7. Klimatické anomálie, hydrometeorologické extrémy, jejich dopady a percepce

7.1 Velké přírodní katastrofy

Definition: What are “GREAT natural catastrophes“

(In keeping with United Nations definition criteria)

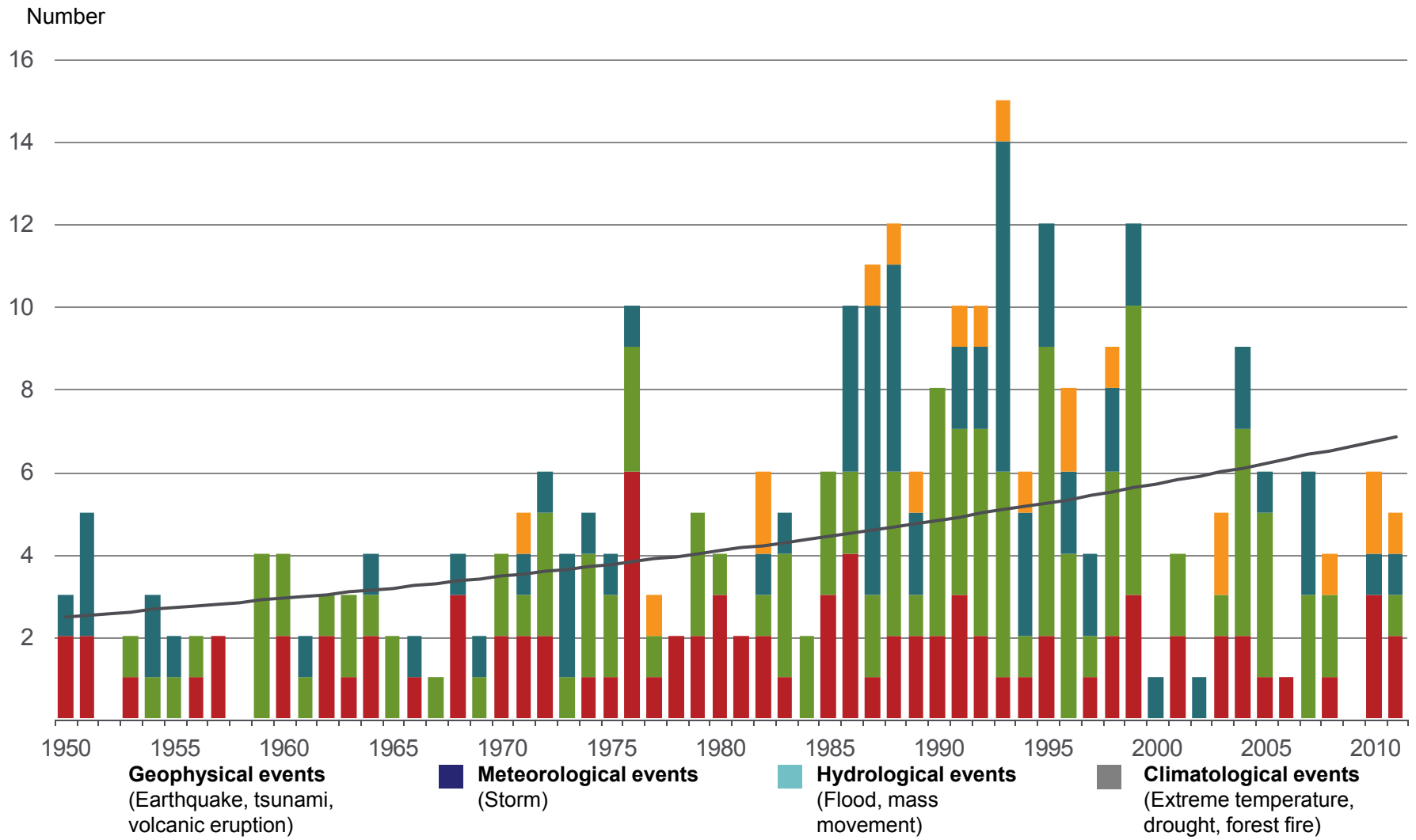
The affected region's ability to help itself is distinctly overtaxed

- **Interregional or international assistance is necessary**
- **Thousands are killed**
- **Hundreds of thousands are made homeless**
- **Substantial economic losses**
- **Considerable insured losses**

NatCatSERVICE

Great natural catastrophes worldwide 1950 – 2011

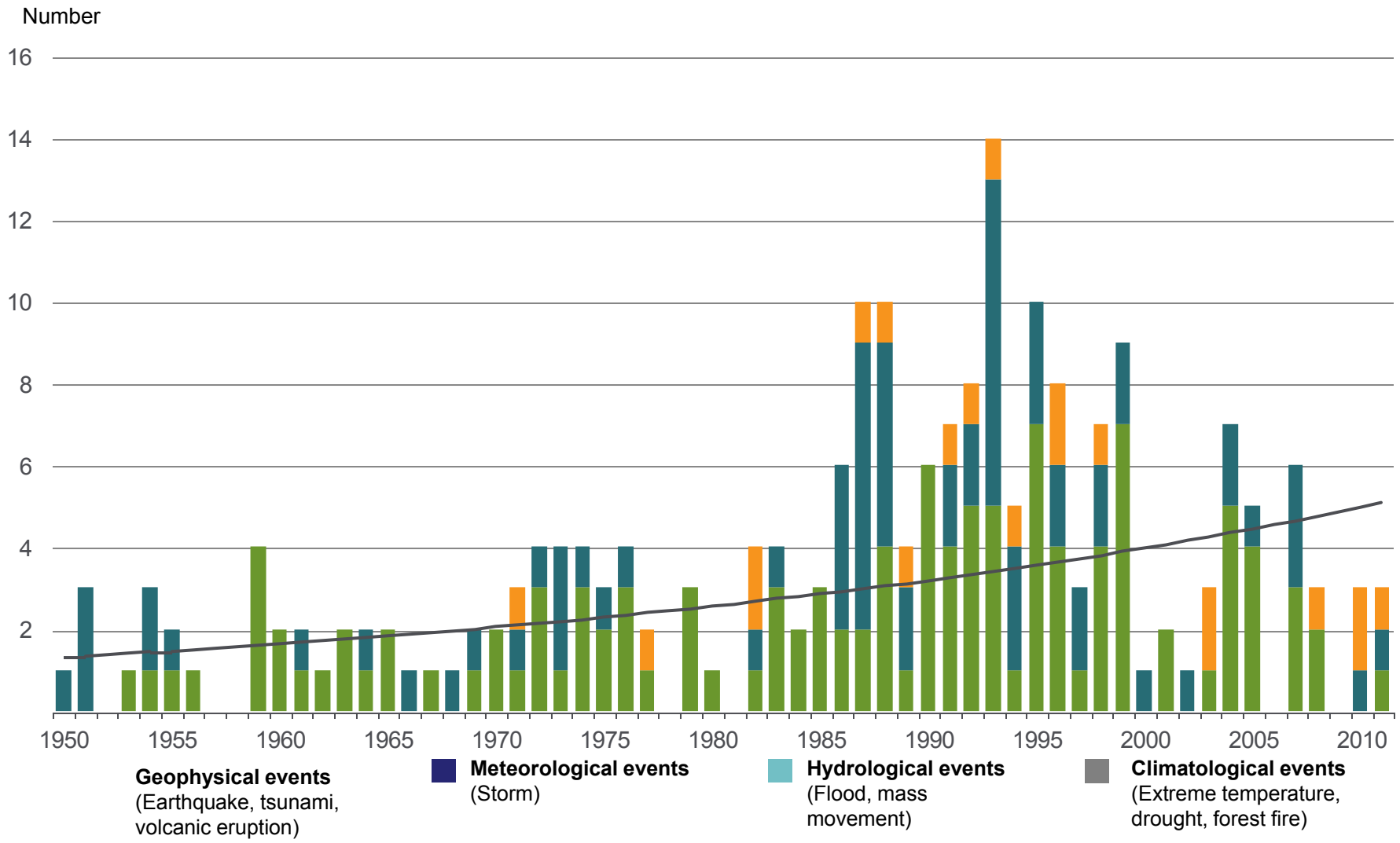
Number of events with trend



NatCatSERVICE

Great weather catastrophes worldwide 1950 – 2011

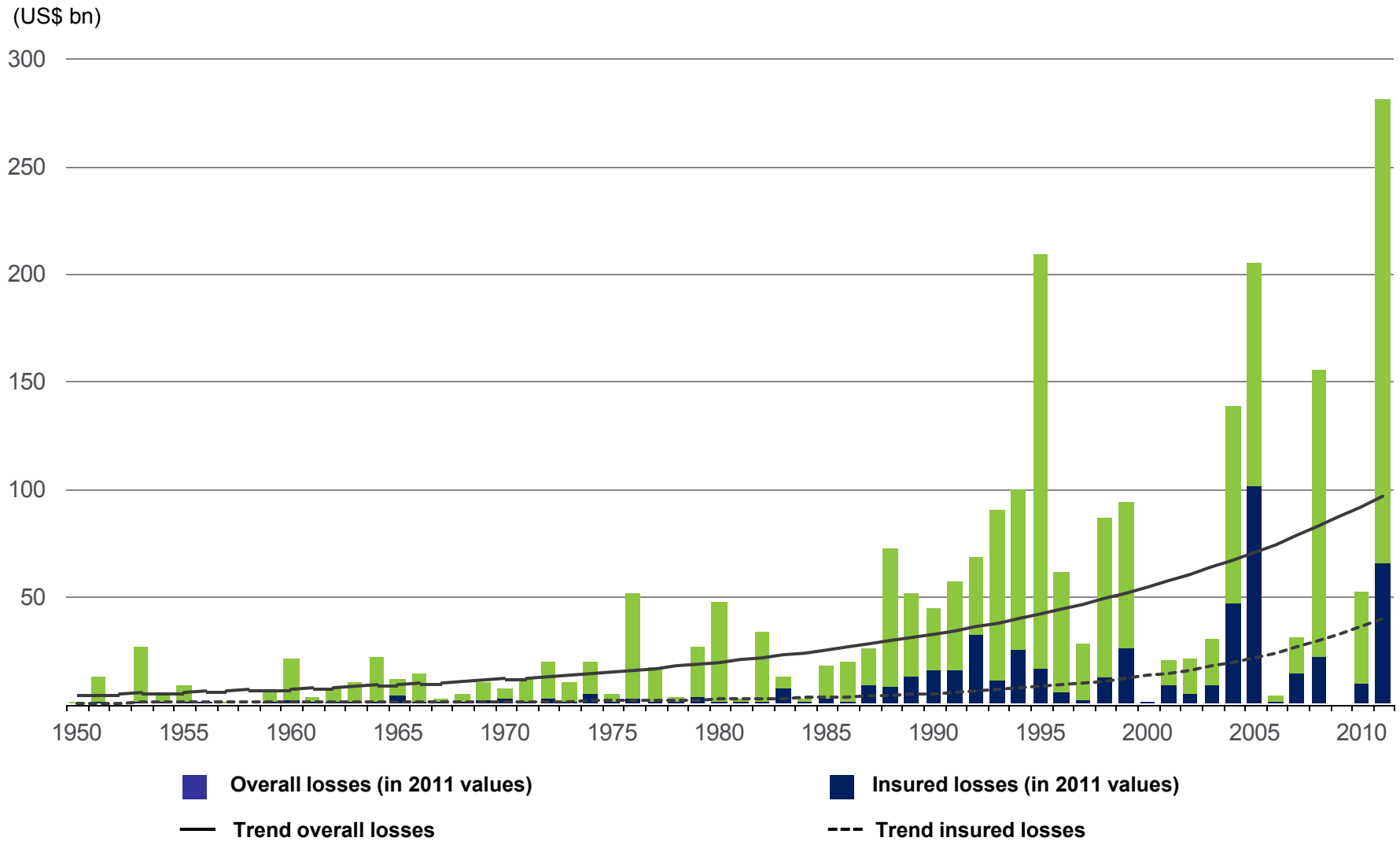
Number of events with trend



NatCatSERVICE

Great natural catastrophes worldwide 1950 – 2011

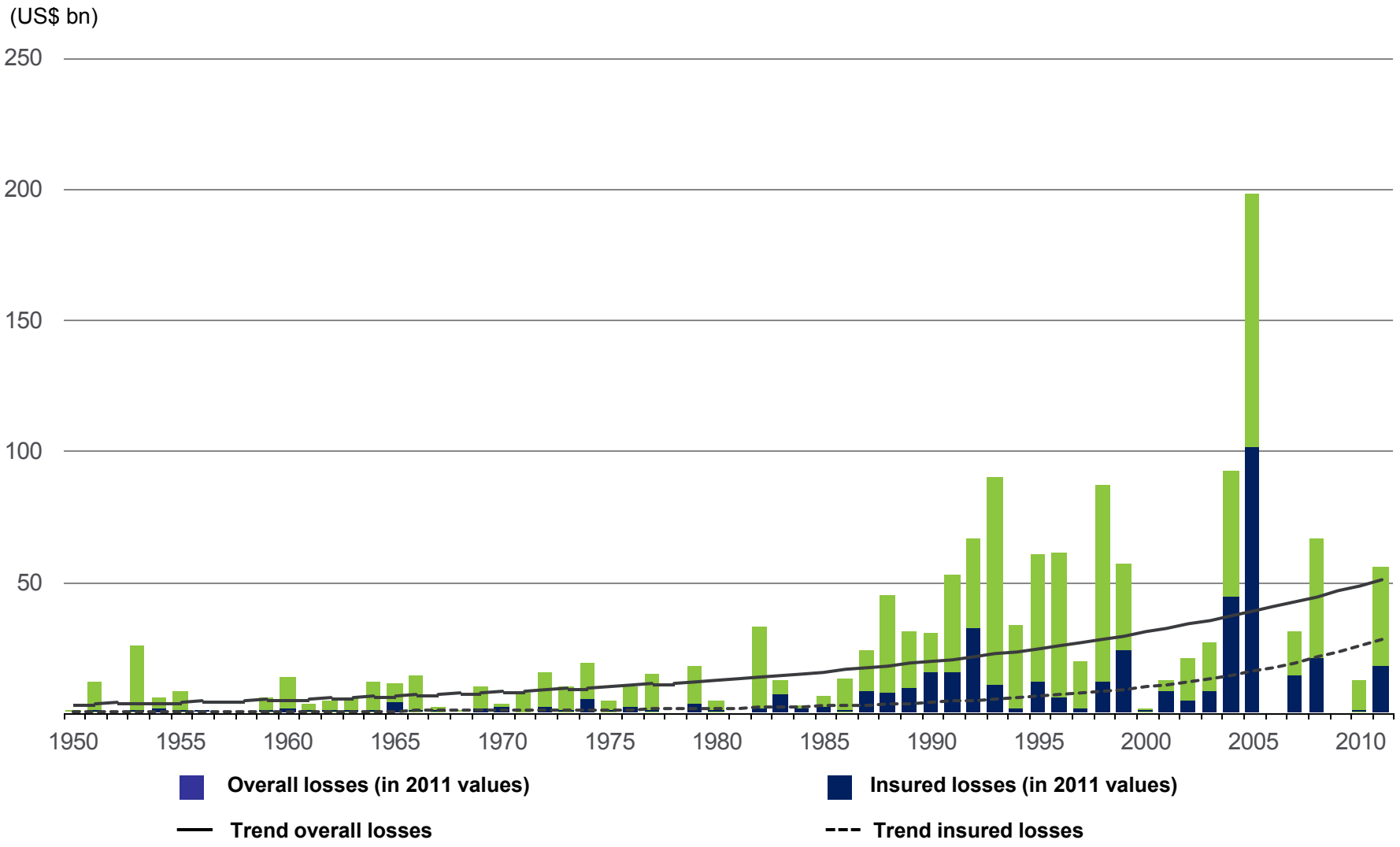
Overall and insured losses with trend



NatCatSERVICE

Great weather catastrophes worldwide 1950 – 2011

Overall and insured losses with trend



NatCatSERVICE

Significant loss events worldwide 1980 – 2013

10 costliest events ordered by overall losses

Date	Event	Affected area	Overall losses in US$ m original values	Insured losses in US$ m original values	Fatalities
11.3.2011	Earthquake, tsunami	Japan: Honshu, Aomori, Tohoku; Miyagi, Sendai; Fukushima, Mito; Ibaraki; Tochigi, Utsunomiya	**210,000**	40,000	15,880
25-30.8.2005	Hurricane Katrina, storm surge	USA: LA, New Orleans, Slidell; MS, Biloxi, Pascagoula, Waveland, Gulfport; AL; FL	**125,000**	62,200	1,322
17.1.1995	Earthquake	Japan: Hyogo, Kobe, Osaka, Kyoto	**100,000**	3,000	6,430
12.5.2008	Earthquake	China: Sichuan, Mianyang, Beichuan, Wenchuan, Shifang, Chengdu, Guangyuan, Ngawa, Ya'an	**85,000**	300	84,000
24-31.10.2012	Hurricane Sandy, storm surge	Bahamas, Cuba, Dominican Republic, Haiti, Jamaica, Puerto Rico, USA, Canada	**68,500**	29,500	210
17.1.1994	Earthquake	USA: CA, Northridge, Los Angeles, San Fernando Valley, Ventura, Orange	**44,000**	15,300	61
1.8-15.11.2011	Floods	Thailand: Phichit, Nakhon Sawan, Phra Nakhon Si Ayuttaya, Pathumthani, Nonthaburi, Bangkok	**43,000**	16,000	813
6-14.9.2008	Hurricane Ike	USA, Cuba, Haiti, Dominican Republic, Turks and Caicos Islands, Bahamas	**38,000**	18,500	170
May-Sept 1998	Floods	China: Yangtze, Songhua Jiang	**30,700**	1,000	4,160
27.2.2010	Earthquake, tsunami	Chile: Bió Bió, Concepción, Talcahuano, Coronel, Dichato, Chillán; Del Maule, Talca, Curicó	**30,000**	8,000	520

