InsurTech/RegTech
- P2P-credit/finance
- Social networks
- ...



# Die Zukunft?

**“In (computer) code we trust”**



# ETH Zürich Kompetenzzentren für Risikoforschung

- ...
- **RiskLab** (seit 7. Oktober 1994) D-MATH, **PC-MW(2)**, hauptsächlich für Banken, Versicherungen und Regulatoren (BCBS, FINMA, ... )
- **Risk Center** (seit Juni 2011) 8 Departemente, **20(+)** Professoren, **interdisziplinär**, breit gefasste Forschungsprojekte
- ...

# 7/10/1994, die Gründung von

**RiskLab<sup>®</sup>**  
Switzerland

zusammen mit

(Kompetenzzentrum)



Hans-Jakob  
Lüthi (IFOR)

FORSCHUNG **Zusammenarbeitsvertrag der  
ETH mit den drei Grossbanken**

## **Brückenschlag zum Finanzplatz Schweiz**

Die ETH wird gemeinsam mit den drei Grossbanken im vorwettbewerblichen Bereich forschen, wobei Fragen des Risikomanagements im Vordergrund stehen. SBG, SKA und SBV haben den Zusammenarbeitsvertrag, der dem Departement Mathematik eine neue Quelle für Forschungsgelder eröffnet, im Oktober unterzeichnet.

!!!

