Road and Rail transport

- ☀ High temperatures
- ☀ Heat waves
- ☀ Snowfall and cold spells
- ☀ Storm/Wind gusts
- ☀ Heavy precipitation - Floodings and Landslides
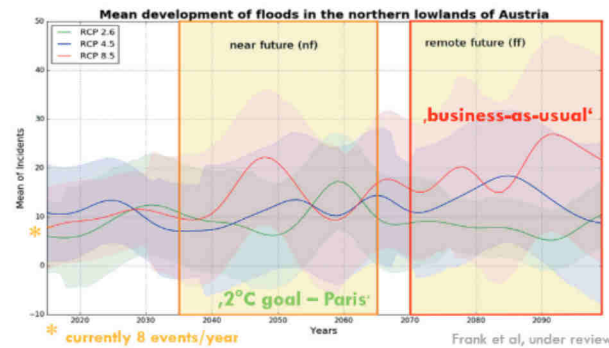- ☀ Bad visibility - Fog

Maritime and Inland shipping

- ☀ Storm and waveheight
- ☀ Snow storms
- ☀ Cold spells
- ☀ Heat waves
- ☀ Bad visibility - Fog
- ☀ Droughts
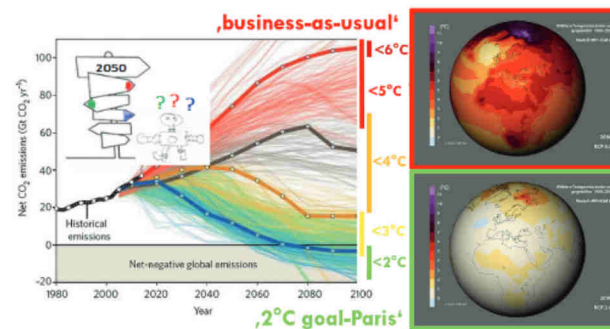- ☀ Heavy precipitation - high water

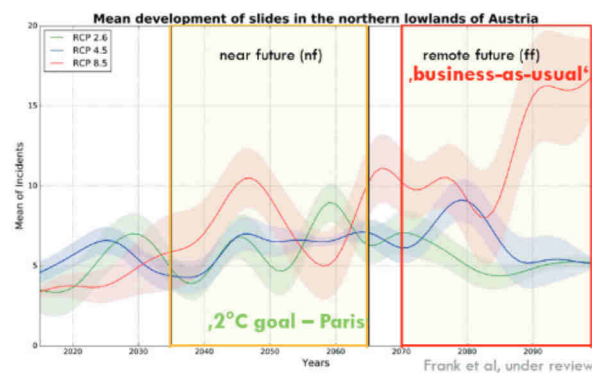## What will the future look like in terms of supply-chain challenges?

Future *Flooding*-corridors in Alpine foothills

Frank et al, under review

Climate-change scenarios

Future *Landslide*-corridors in Central Europe

Frank et al, under review

Design of a (decision & probability theory based) procedure supporting key executives

The design of anticipatory strategies efficiently implementing protection measures sustainably sheltering the public against floodings has already been successfully applied to Austria's most comprehensive civil protection project since WWII. The key to success is close, focused cooperation between partners. This provides the necessary basis for intertwining hazard-occurrence data and working expertise (in terms of options for immediate shelter as well as available protection measures granting safety on long time-scales) with skills in system-modelling as well as decision- and probability-theory.

A typical matrix used in decision-theory, combining practical countermeasures with hazard-corridors.

	near future		remote future	
	RCP2.6	RCP8.5	RCP2.6	RCP8.5
Expected probability	8%	62%	30%	10%
F&L countermeasure 1	$u(e_{11})$	$u(e_{15})$	$u(e_{1d})$	$u(e_{16})$
F&L countermeasure 2	$u(e_{21})$	$u(e_{23})$	$u(e_{24})$	$u(e_{26})$
F&L countermeasure 3	$u(e_{51})$	$u(e_{53})$	$u(e_{5c})$	$u(e_{36})$

Application to Austria's most extensive project in public protection since WWII

Strategies	von Neumann	Hurwicz	Savage-Niehans	Ranking
A	43.55	10.50 (19.78)	0.14	2.
R	43.57	10.52 (19.79)	0.12	1.
L	43.46	10.51 (19.86)	0.18	3.
A	87.86	10.76 (19.83)	0.14	1.
R	87.48	10.69 (19.73)	0.28	2.
L	87.04	10.68 (19.71)	0.46	3.