Source: Munich Re, NatCatSERVICE, 2014

NatCatSERVICE

Significant loss events worldwide 1980 – 2013

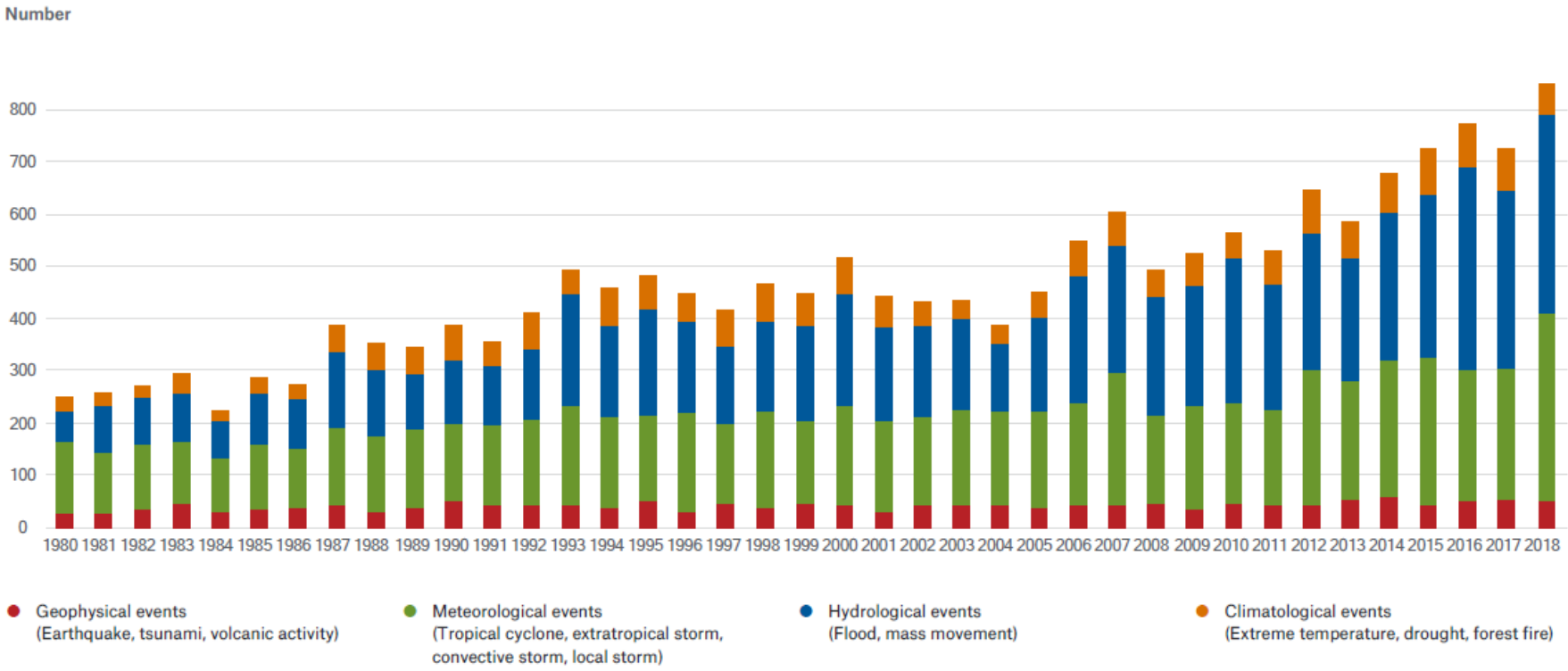
10 deadliest events

Date	Event	Affected area	Overall losses in US$ m original values	Insured losses in US$ m original values	Fatalities
12.1.2010	Earthquake	Haiti: Port-au-Prince, Petionville, Jacmel, Carrefour, Leogane, Petit Goave, Gressier	8,000	200	**222,570**
26.12.2004	Earthquake, tsunamis	Sri Lanka, Indonesia, Thailand, India, Bangladesh, Myanmar, Maldives, Malaysia	11,200	1,000	**220,000**
2-5.5.2008	Cyclone Nargis, storm surge	Myanmar: Ayeyawaddy, Yangon, Bugalay, Rangun, Irrawaddy, Bago, Karen, Mon, Laputta; Haing Kyi	4,000		**140,000**
29-30.4.1991	Tropical cyclone, storm surge	Bangladesh: Gulf of Bengal, Cox's Bazar, Chittagong, Bola, Noakhali districts, esp. Kutubdia	3,000	100	**139,000**
8.10.2005	Earthquake	Pakistan, India, Afghanistan	5,200	5	**88,000**
12.5.2008	Earthquake	China: Sichuan, Mianyang, Beichuan, Wenchuan, Shifang, Chengdu, Guangyuan, Ngawa, Ya'an	85,000	300	**84,000**
July-Aug 2003	Heat wave	Europe, esp. France, Germany, Italy, Portugal, Romania, Spain, United Kingdom	13,800	1,120	**70,000**
July-Sept 2010	Heat wave	Russian Federation: Moscow region, Kolomna, Mokhovoye; Voronezh, Ramonskiy, Maslovka	400		**56,000**
20.6.1990	Earthquake	Iran: Caspian Sea, Gilan province, Manjil, Rudbar; Zanjan, Safid, Qazvin	7,100	100	**40,000**
26.12.2003	Earthquake	Iran: Bam	500	19	**26,200**

Source: Munich Re, NatCatSERVICE, 2014

Number of events

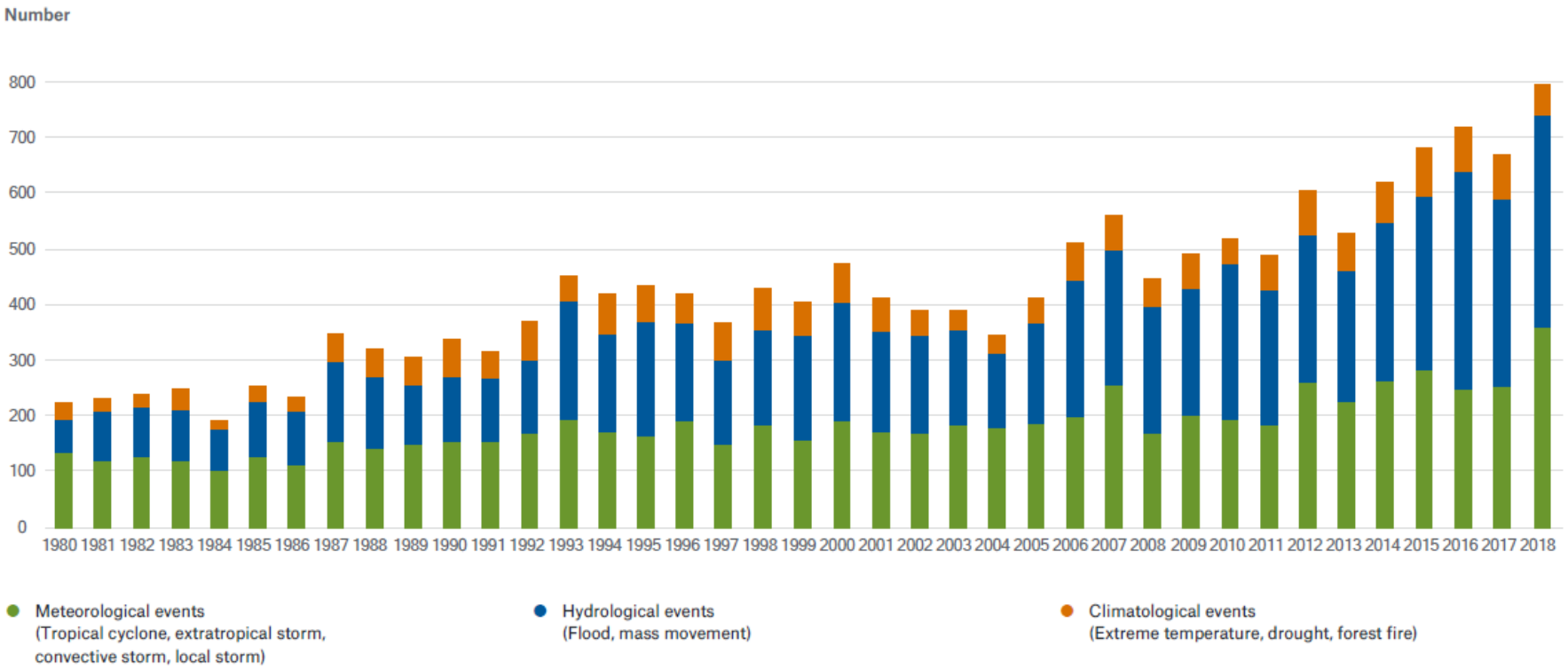
Relevant natural loss events worldwide 1980 – 2018



Accounted events have caused at least one fatality and/or produced normalised losses ≥ US$ 100k, 300k, 1m, or 3m (depending on the assigned World Bank income group of the affected country).

Number of events

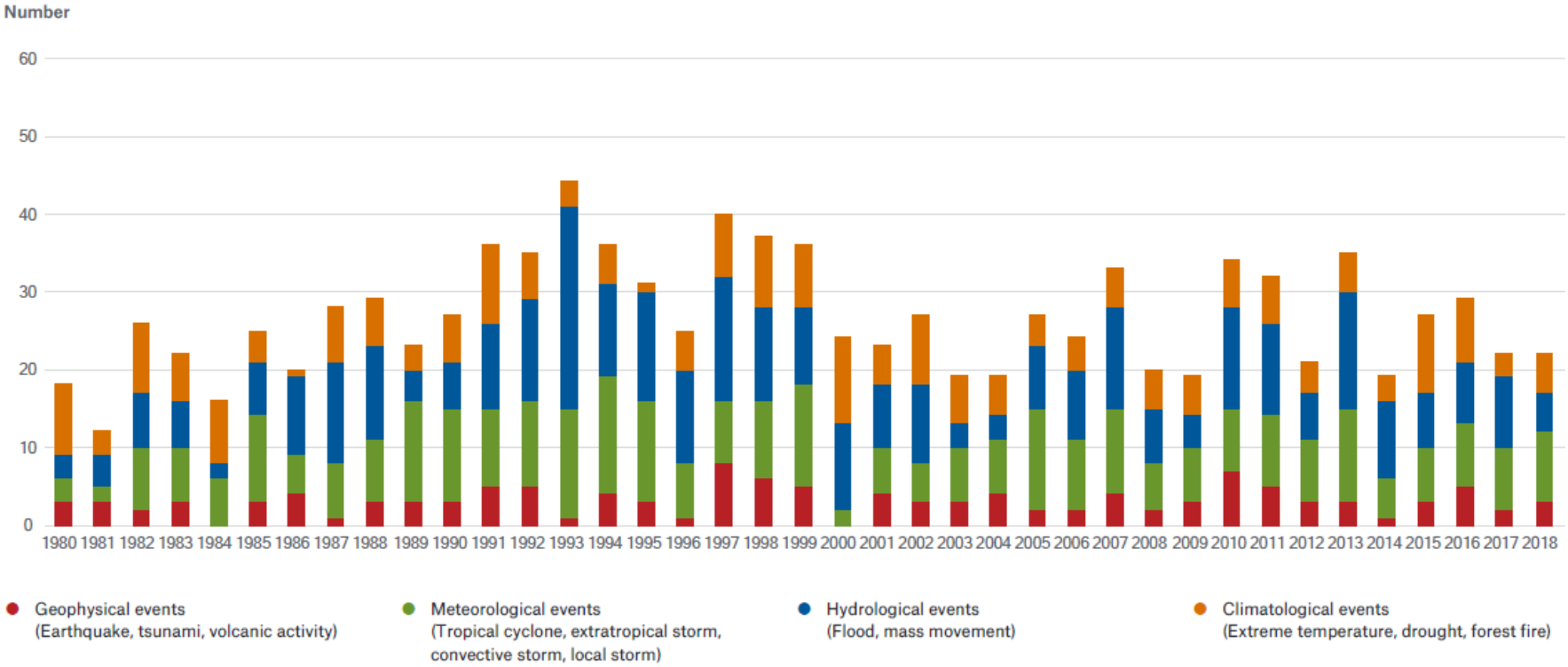
Relevant weather-related loss events worldwide 1980 – 2018



Accounted events have caused at least one fatality and/or produced normalised losses ≥ US$ 100k, 300k, 1m, or 3m (depending on the assigned World Bank income group of the affected country).

Number of events

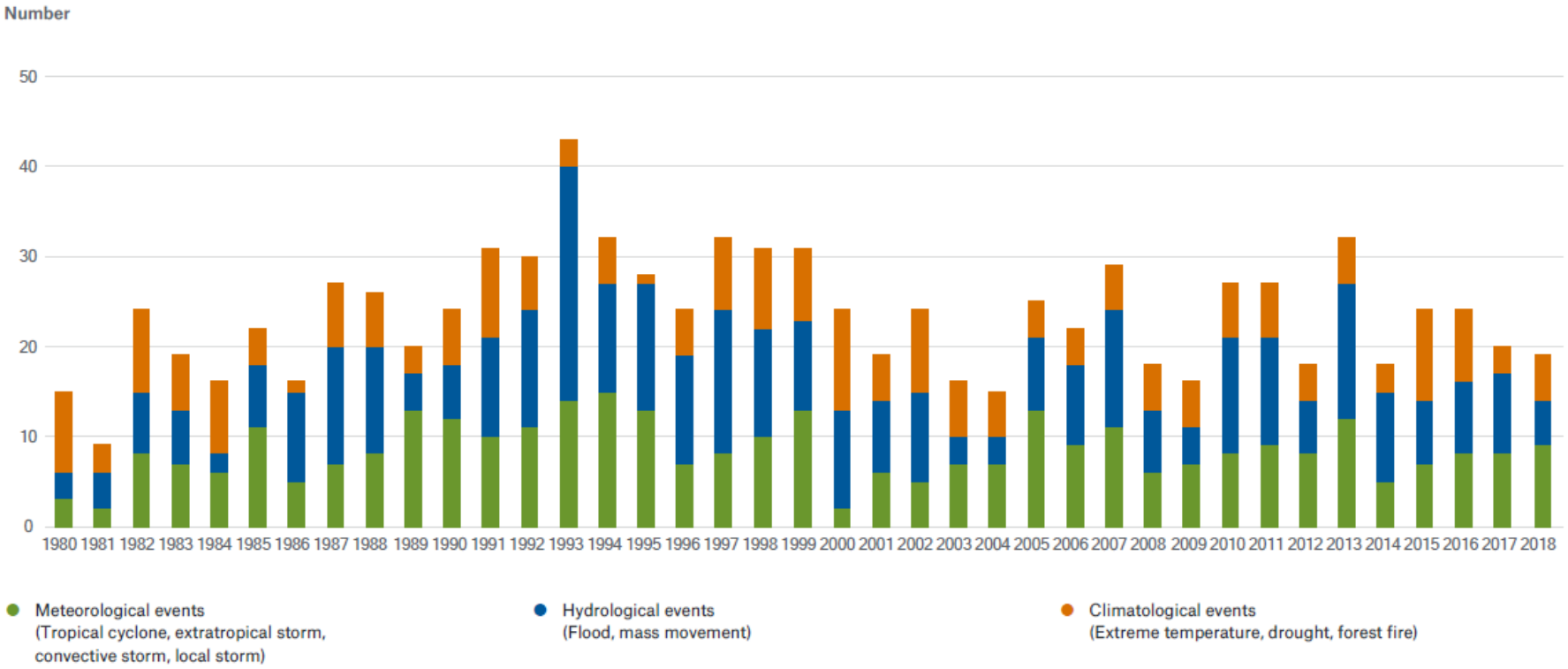
Catastrophic natural loss events worldwide 1980 – 2018



Accounted events have caused ≥ 1,000 fatalities and/or produced normalised losses ≥US$ 100m, 300m, 1bn, or 3bn (depending on the assigned World Bank income group of the affected country).

Number of events

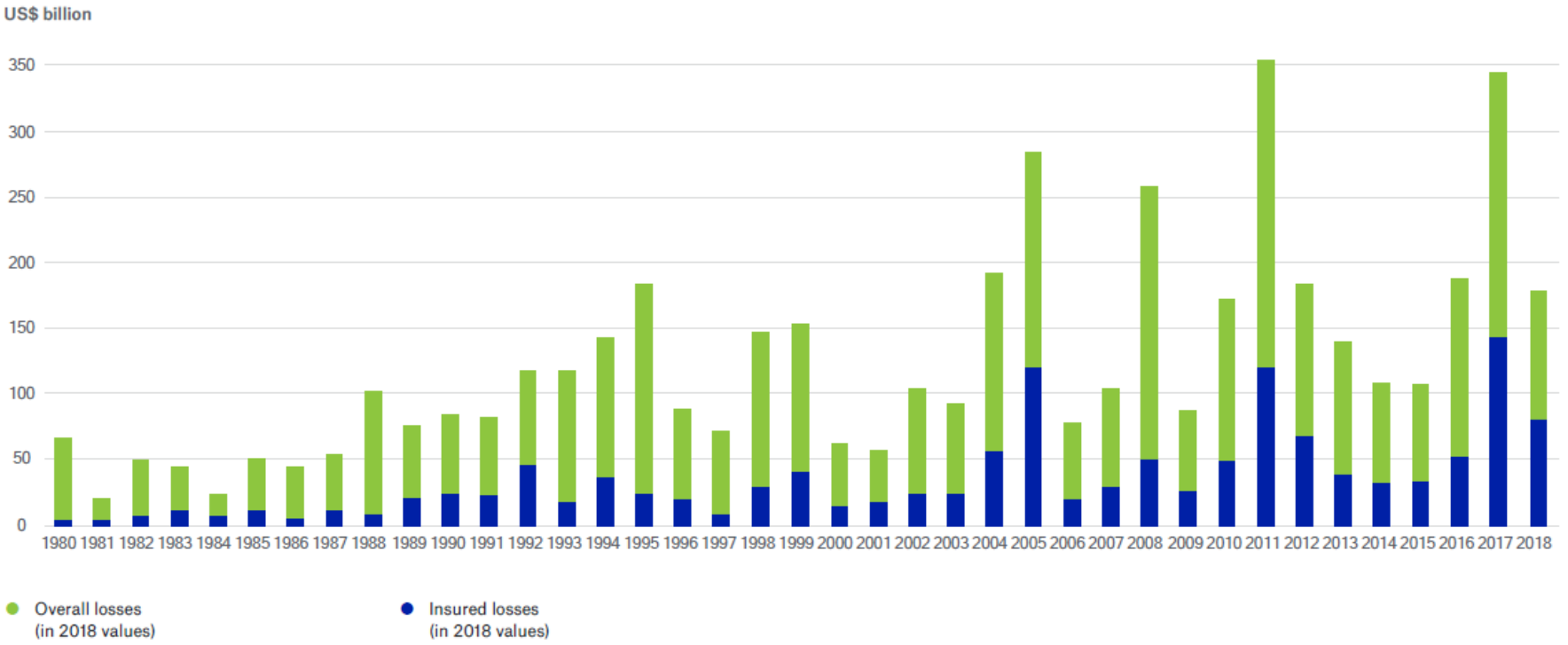
Catastrophic weather-related loss events worldwide 1980 – 2018



Accounted events have caused ≥ 1,000 fatalities and/or produced normalised losses ≥US$ 100m, 300m, 1bn, or 3bn (depending on the assigned World Bank income group of the affected country).