ETH Intern, 3/94

Versicherung,  
Banken und  
Regulierung



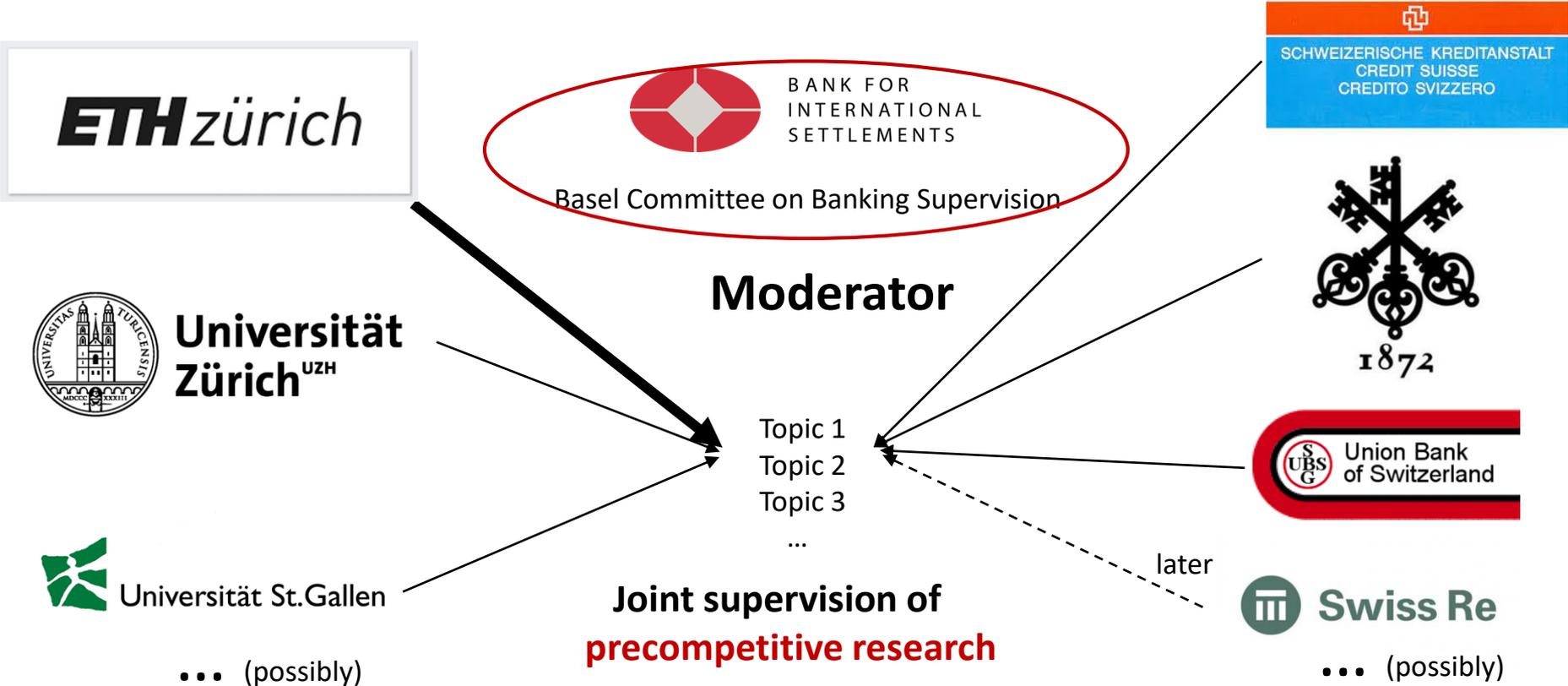
Schulung & Forschung



Wirtschaft,  
Gesellschaft,  
Politik & ...



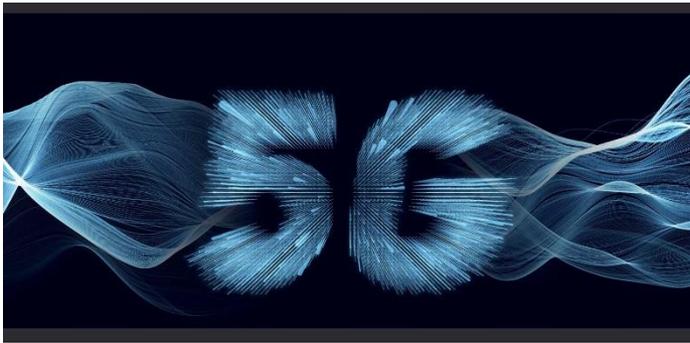
# How did we achieve **RiskLab's** success?



2011



**Keywords:** 8 departments, 20 professors, industry support/topic discussions/joint workshops, (inter)national (CREATE-SG), interdisciplinary (support only when 2 professors from different departments jointly supervise); see <https://riskcenter.ethz.ch/>



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Risk Center Continuing Education

## Machine Learning in Finance

Block Course in Fall 2019

ETH RISK CENTER

ETH zürich

Risk Center Continuing Education

## Cyber Risk

How to Navigate through the Digital Transformation

Block Course in Fall 2019

ETH RISK CENTER

# «5G: Balancing Opportunities and Risks»: 13/3/20

ETH zürich

**ETH Risk Center Workshop**  
**Mastering the Challenges of our Digital Society**  
 Friday, 4.11. 2016, 9.00 - 16.30, Zurich Development Center, Zürich

Organized by ETH Risk Center and Zurich Insurance Company

**About:**  
 Big data technologies are powerful - but with great power comes great responsibility. How can we ensure societal benefits from the deployment of big data technologies and at the same time safeguard individual rights and privacy? This workshop addresses the challenges and opportunities of digitalization from the perspectives of three different stakeholders: citizens, companies and regulators.

Full programme and event details on [www.riskcenter.ethz.ch](http://www.riskcenter.ethz.ch)

**Registration:**  
 You can register at [www.event.ethz.ch/MCDS](http://www.event.ethz.ch/MCDS). Space is limited to 80 seats. This event is free of charge.

In cooperation with Zurich Insurance Company ZURICH

ETH RISK CENTER

ETH zürich

**Workshop**  
**Climate Risk and the Built Environment:**  
**Can Data make a Difference?**  
 Monday, 28 Oct. 2019, 13:15 - 17:30,  
 HIB Level E, Open Space 2, Höggerberg ETH Zurich

**About:**  
 The event addresses the challenges of coping with the risks that climate change poses to buildings, urban agglomerations and their inhabitants. In particular, participants will evaluate and discuss the extent to which current approaches offer strategies to improve our capacity to understand the complex linkages existing within the varied scales of the built environment.