About € 265 million invested in flood protection. Implementation of 3 protection measures: linear **L**, retention **R**, relocation **A**:

- **A** 220 objects, aprox. 85 Mio. €
- **R** 8.7 km, aprox. 15 Mio. €
- **L** 36 km, aprox. 165 Mio. €

In Short: here is a brand-new, successfully evaluated, and published procedure helping us to base our decisions on knowledge.

Industry and science pulling together to sustainably protecting of your company under accerlated aggravating hazards forced by climate-change

Can we achieve that?

Increase in Average Losses

More Loss Triggering Weather

More Severe Losses

Less Non-Hazardous Weather

Current Climate

New Climate

Probability of Occurrence

Safe — Average Conditions — Extreme

Bundesministerium Nachhaltigkeit und Tourismus

imgw Institut für Meteorologie und Geophysik

universität wien

Global temperature change (1850–2016)

2016

Apr May Jun Jul Aug Sep Oct Nov Dec Mar

@ed_hawkins

Global mean temperatures 1850 to 2018

1850   1934   2018

Climate Change is upsetting existing rules, and induced losses can only be controllable by science and business pulling together. Can we do that?

BUT HOW?

The design of anticipatory strategies efficiently implementing protection measures sustainably safeguarding investments in supply-chain operations relies on decision theory, derived hazard development-corridors and most effective countermeasures known from business practice.

Thus, their success in keeping the supply-chain operational under accelerated aggravating future risks, depends crucially on the performance of the cooperation between F&L and CIT (Climate Impact Team, KLFOR/ZAMG).
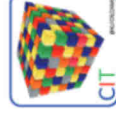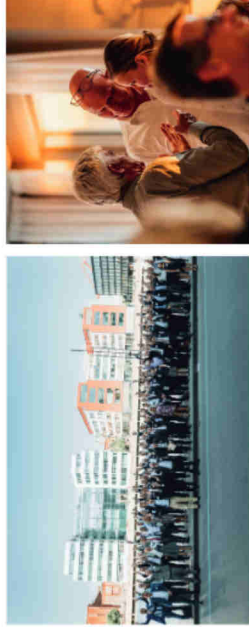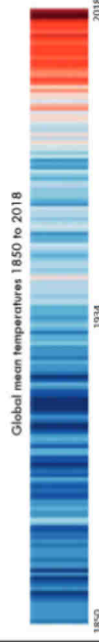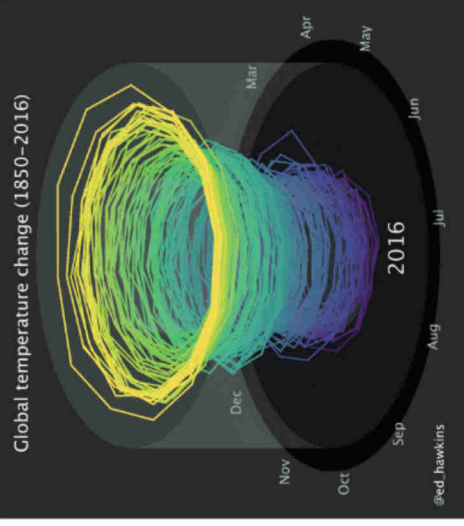
Necessary steps comprise:

- gathering + compilation of F&L members' damage data, which is kindly taken over by F&L
- sharing of mutual expertises (e.g. survey)
- intense, spotless and focused cooperation

Successful decision-making and asset protection requires interlinking F&L members' expertise in dealing with extreme weather and natural hazards with climate impact research.
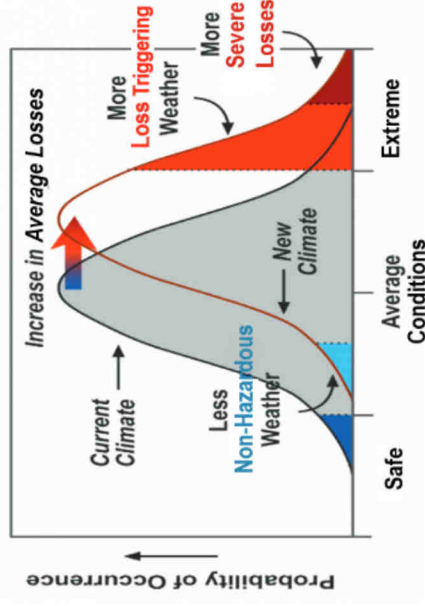
Contact:

Dr. Christoph Matulla, *christoph.matulla@zamg.ac.at*

Katharina Enigl MSc, *kathi.enigl@gmail.com*

Sebastian Lehner BSc, *sebastian_lehner@icloud.com*