Overall and insured losses in US$

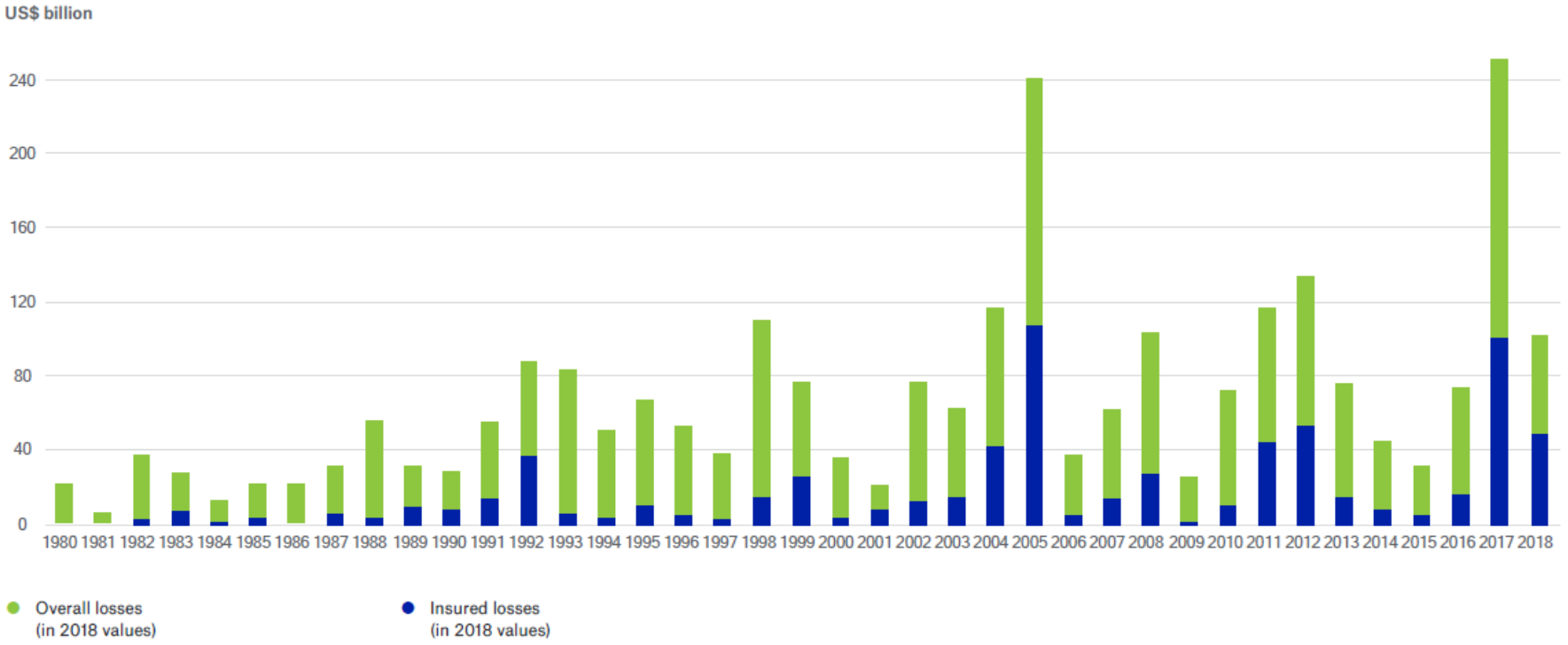
Relevant natural loss events worldwide 1980 – 2018



Inflation adjusted via country-specific consumer price index and consideration of exchange rate fluctuations between local currency and US$.

Overall and insured losses in US$

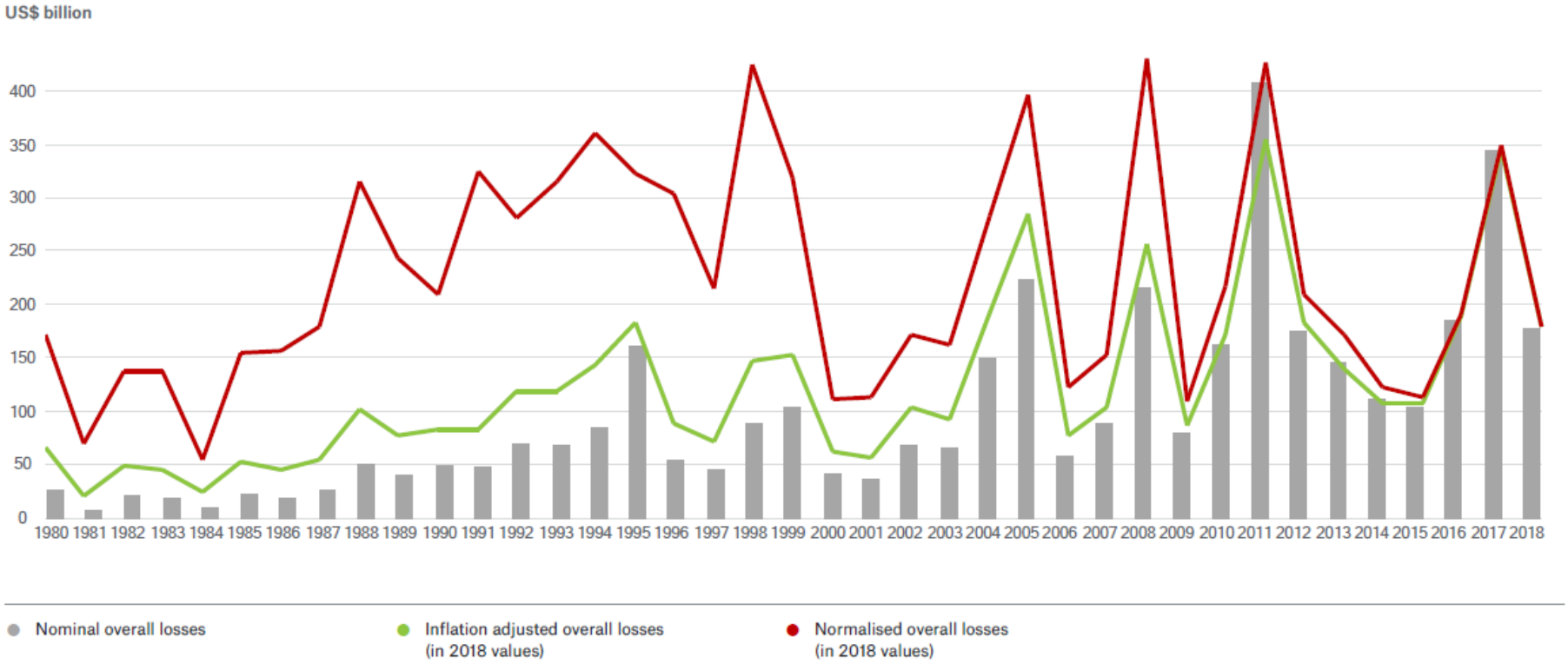
Catastrophic weather-related loss events worldwide 1980 – 2018



Inflation adjusted via country-specific consumer price index and consideration of exchange rate fluctuations between local currency and US$.

Overall losses in US$: nominal, inflation adjusted, and normalised

Relevant natural loss events worldwide 1980 – 2018



Inflation adjusted via country-specific consumer price index and consideration of exchange rate fluctuations between local currency and US$.
Normalization via local GDP developments measured in US$.

5 costliest events ordered by nominal overall losses

Relevant natural loss events worldwide 1980 – 2018

Date	Event	Affected Area	Overall losses (US$m, original values)	Insured losses (US$m, original values)	Fatalities
11 Mar 2011	Earthquake, tsunami	Japan: Honshu, Miyagi, Sendai, Aomori, Tohoku, Fukushima, Mito, Ibaraki, Tochigi, Utsunomiya, Iwate, Morioka, Yamagata, Chiba, Tokyo	210,000	40,000	15,880
25 - 30 Aug 2005	Hurricane Katrina, storm surge	United States: LA, New Orleans, Slidell, MS, Biloxi, Pascagoula, Waveland, Gulfport, Bay St. Louis, Hattiesburg, McComb, AL, FL	125,000	60,500	1,720
17 Jan 1995	Earthquake	Japan: Hyogo, Kobe, Osaka, Kyoto	100,000	3,000	6,430
25 Aug - 1 Sep 2017	Hurricane Harvey, storm surge, flood	United States: TX, Harris County, Houston, Rockport, Refugio, Corpus Christi, Galveston, Crosby, LA, Lake Charles, Evangeline, AL, LA, MS, NC, TN, Nashville, Davidson County	95,000	30,000	88
12 May 2008	Earthquake	China: Sichuan, Mianyang, Beichuan, Wenchuan, Shifang, Chengdu, Guangyuan, Ngawa, Ya'an, Ziyang, Meishan, Suining, Garzê, Neijiang, Gansu, Shaanxi, Chongqing, Yunnan, Maoxian	85,000	300	87,149

5 costliest events ordered by nominal insured losses

Relevant natural loss events worldwide 1980 – 2018

Date	Event	Affected Area	Overall losses (US$m, original values)	Insured losses (US$m, original values)	Fatalities
25 - 30 Aug 2005	Hurricane Katrina, storm surge	United States: LA, New Orleans, Slidell, MS, Biloxi, Pascagoula, Waveland, Gulfport, Bay St. Louis, Hattiesburg, McComb, AL, FL	125,000	60,500	1,720
11 Mar 2011	Earthquake, tsunami	Japan: Honshu, Miyagi, Sendai, Aomori, Tohoku, Fukushima, Mito, Ibaraki, Tochigi, Utsunomiya, Iwate, Morioka, Yamagata, Chiba, Tokyo	210,000	40,000	15,880
6 - 14 Sep 2017	Hurricane Irma, storm surge, flood	United States, Virgin Islands, U.S., Virgin Islands, British, Cuba, Saint Martin, Sint Maarten, Saint Barthelemy, Anguilla, Puerto Rico, Turks and Caicos Islands, Antigua and Barbuda, Bahamas, Bonaire, Sint Eustatius, Saba, Dominican Republic, Haiti, Saint Kitts and Nevis	60,600	33,400	128
25 Aug - 1 Sep 2017	Hurricane Harvey, storm surge, flood	United States: TX, Harris County, Houston, Rockport, Refugio, Corpus Christi, Galveston, Crosby, LA, Lake Charles, Evangeline, AL, LA, MS, NC, TN, Nashville, Davidson County	95,000	30,000	88
19 - 22 Sep 2017	Hurricane Maria, flood	Puerto Rico, Virgin Islands, U.S., Dominica, Guadeloupe, Dominican Republic, Martinique, Haiti	68,600	29,900	3,019

Percentage distribution by continent

Catastrophic natural loss events worldwide 1980 – 2018

Number of events:
1,042

- 16.7%
- 4.8%
- 6.8%
- 9.3%
- 60.4%
- 2.0%

Overall losses:
US$ 3,483bn

- 41.4%
- 3.0%
- 8.8%
- 1.0%
- 43.7%
- 2.1%

Fatalities :
1,489,216

- 14.4%
- 2.3%
- 8.9%
- 1.6%
- 72.6%
- 0.2%

Insured losses :
US$ 821bn

- 71.7%
- 1.4%
- 7.3%
- 0.1%
- 15.4%
- 4.1%

- North America (incl. Central America and Caribbean)
- South America
- Europe
- Africa
- Asia
- Australia/Oceania

Accounted events have caused ≥ 1,000 fatalities and/or produced normalised losses ≥US$ 100m, 300m, 1bn, or 3bn (depending on the assigned World Bank income group of the affected country).

Inflation adjusted via country-specific consumer price index and consideration of exchange rate fluctuations between local currency and US$.

Percentage distribution by continent

Relevant natural loss events worldwide 1980 – 2018

Number of events:
18,169

- 21.4%
- 6.9%
- 16.2%
- 10.9%
- 38.7%
- 5.9%

Overall losses:
US$ 4,798bn

- 43.0%
- 2.9%
- 13.1%
- 1.1%
- 36.7%
- 3.2%

Fatalities :
1,739,485

- 13.6%
- 3.1%
- 8.9%
- 2.9%
- 71.1%
- 0.4%

Insured losses :
US$ 1,354bn

- 68.8%
- 1.1%
- 13.7%
- 0.2%
- 11.5%
- 4.7%

- North America (incl. Central America and Caribbean)
- South America
- Europe
- Africa
- Asia
- Australia/Oceania

Accounted events have caused at least one fatality and/or produced normalised losses ≥ US$ 100k, 300k, 1m, or 3m (depending on the assigned World Bank income group of the affected country).

Inflation adjusted via country-specific consumer price index and consideration of exchange rate fluctuations between local currency and US$.

Otázky:

- **Promítá se pozorovaný proces globálního oteplování na Zemi do frekvence a intenzity hydrometeorologických extrémů?**
- **Stává se lidská společnost citlivější na dopady hydrometeorologických extrémů?**
- **Je percepce hydrometeorologických extrémů ovlivňována ve větší míře sdělovacími prostředky?**

7.2 Hydrometeorologické extrémy

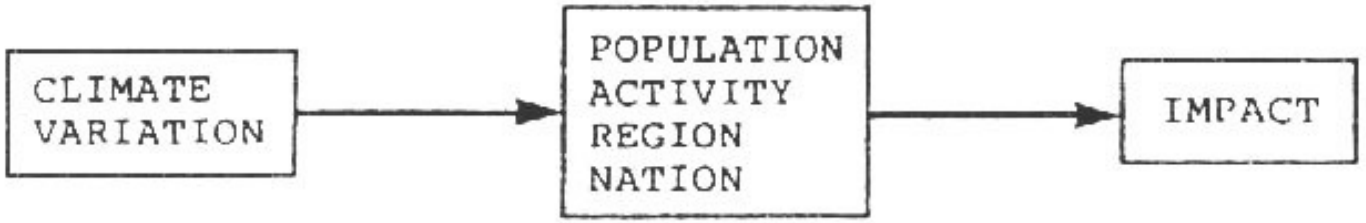
- hodnoty meteorologických (hydrologických) prvků vyskytující se s dostatečně malou pravděpodobností – teoretické rozdělení
- případy meteorologických (hydrologických) jevů způsobujících ztráty na lidských životech a různé materiální škody

Zdroje údajů o hydrometeorologických extrémech

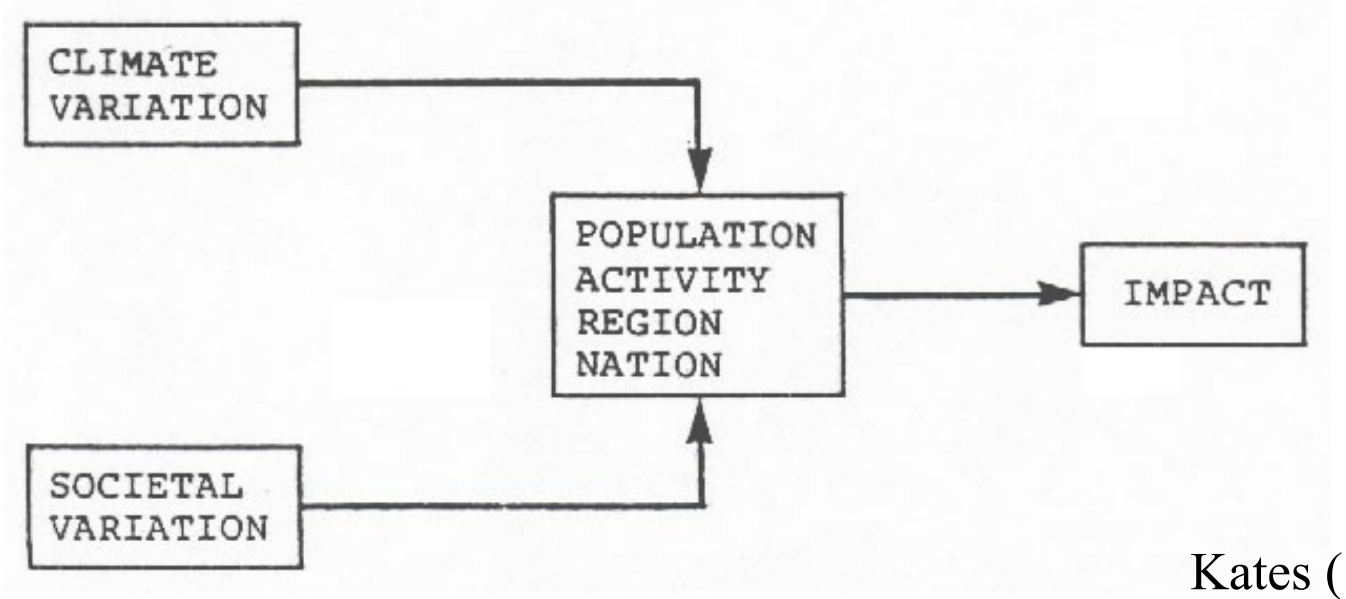
- systematická (přístrojová) pozorování - národní sítě meteorologických (hydrologických) stanic
- dokumentární údaje - přímé a nepřímé (proxy) informace
- paleoklimatické údaje – přírodní proxy