**Speakers:**  
 Arno Schlueter, Institute for Technology in Architecture, D-ARCH  
 David Bresch, Chair of Weather and Climate Risk, D-USYS  
 Annette Aumann, Sustainable Construction, City of Zurich  
 Tina Comes, 4TU Center on Resilience Engineering, TU Delft  
 Antony Elliott, Business Transformation, Zurich Insurance  
 Martino Tran, Urban Predictive Analytics Lab, Univ. of British Columbia

**Panel Moderator:**  
 Christian Schaffner, ETH Energy Science Center

**Registration:**  
 Register via [www.riskcenter.ethz.ch](http://www.riskcenter.ethz.ch)  
 This event is free of charge.

**Masters Programme in Integrated Building Systems**

Seminar series  
 Dialogue events  
 Risk courses  
 Workshops  
 Conferences

...

PE = Risk Center Ambassador

## Five steps to the MSc Risk Studies Certificate in cooperation with the ETH Risk Center

Answers to the most challenging risks of our society, like climate, energy, health, economic, and many more are rarely possible to give from within one discipline. The interdependence of these risks on each other make answers even more challenging. In addition, risks on the corporate level are also becoming more integrated in the future ranging from business interruption risk, cyber attacks, natural hazards, macro-economic shocks, and many more. People with a holistic and interdisciplinary mindset are necessary to understand the increasing complexity and dynamic interdependence of social and human-engineered systems.

Follow these five steps in order to obtain the MTEC MSc Risk Studies Certificate (Total of 60 ETCS):

### 1. Choose your MTEC tutor among Risk Center Professors at MTEC!



**Prof. Dr. Antoine Bomnier**  
Chair for Innovative Risk Management, D-MTEC

Antoine Bomnier works on the economic analysis of interdependent risks and risks with long term consequences. This involves the development of methods to analyze the cost of such risks and to integrate innovative strategies to mitigate them and develop efficient insurance schemes.



**Prof. Dr. Hans Gersbach**  
Chair Macroeconomics, Innovation and Policy, D-MTEC

Hans Gersbach analyzes new designs for the financial architecture and for fiscal and monetary policy-making, to deal with systemic risks. For this purpose, he embeds models of banking, systemic risk, and politics into new macroeconomic models, to examine their possible consequences.



**Prof. Dr. Wanda Mimra**  
Chair of Risk and Insurance Economics, D-MTEC

Wanda Mimra's research analyzes strategic interaction in markets with risk and asymmetric information with applications in insurance, health, and industrial organization.



**Prof. Dr. Frank Schweitzer**  
Chair of System Design, D-MTEC

Frank Schweitzer focuses in part on the emergence of systemic risk resulting from the collective interaction of economic or social agents. His work applies formal models to economic and financial networks, as well as to business companies, social organizations, and online communities in cyberspace.



**Prof. Dr. Didier Sornette**  
Chair of Entrepreneurial Risks, D-MTEC

Didier Sornette researches on the prediction of crises and extreme events in complex systems. Applications include the ex-ante diagnosis of financial bubbles and crashes, earthquake physics and geophysics, the failure of engineered structures, successes in social networks, etc.

### 2. Select your courses depending on your own risk-focus!

Choose from your core-courses, elective courses and non-MTEC courses a set of risk-related courses matching 24 ETCS.

Your tutor will help to choose eligible courses depending on your focus.