7.3 Dopady klimatu na lidskou společnost

Impact Model



Interaction Model

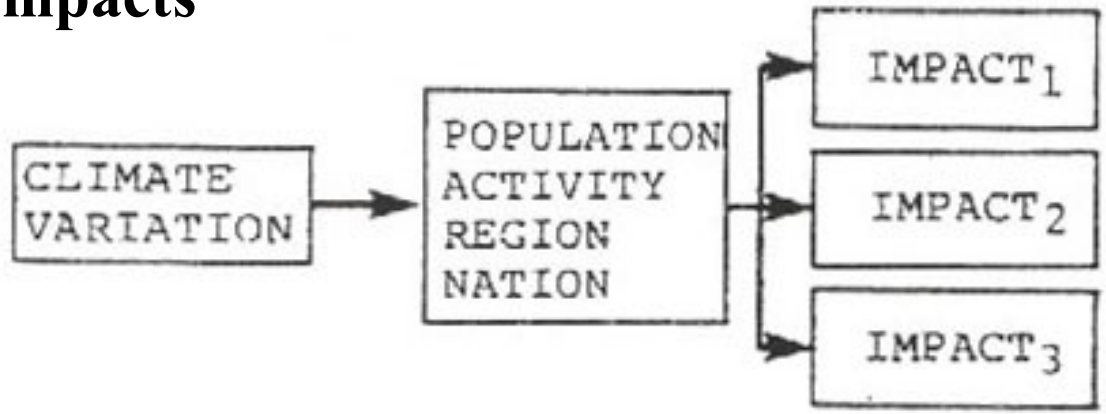


Kates (1985)

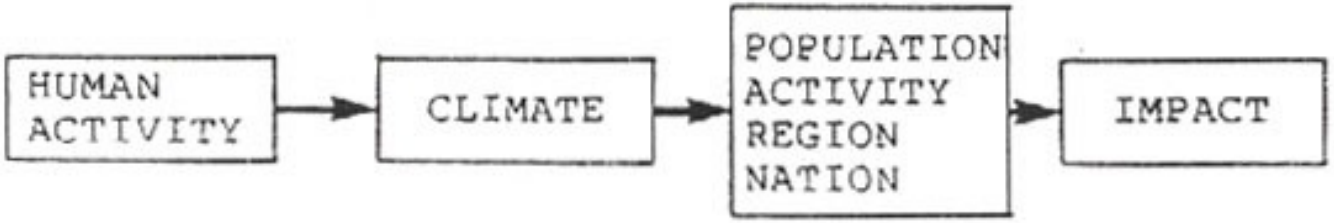
Impaktní modely

Ordered Impacts

Multiple Impacts



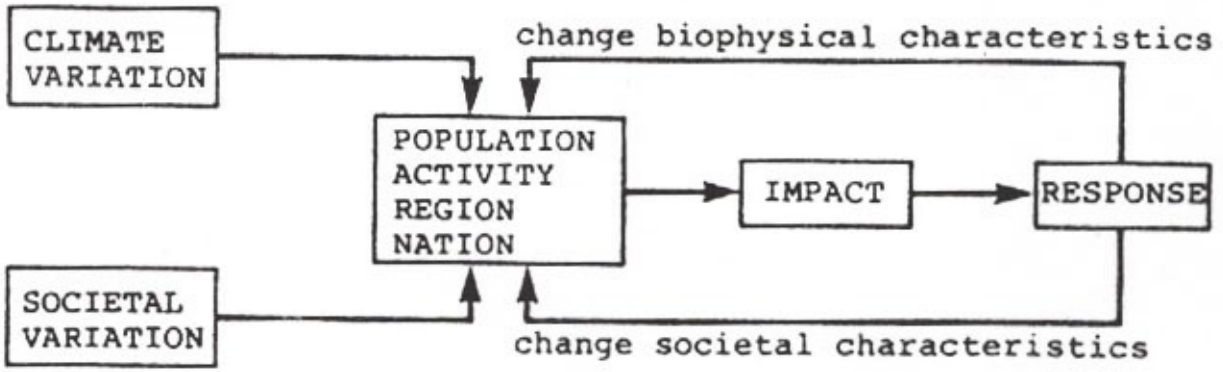
Anthropogenic Climatic Impacts



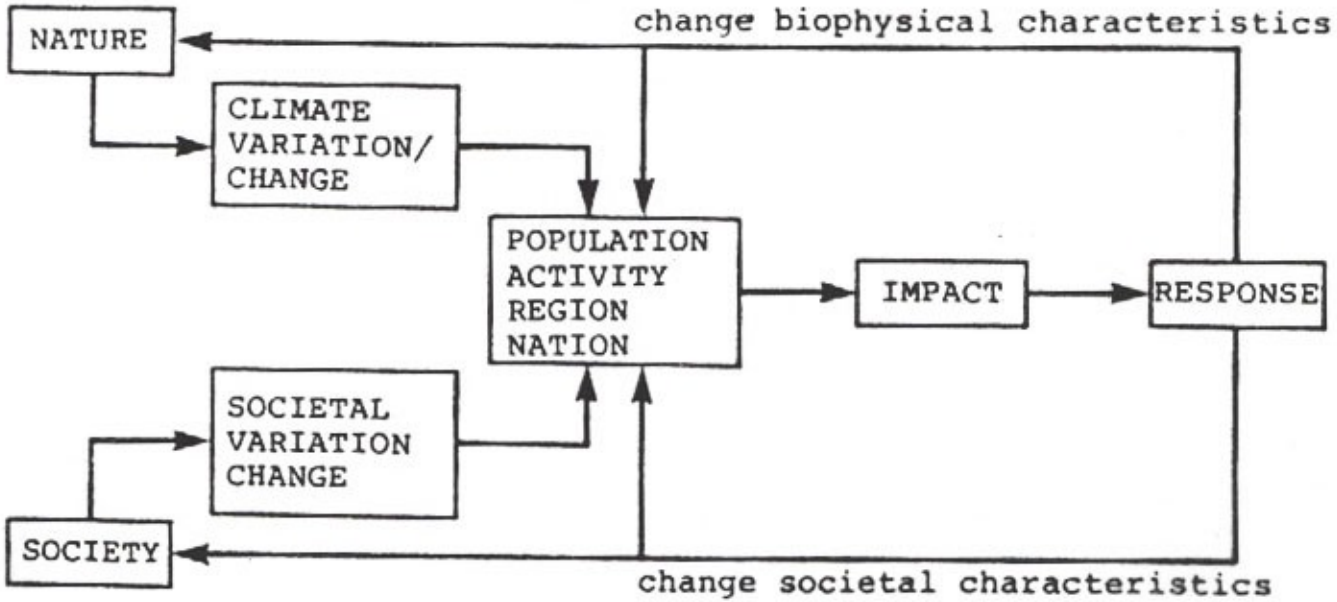
Kates (1985)

Interakční modely

Interactive Model/Feedback



Interactive Model/Feedback/Underlying Process



Kates (1985)

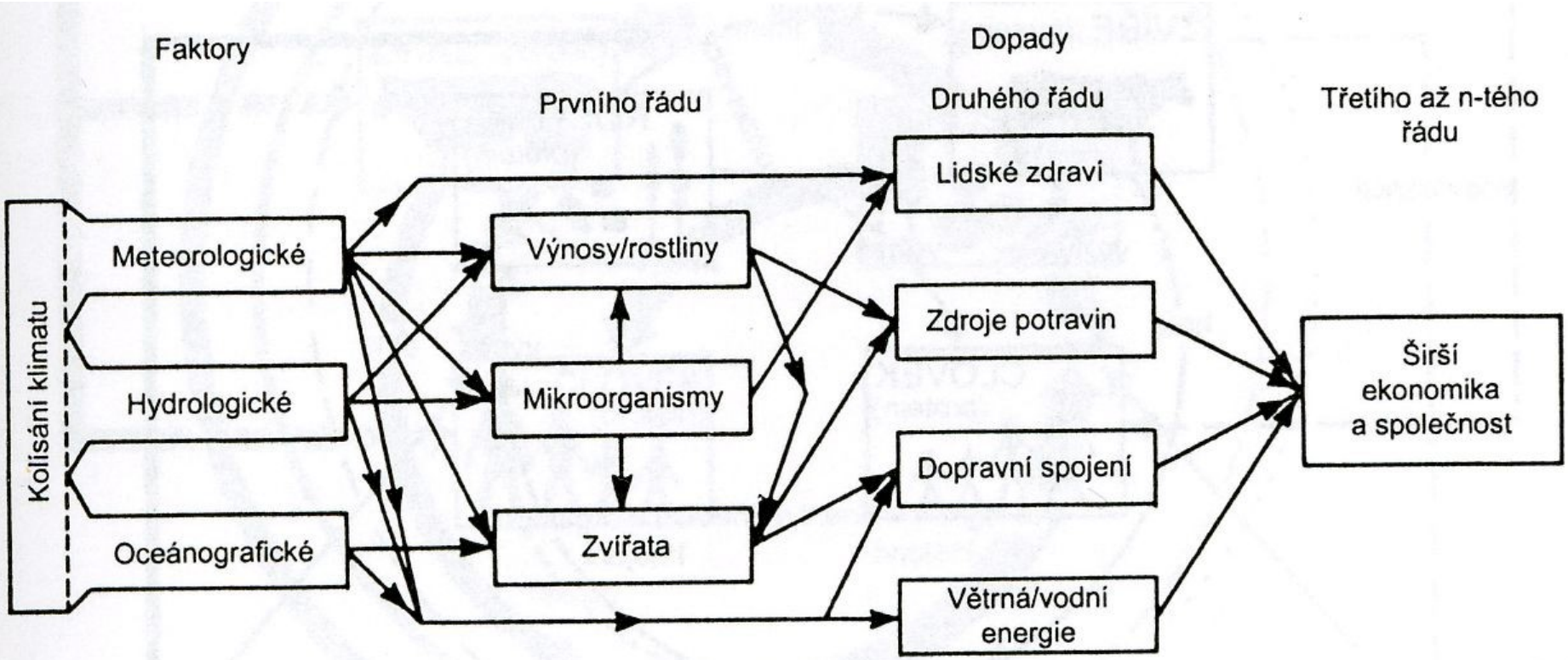
Úrovně dopadů klimatu na lidskou společnost

- ***First-order impacts***: Biophysical impacts on crops, energy availability and animals (wild and domestic)

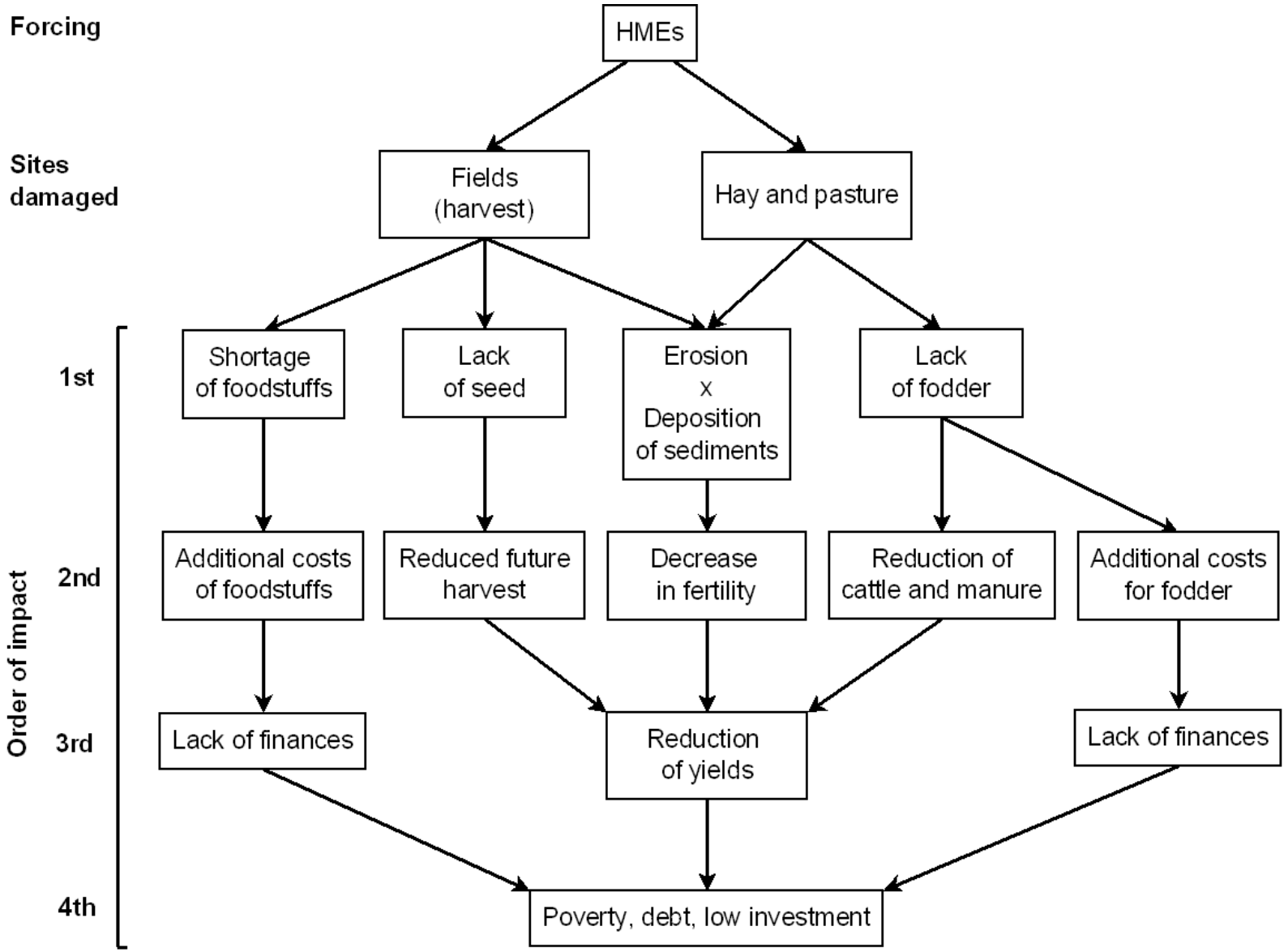
- ***Second-order impacts:*** Food prices; hunger, malnutrition and disease; population decline

- ***Third-order impacts***: Economic disruption and social disturbance (birth-rate, death-rate, migration etc.)

Kates (1985), Pfister (2007)



Obr. 9. Působení kolísání klimatu na člověka a společnost – příklad specifikace modelu postupných impaktů[95]



Dopady hydrometeorologických extrémů v zemědělství (jižní Morava – 18.-19. století) (Dolák et al., Geografie, 2015)

7.3.1 Výživa a ceny

Klimatické podmínky ovlivňující kvalitu a kvantitu produkce v tradičním zemědělství ve střední Evropě

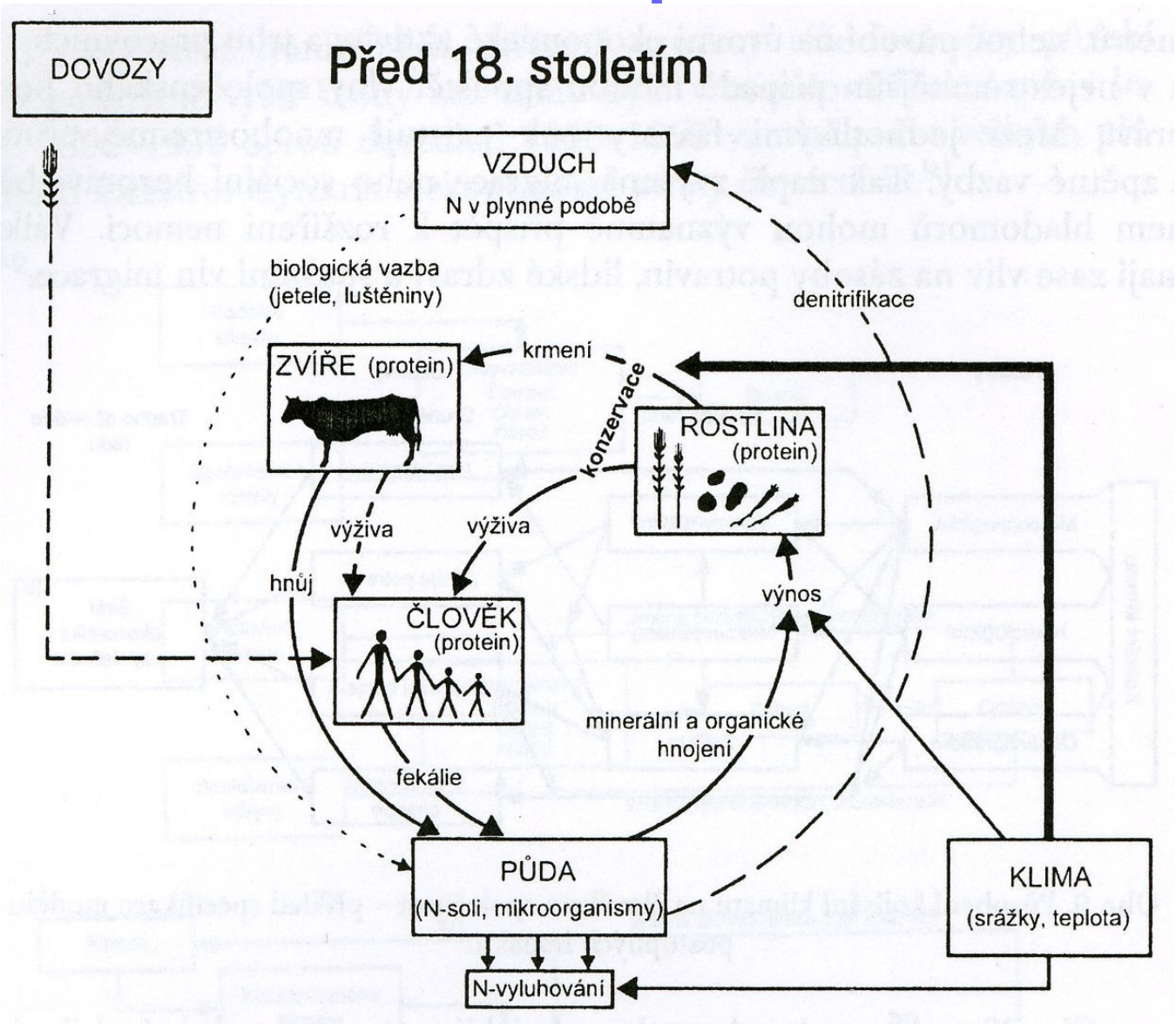
Critical months	***Grain***	***Dairy***	***Vine***
September-October	Wet	Cold	**Cold, wet**
March-April	Cold	Cold	(Late frost)
July-August	**Wet**	Wet	Wet

Bold: conditions affecting the quality of crops
Normal: volume of harvests or animal production

ztráty nedostatečně suchého obilí při uskladnění až 1/3 sklizně (klíčení, plísně, škůdci); srážky během senoseče – vymývání živin (proteiny) – pokles produkce mléka; studené deště – poškození plodových oček u vinné révy – menší sklizeň

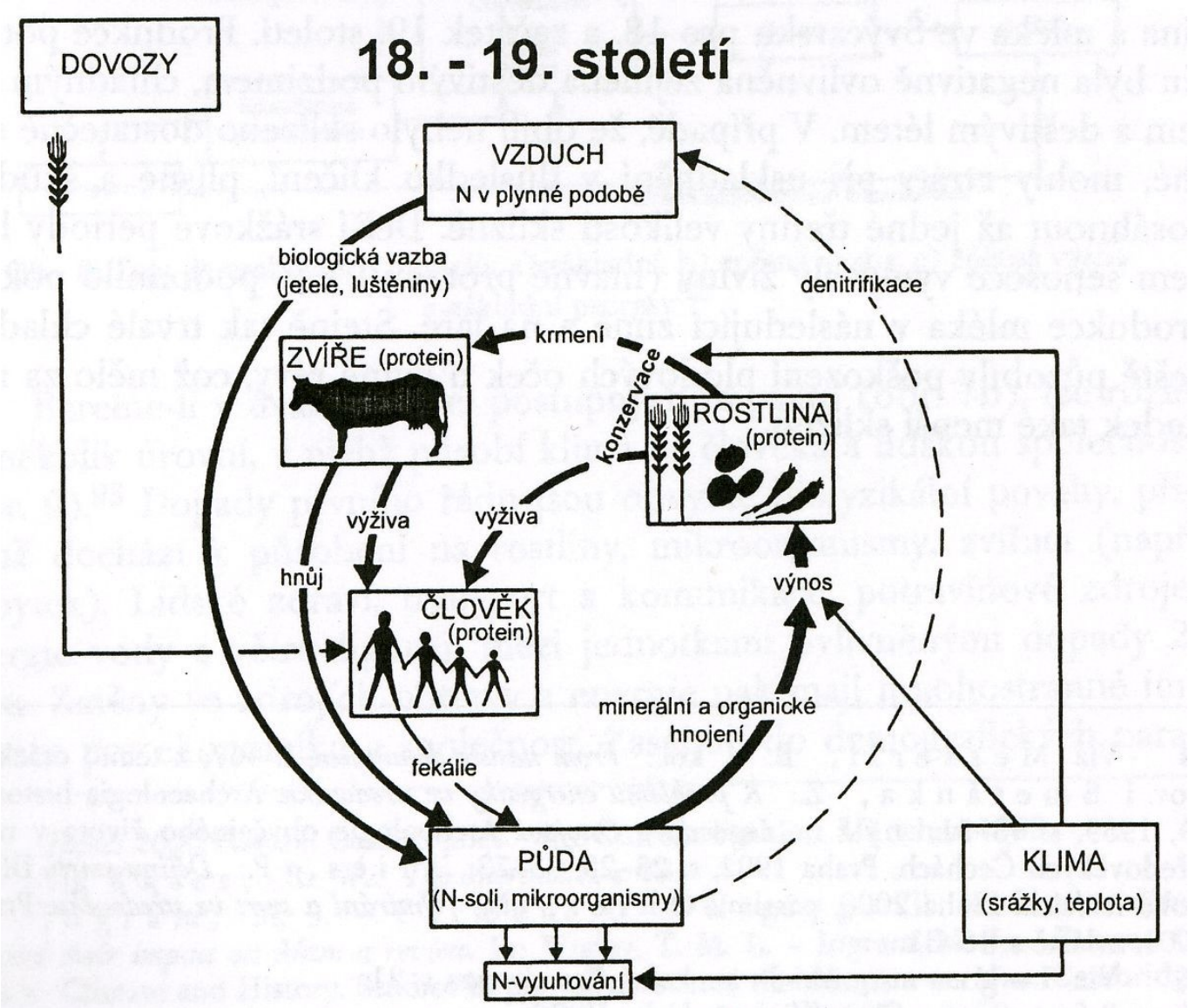
Pfister (2005)

Evolution of the nitrogen cycle in societies in Central Europe - 1



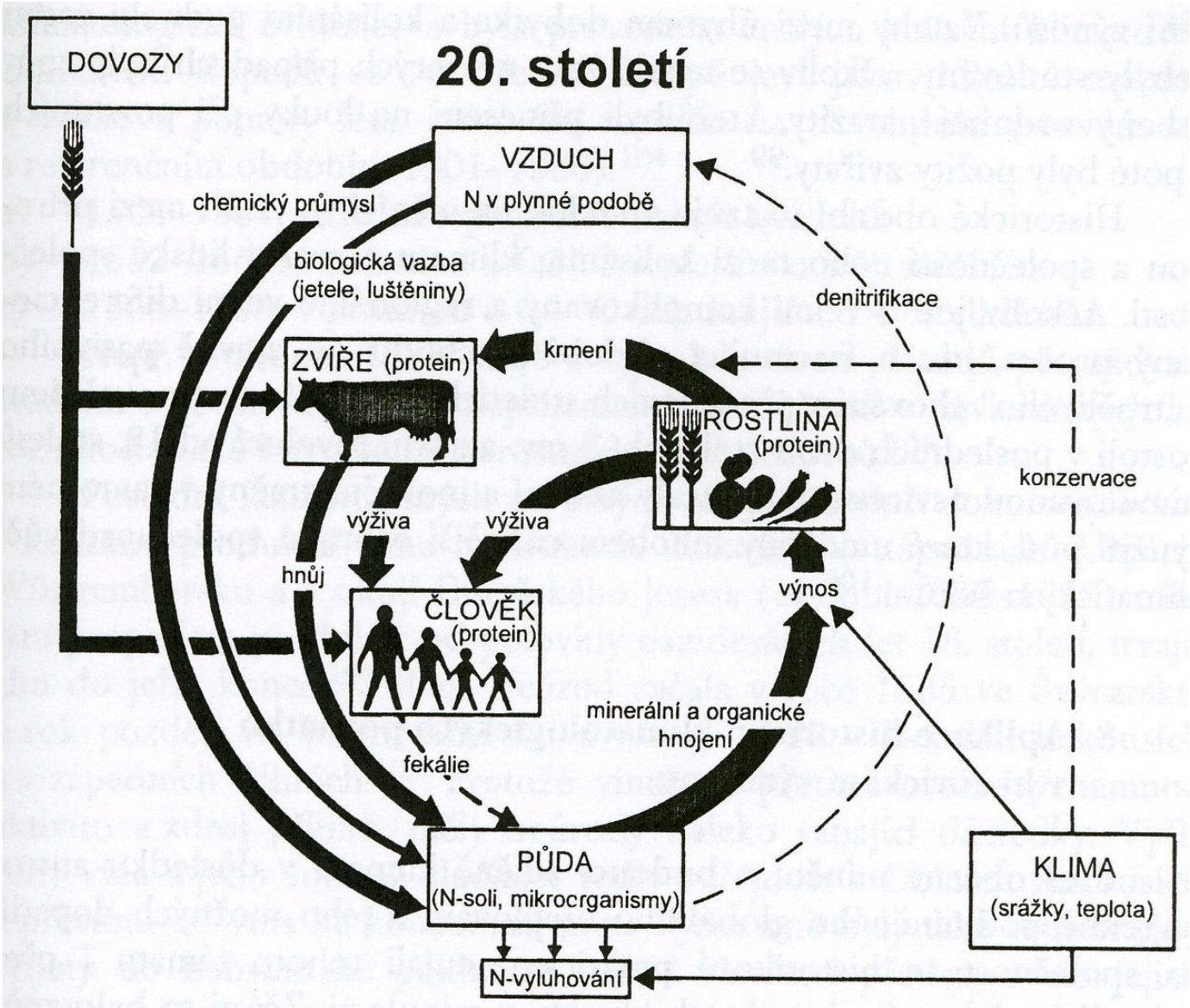
Pfister (1988)

Evolution of the nitrogen cycle in societies in Central Europe - 2



Pfister (1988)

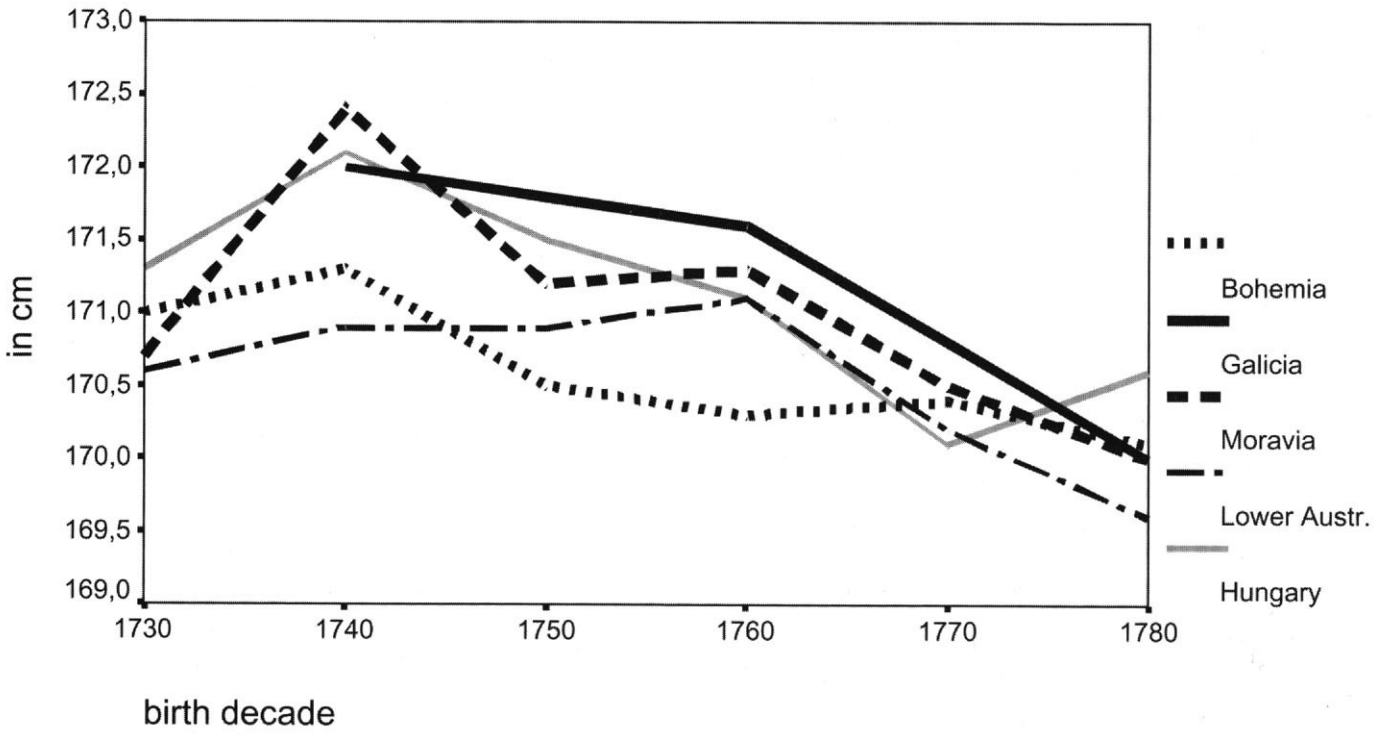
Evolution of the nitrogen cycle in societies in Central Europe - 3



Pfister (1988)

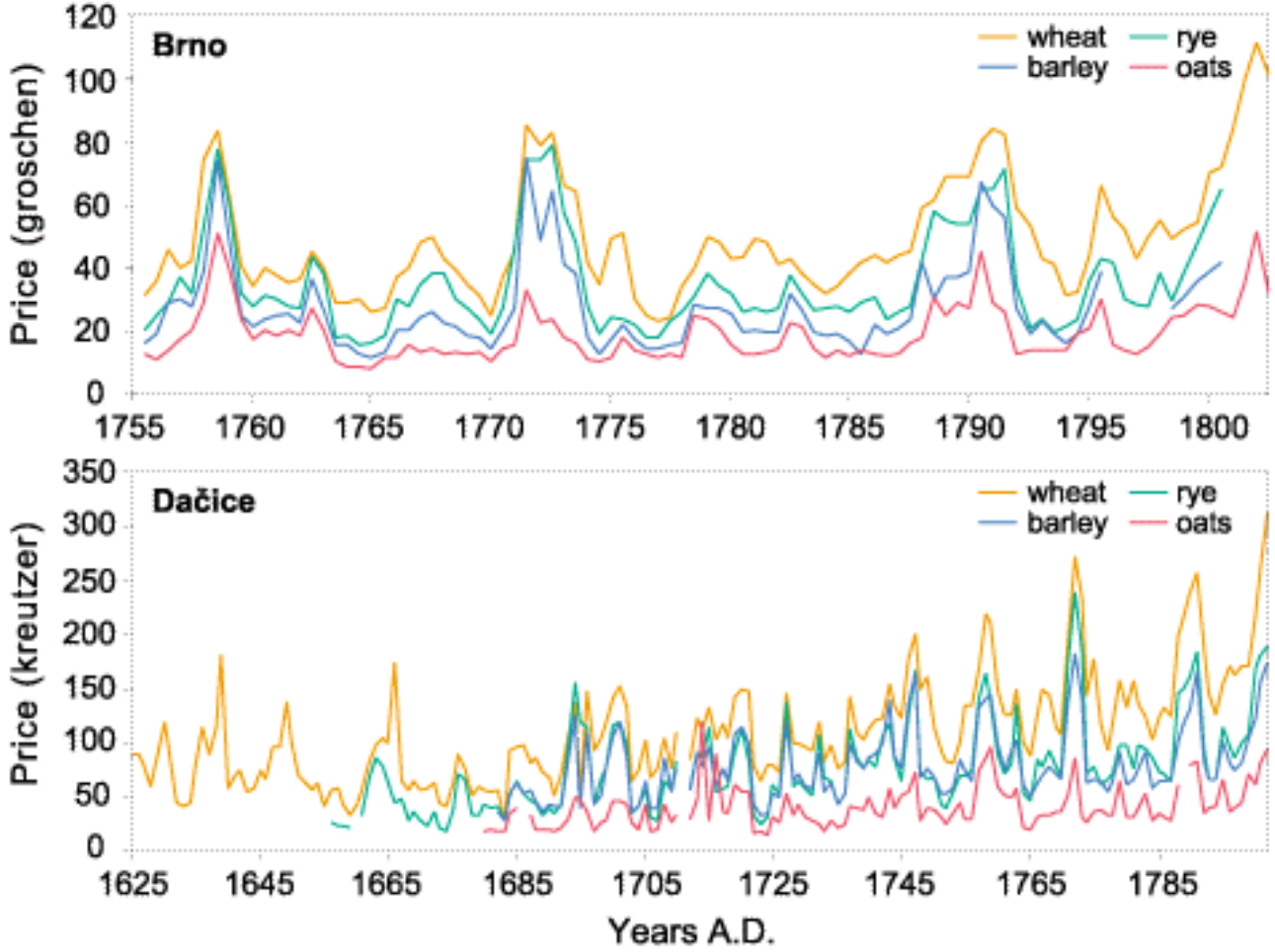
Human Stature and Climate

Climate - Nutritional Status - Human Stature



Trends in heights of the Habsburg soldiers in age 23-50 years sorted according to birth decade (Baten, 2002)

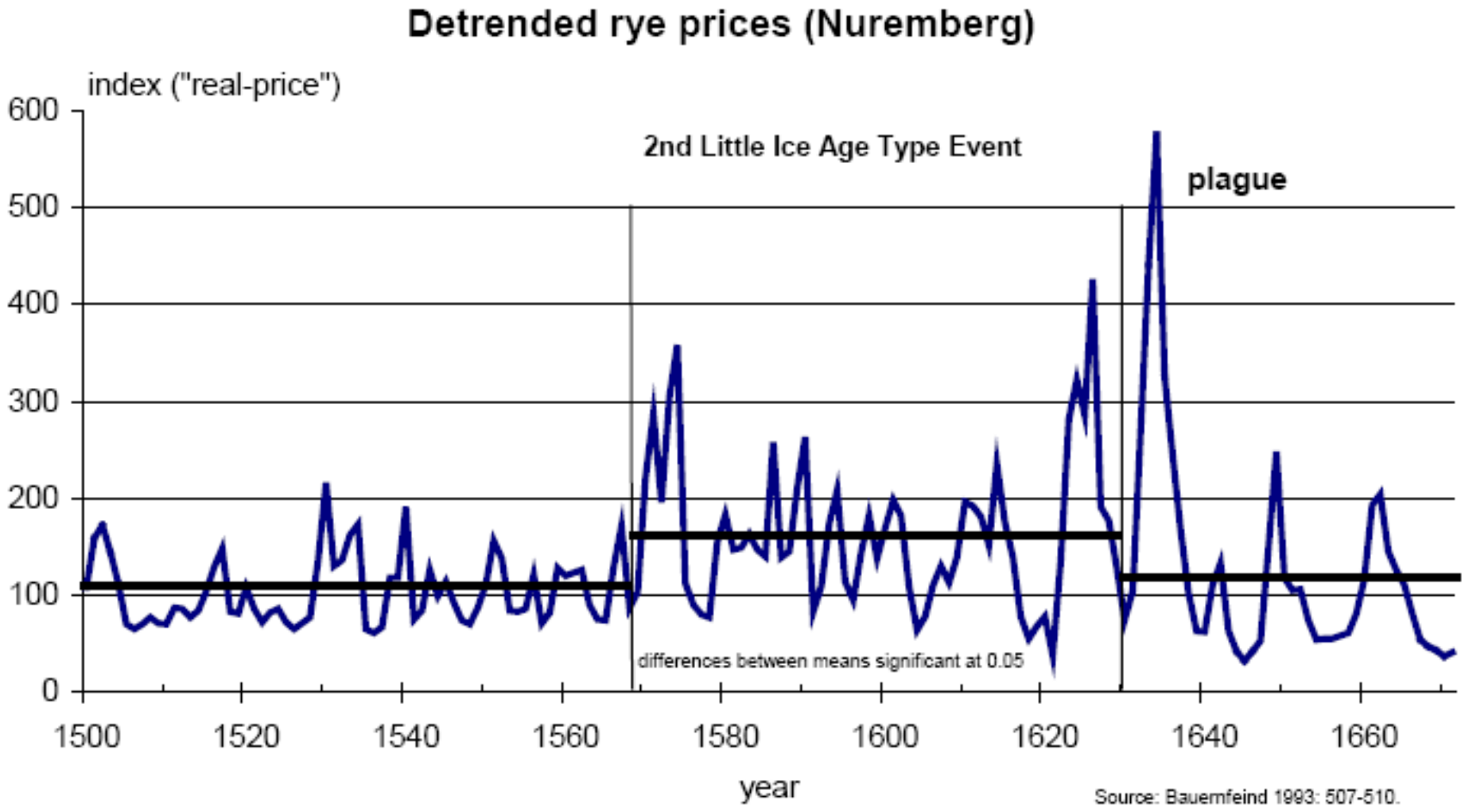
Climate and grain prices in the 16th-18th centuries



- adverse weather of the given or preceding year was a reason for bad harvest in 67% of 61 selected years (socio-economic factors in 57%)

- a weather effect was quite dominant in one-third of all years

(Brázdil and Durďáková, 2000)



Pfister (2005)

7.3.2 Hydrometeorologické extrémy a daně

Daňový systém na Moravě v 17.-19. století

Tzv. **lánové bernictví** - zdaněna pouze půda poddanská (rustikál), půda panská (dominikál) osvobozena.