Select courses from other Risk Center Professors coming from other departments of ETH Zurich:

**Prof. Dr. David Basin**  
Chair for Information Security Research, D-INFK

**Prof. Dr. Lars-Erik Cederman**  
Chair of International Conflict Research, D-GESS

**Prof. Dr. Paul Embrechts**  
Professor of Mathematics, D-MATH

**Prof. Dr. Hans R. Heinemann**  
Chair of Land Use Engineering, D-USYS

**Prof. Dr. Hans J. Herrmann**  
Chair of Computational Physics, D-BAUG

**Prof. Dr. Giovanni Sansavini**  
Chair of Reliability and Risk Engineering, D-MAVT

**Prof. Dr. Bozidar Stojadinovic**  
Chair of Structural Dynamics and Earthquake Engineering, D-BAUG

**Prof. Dr. Bruno Sudret**  
Chair of Risk, Safety and Uncertainty Quantification, D-BAUG

**Prof. Dr. Ulrich Alois Weidmann**  
Chair of Traffic Planning and Transport Systems, D-BAUG

**Prof. Dr. Stefan Wiemer**  
Director of Swiss Seismological Service, D-ERDW

### 3. Choose your internship in the area of risk management!

Experience a risk-related internship (6 ETCS). With a strong educational record in the area of risk you qualify for various positions in the risk modeling, risk management or risk analysis teams in the industry or governmental bodies.

### 4. Write your Master thesis on a risk-related topic!

Obtain the remaining 30 ETCS by writing your thesis in the area of risk, supervised by your Tutor, coming from the Risk Center.

### 5. Obtain the Certificate and be selected to present your thesis to the Risk Center

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For more information please contact Bastian Bergmann, Executive Director, Risk Center, [bbergmann@ethz.ch](mailto:bbergmann@ethz.ch)  
ETH Risk Center - Scheuchzerstrasse 7 - 8092 Zurich - Switzerland - [www.riskcenter.ethz.ch](http://www.riskcenter.ethz.ch) - [info-riskcenter@ethz.ch](mailto:info-riskcenter@ethz.ch)



ETH Risk Center Seminar Series presents  
**Prof. Nassim Nicholas Taleb**  
NYU Polytechnic School of Engineering  
*How to Understand Fragility?*

Tuesday | 27.10.2015 | HG F30

Time: 16.15 -17.30 | Aperó

Please register for this event on  
[www.riskcenter.ethz.ch](http://www.riskcenter.ethz.ch)

**Audimax**  
ETH Main Campus

ETH Risk Center - Scheuchzerstrasse 7 - 8092 Zurich - Switzerland - [www.riskcenter.ethz.ch](http://www.riskcenter.ethz.ch) - [info-riskcenter@ethz.ch](mailto:info-riskcenter@ethz.ch)

**ETH RISK CENTER**



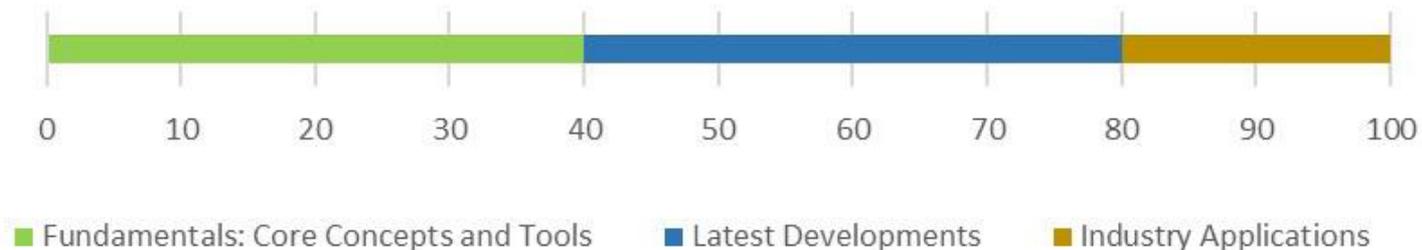
ETH Risk Center Seminar Series presents  
Joachim Oechslin  
Chief Risk Officer – Credit Suisse

*Key Topics in Risk Management at Credit Suisse*



Risk Center Continuing  
Education  
**Climate Risk and Decision  
Making under Deep  
Uncertainty**  
Block Course in Spring  
**2020**

Content



# **Interdisziplinarität**

**Danke!**