První moravská lánová vizitace (1655)

- „*kdo budoucně utrpí škodu ohněm neb jinak, má za účelem odpisu berních lánů na škodu připadajících, hlásiti ji krajskému hejtmanu, který ji se sousedy zjistí*“

Druhá moravská lánová vizitace (1675)

- hlášení živelní škody (rychtář)
- kontrola škodní komisí ustavenou krajským hejtmanem
- krajská správa - snížení daně

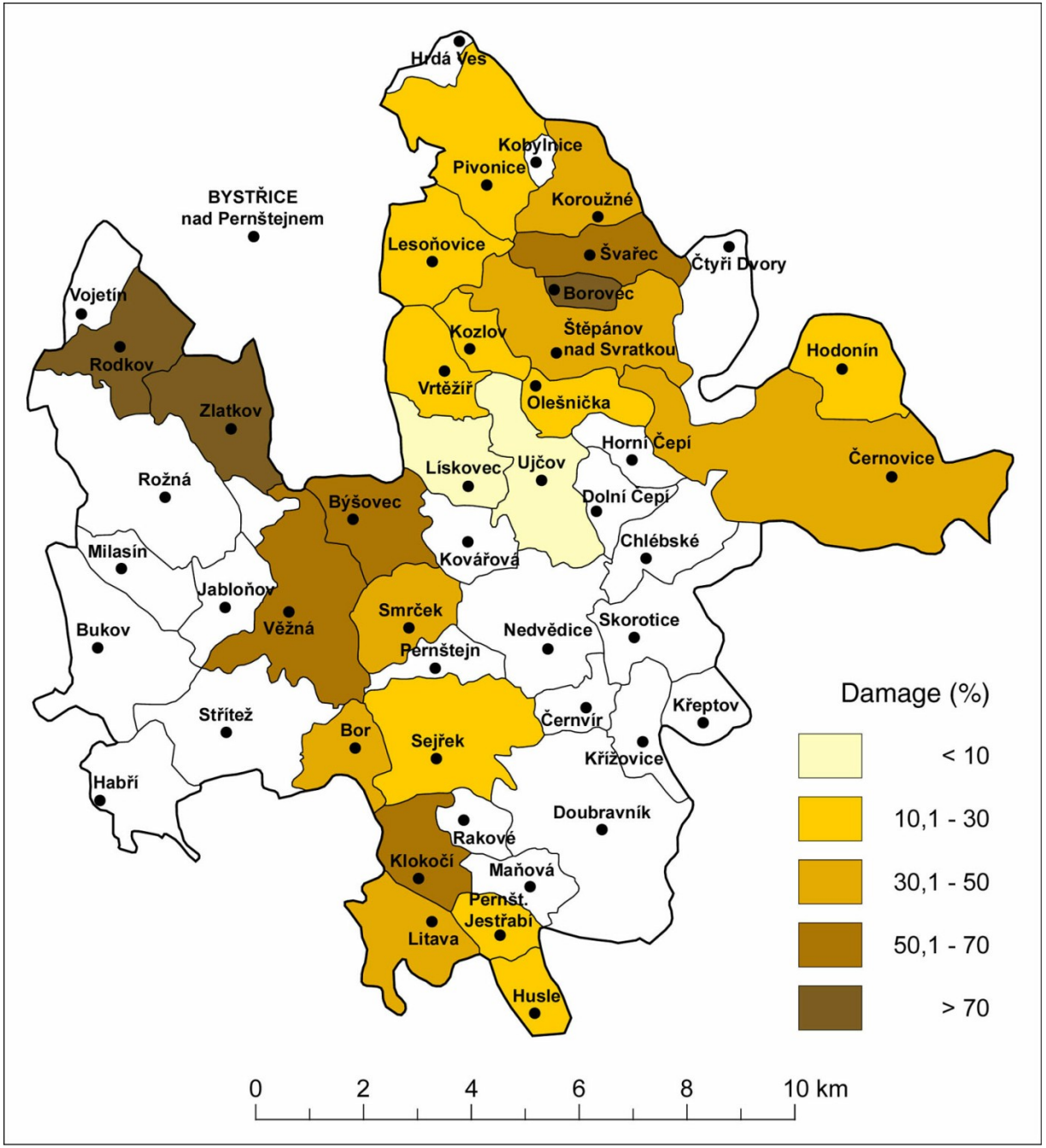
Tereziánský katastr (1760-1820)

- placení daně postupně i z dominikálu

Impacts of weather extremes

Percentage expression of damage on subject land due to hailstorm, torrential rain and flood of 10 August 1694 at the domain Pernštejn (related to the land-registers of communities in 1675)

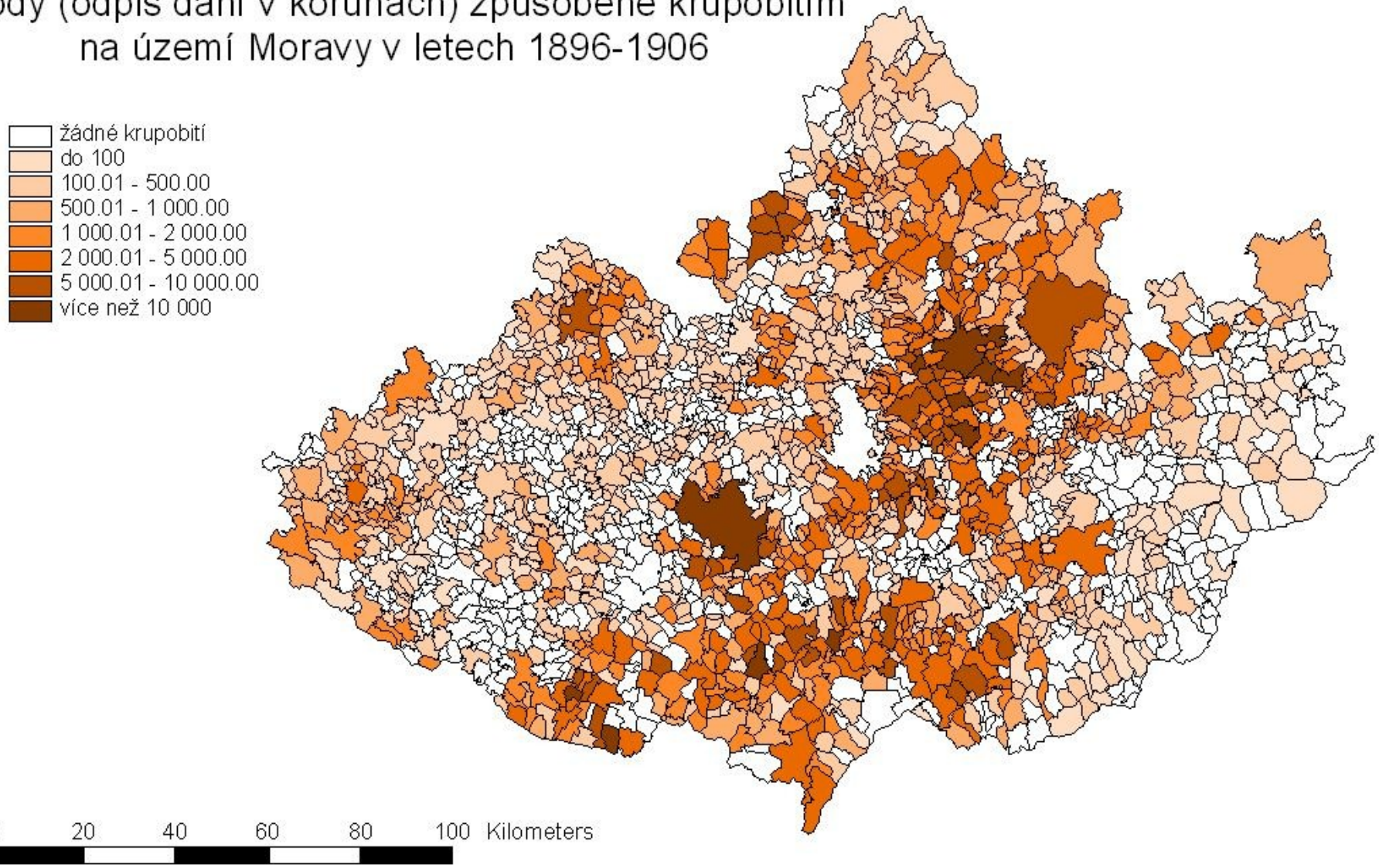
(Brázdil, Valášek, Meteorologicky časopis, 2003)

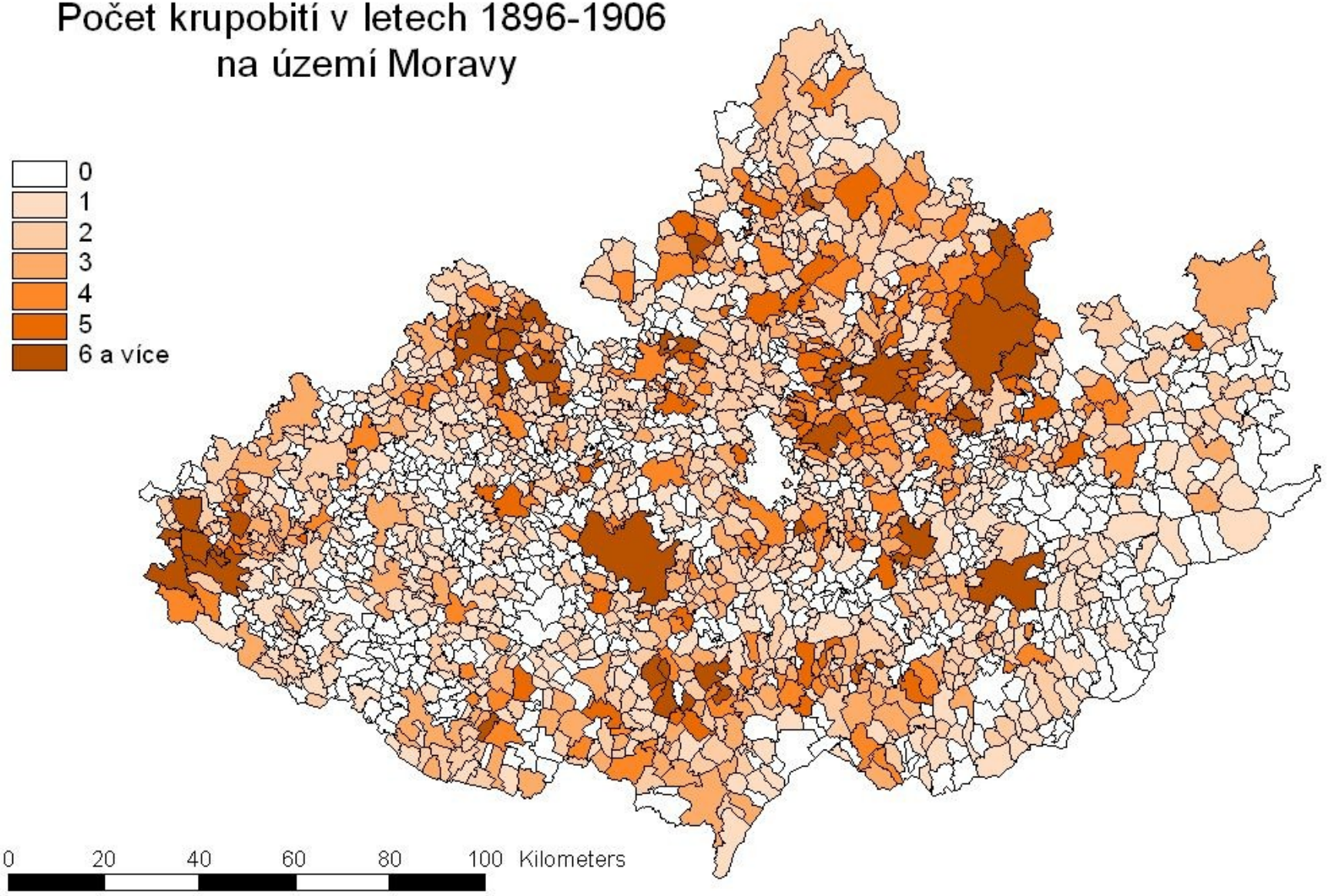


An overview of hydrological and meteorological extremes and their impacts on the domain of Perštejn in the period 1694–1718. The affected area is expressed on the one hand in metres (m), on the other hand as a percentage share of the area on the rustical land as existed in 1675. Explanations: H—hailstorms, SR—spate rain, F—flood, *—damage in three days

Date	Event	Number of villages	Number of farmers	Area (m)	Area (%)
10 Aug. 1694	H, SR, F	25	224	203 7/8	25.0
1705*	H, SR, F	10	72	82 3 7/8	10.1
2 Jun. 1710	SR, F	8	49	60 5 6/8	7.4
28 May 1711	(H)	4	24	39 6 7/8	4.9
8 May 1714	H, SR, F	10	94	96 8 3/8	11.9
1 Aug. 1714	SR, F	9	25	12 7 7/8	1.6
22 Jun. 1717	SR, F	4	10	19 4 6/8	2.4
10 Oct. 1718	SR, F	4	7	6 6 -	0.8

Škody (odpis daní v korunách) způsobené krupobitím na území Moravy v letech 1896-1906




Počet krupobití v letech 1896-1906
na území Moravy
0
1
2
3
4
5
6 a více
0
20
40
60
80
100
Kilometers

7.3.3 Povětrnostní extrémy a lesy

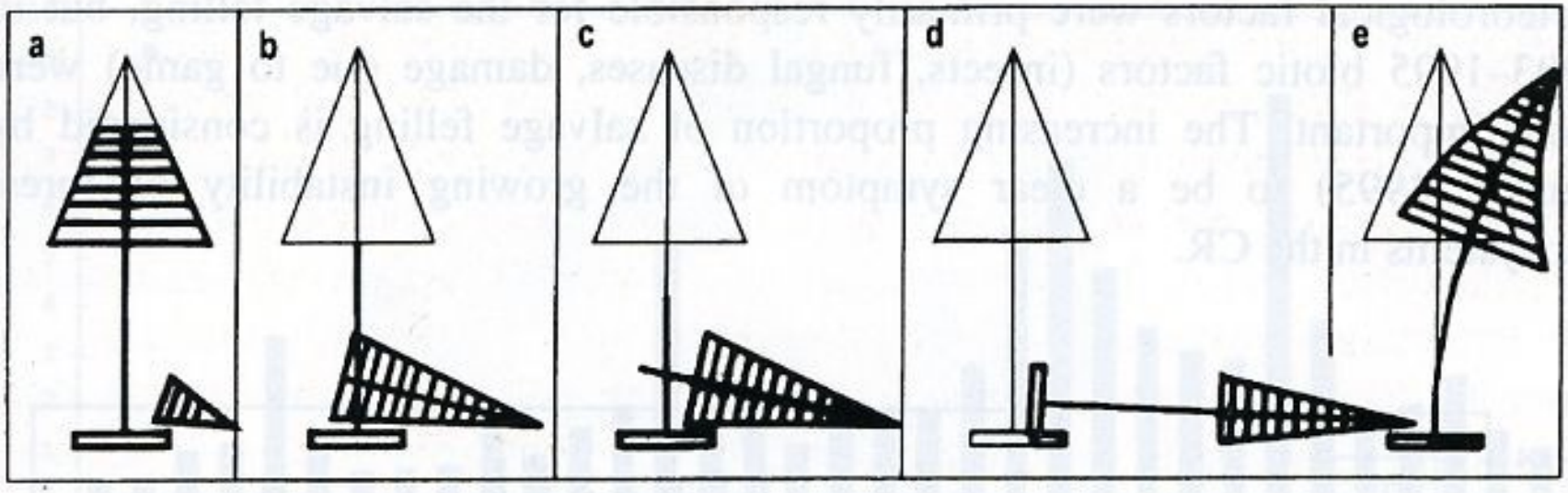


Fig. 1. Possible kinds of tree damage during wind, snow and ice deposit disasters: a) top-break, b) crown-break, c) stem-break, d) wind-fall, e) wind-lean (adapted after Vicena 1992)

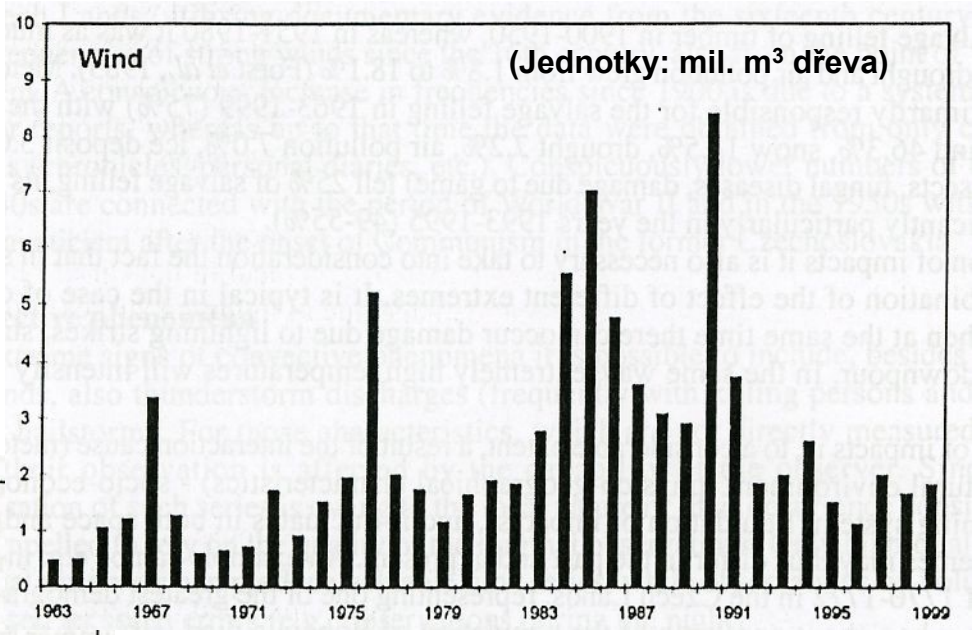
Brázdil, R. (1998): Meteorological extremes and their impacts on forests in the Czech Republic. In: Beniston, M., Innes, J. L., eds.: The Impacts of Climate Variability on Forests. Lecture Notes in Earth Sciences 74. Springer, Berlin, Heidelberg, New York, s. 19-47.

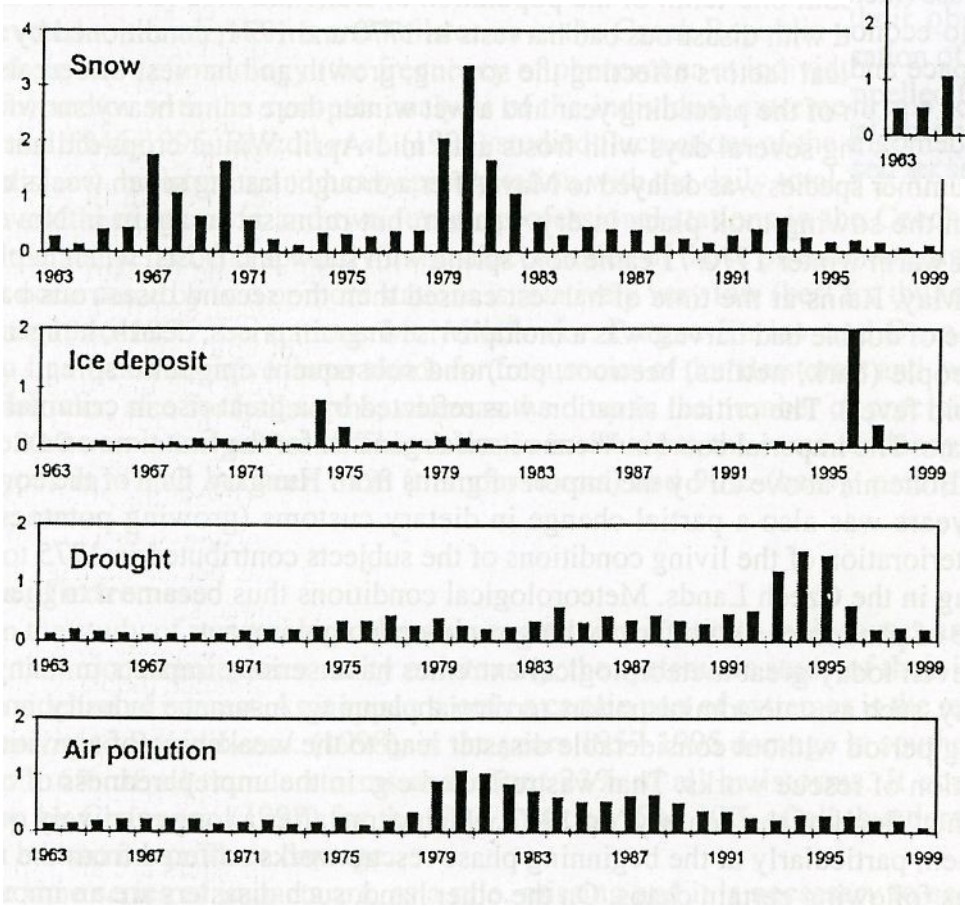
Podíl meteorologických extrémů na nahodilé těžbě dřeva

1900-1950: 43,8 % 1951-1980: 73,0 %

(sucho + znečištění z 1,8 % na 18,1 %)

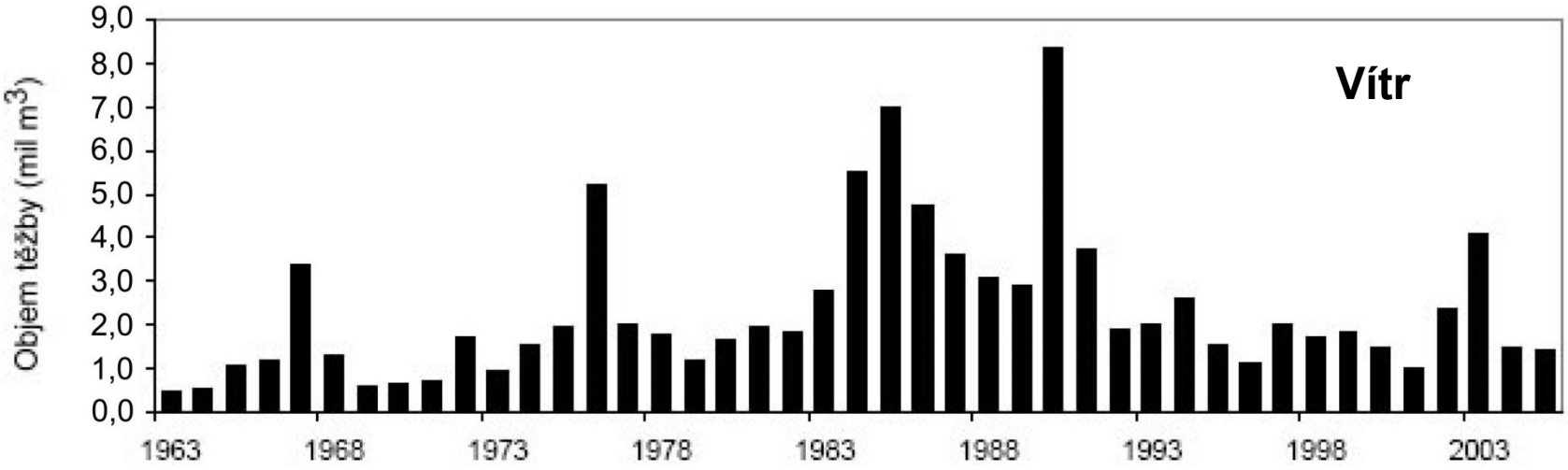
1963-1999: 75,0 %

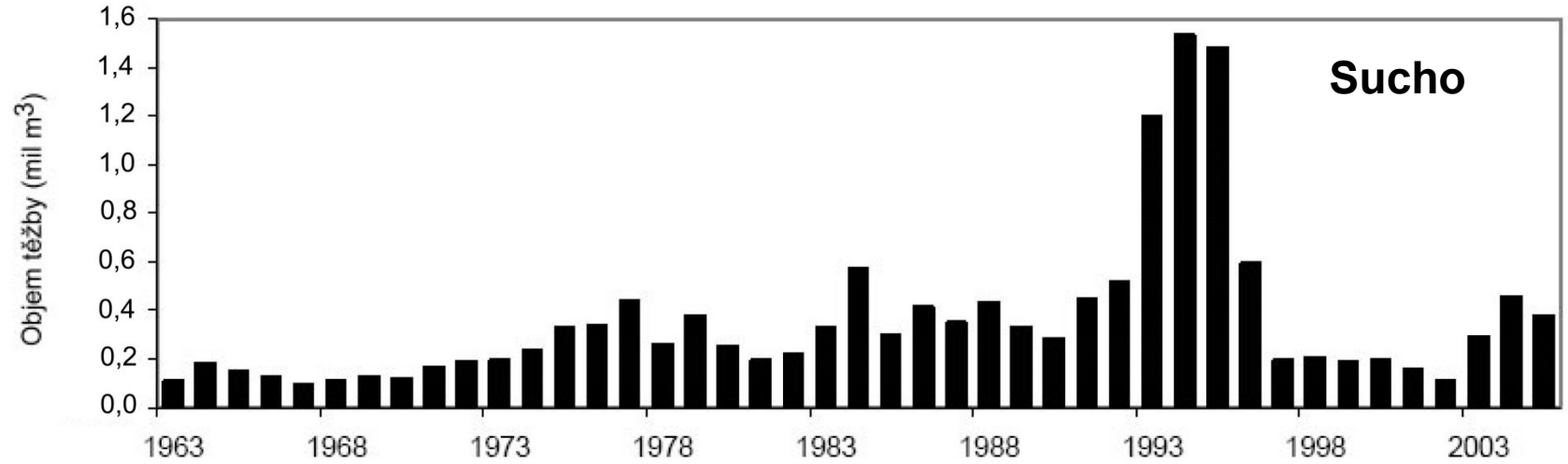




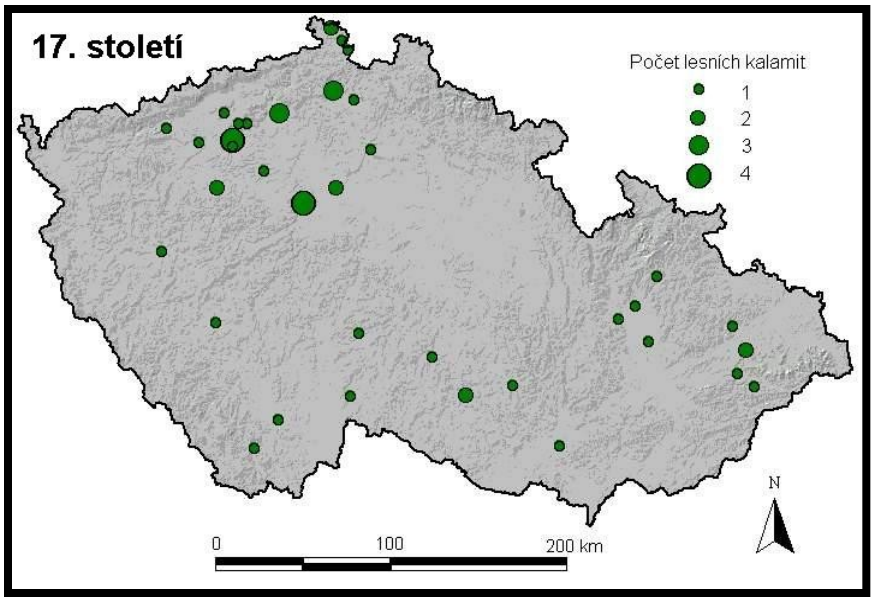
Podíly meteorologických faktorů na nahodilé těžbě dřeva (1963-1999)

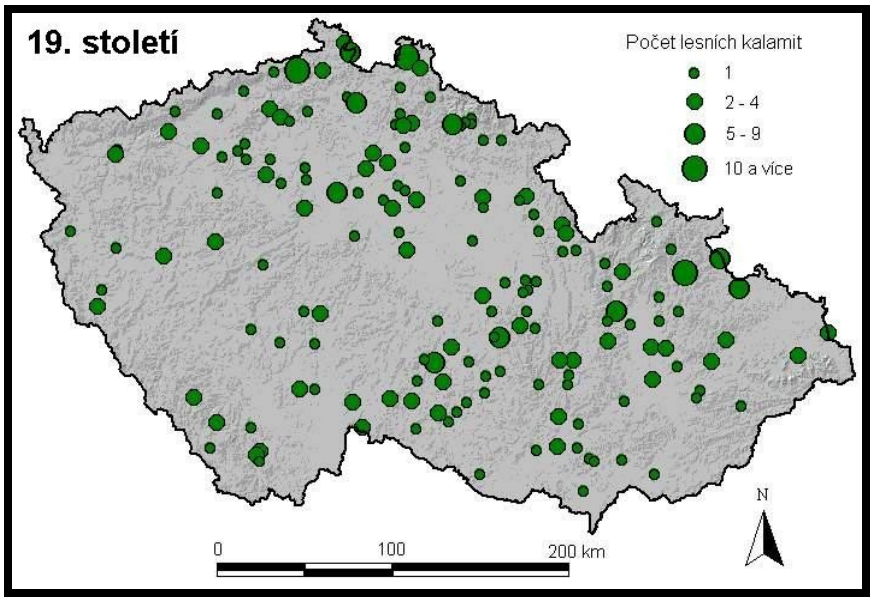
- vítr – 46,3 %
- sníh – 11,5 %
- sucho – 7,2 %
- znečištění ovzduší – 7,0 %
- námraza – 3,0 %

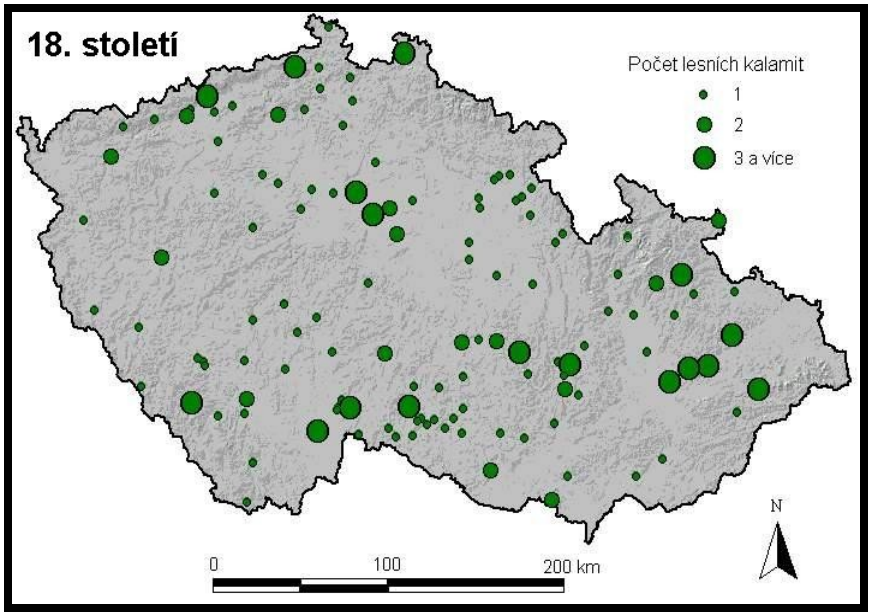

Vítr
Objem těžby (mil m3)
9,0
8,0
7,0
6,0
5,0
4,0
3,0
2,0
1,0
0,0
1963
1968
1973
1978
1983
1988
1993
1998
2003

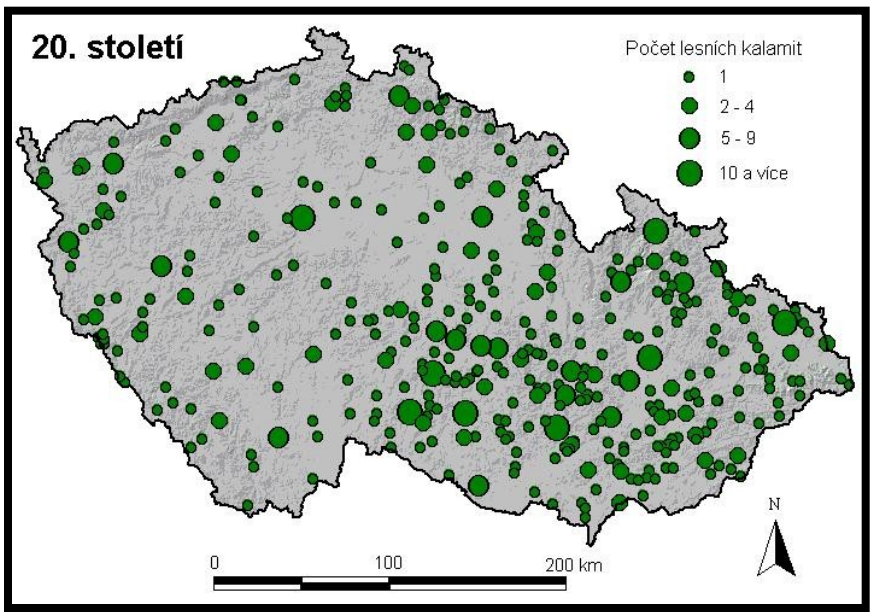

Sucho
Objem těžby (mil m3)
1,6
1,4
1,2
1,0
0,8
0,6
0,4
0,2
0,0
1963
1968
1973
1978
1983
1988
1993
1998
2003

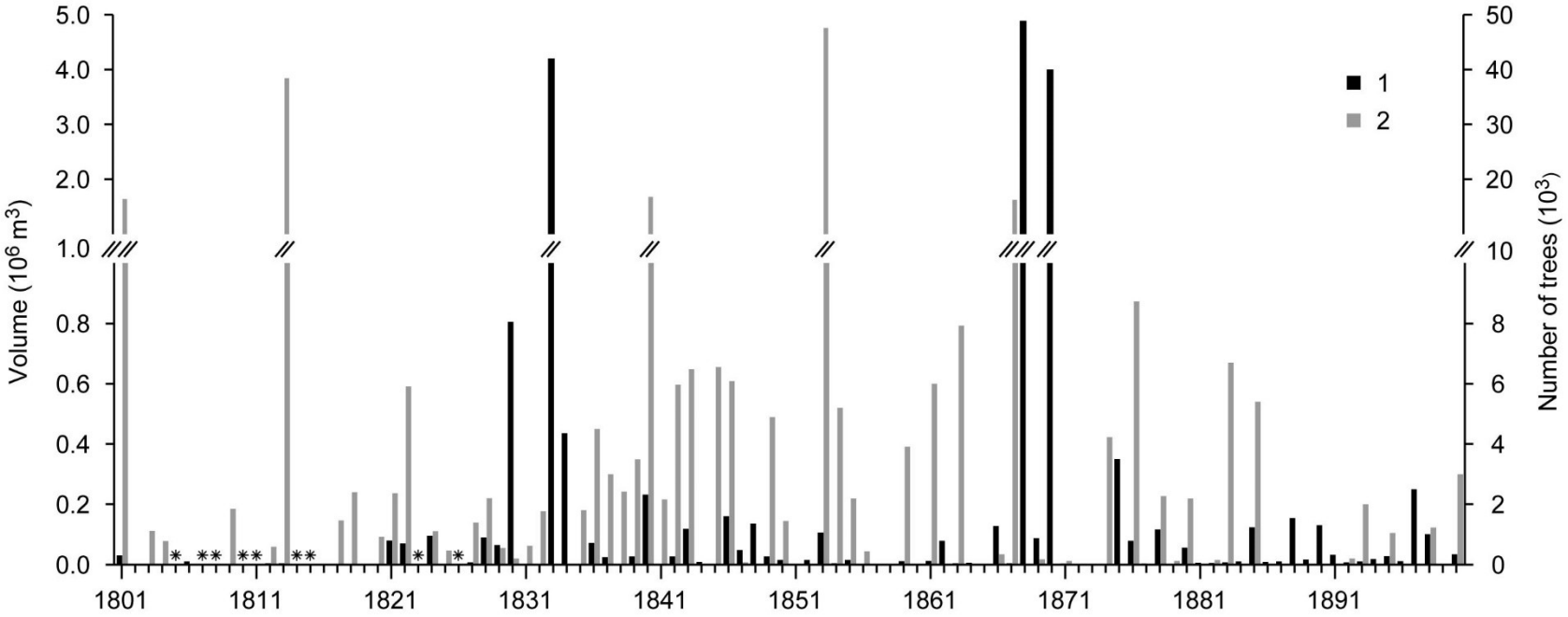
Počet lesních polomů způsobených větrem



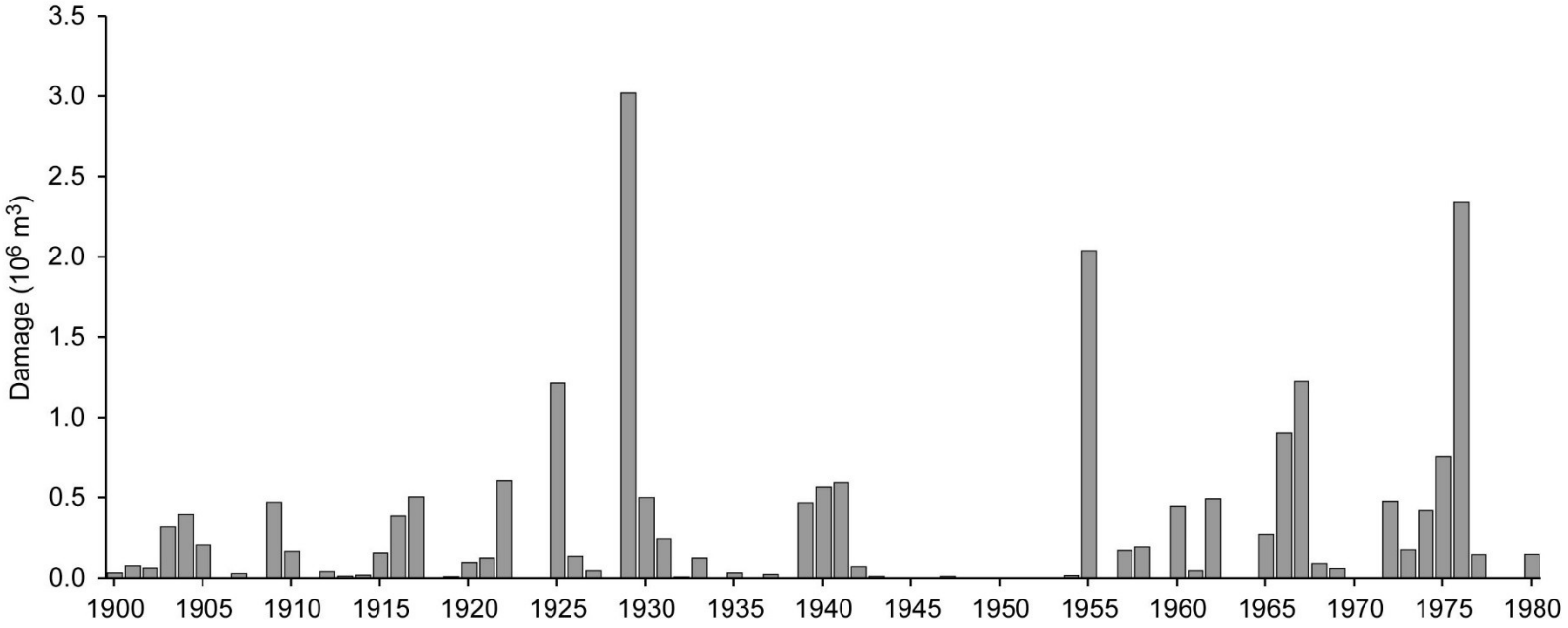




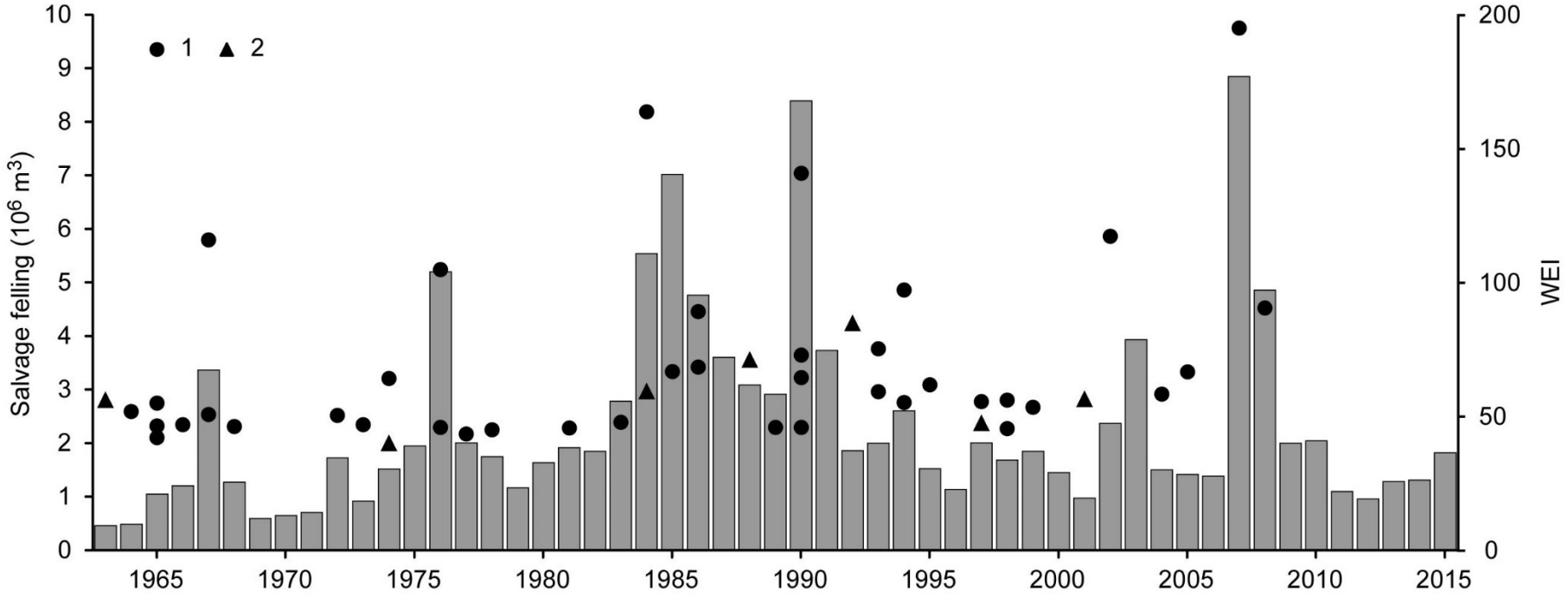




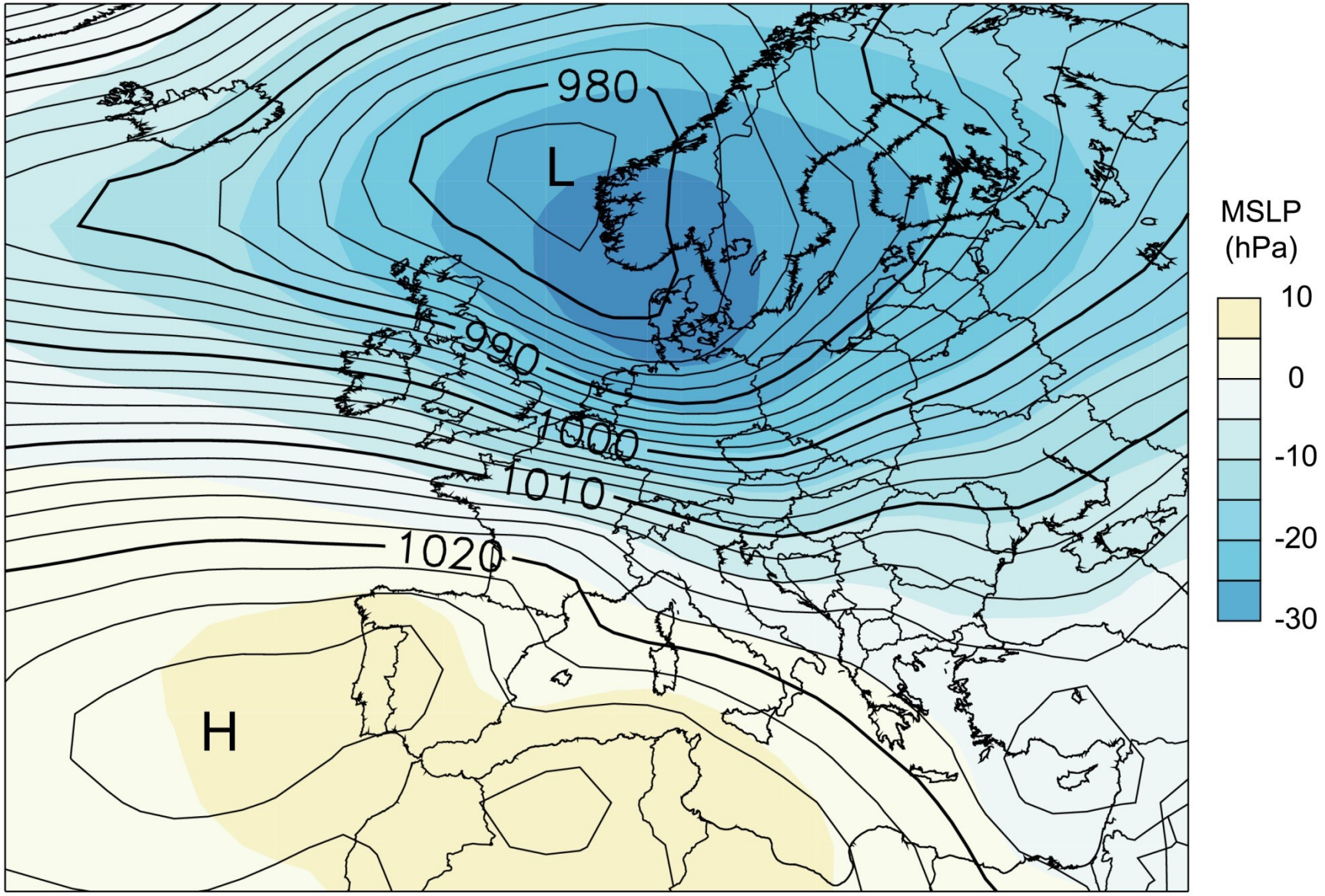
Annual estimates of forest damage over the territory of the Czech Lands, compiled from documentary data and complemented by published papers, expressed as two separate independent variables: m^3 of damaged solid wood (1) and in numbers of damaged (uprooted and broken) trees (2). Asterisks identify years in which forest damage was reported without exact quantification (Brázdil et al., Agricultural and Forest Meteorology, 2018)



Annual estimates of forest damage (m^3 of timber) done by 70 individual windstorms in the 1900–1980 period over the territory of the Czech Lands, compiled by Hošek (1981) (in Brázdil et al., AFM, 2018)



Volume of salvage felling of timber (m^3) resulting from windstorms over the territory of the Czech Republic in 1963–2015 (source: Research Institute of Forestry Economy and Gamekeeping, Jíloviště-Strnady; data after 1990 include about three-quarters of the forest area in the current Czech Republic) and the weather extremity index (WEI) for 50 extreme wind events in 1961–2010, after Kašpar et al. (2017): 1 – winter half-year, 2 – summer half-year (Brázdil et al., AFM, 2018)



Composite of mean sea-level pressure (MSLP in hPa; contours) derived from nine outstanding winter half-year windstorms at time-steps near the initial phase of most intense winds. Long-term anomalies of MSLP (hPa; shaded) with regard to 20th Century Re-analysis version 2c (1851–2014) are added (Brázdil et al., AFM, 2018)

7.3.4 Hladomory v českých zemích

• začátek 80. let 13. století (po smrti krále Přemysla Otakara II), polovina 2. dekády 14. století (Jan Lucemburský), začátek 30. let 15. století (husitské války)

• despite different time intervals and states of the society in the Czech Lands, **the general features of the famines** were the same

- **complicated social-political situation** (weakening of the central role of the state; internal problems; steady collapse of any “policing” system; civil war and/or presence of foreign armies; impoverished inhabitants, very high proportion of poor people; craftsmen losing money and social status; deterioration of general moral standards)

- **accumulation of adverse weather patterns** (influencing field work; problems with sowing and harvesting; livestock deaths)

- **severe-to-catastrophic failures of key agricultural crops** (mainly grain) for at least two successive years

- **consequences**: dramatic increases in the prices of key foodstuffs; hunger; consumption of poor-quality substitutes for normal diet and consequent increases in vulnerability to illness; spread of disease; sharp rise in human mortality; villages abandoned as the inhabitants take to begging in towns; severe increase in crime; cases of cannibalism

- **consolidation**: resolution of political tension in the country; consolidation of internal patterns; improvements in supply of essentials; decrease in prices of basic foodstuffs; good harvest in successive years leading relatively quickly to normalisation of social patterns

(Brázdil, R., Kotyza, O., Bauch, M. (2017): Climate and famines in the Czech Lands prior to AD 1500: Possible interconnections in a European context. In: Collet, D., Schuch, M. (eds.): Famines During the □ Little Ice Age□ (1300–1800). Socionatural Entanglements in Premodern Societies. Springer International Publishing AG, 91–114)

7.3.4.1 Hladová léta v českých zemích 1770-1772

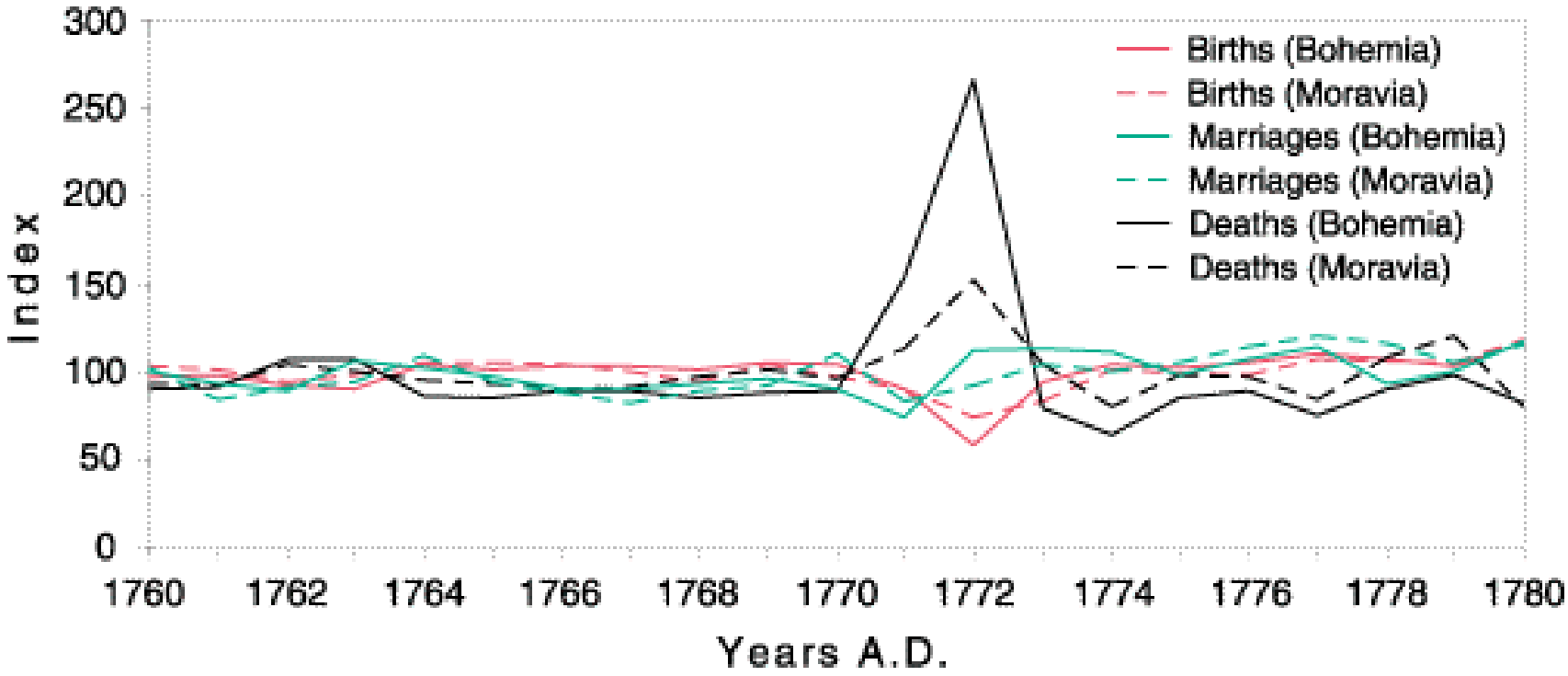
Katastrofální neúroda v letech 1770 a 1771 v důsledku nepříznivých meteorologických podmínek:

- 1769: vlhký podzim

- 1770: mokrá zima (1769/70), od 19. března několikadenní sněžení a následné mrazy do poloviny dubna, ozimy nevzešly, opozdilo se setí jařin na květen, poté sedmitýdenní sucho, nato deště, které nepříznivě poznamenaly vlastní žně, na podzim se selo za sucha, ale deště opět v listopadu a v prosinci

- 1771: teplá zima (1770/71), studené jaro se sněhem a mrazy (mnohde ležel sníh až do května), deště v době žní

- několikanásobný růst cen obilí, bída, hlad, náhražky potravin u chudých lidí
- epidemické rozšíření břišního tyfu a velký nárůst úmrtnosti (zemřela 1/10 obyvatel v Čechách)



- velký nárůst kriminality a počtu žebráků
- rozsáhlá pomoc trpícím Čechám organizovaná císařským dvorem ve Vídni
- částečná změna stravovacích zvyklostí (pěstování brambor)
- četné ozbrojené bouře proti vrchnosti v českých zemích v roce 1775

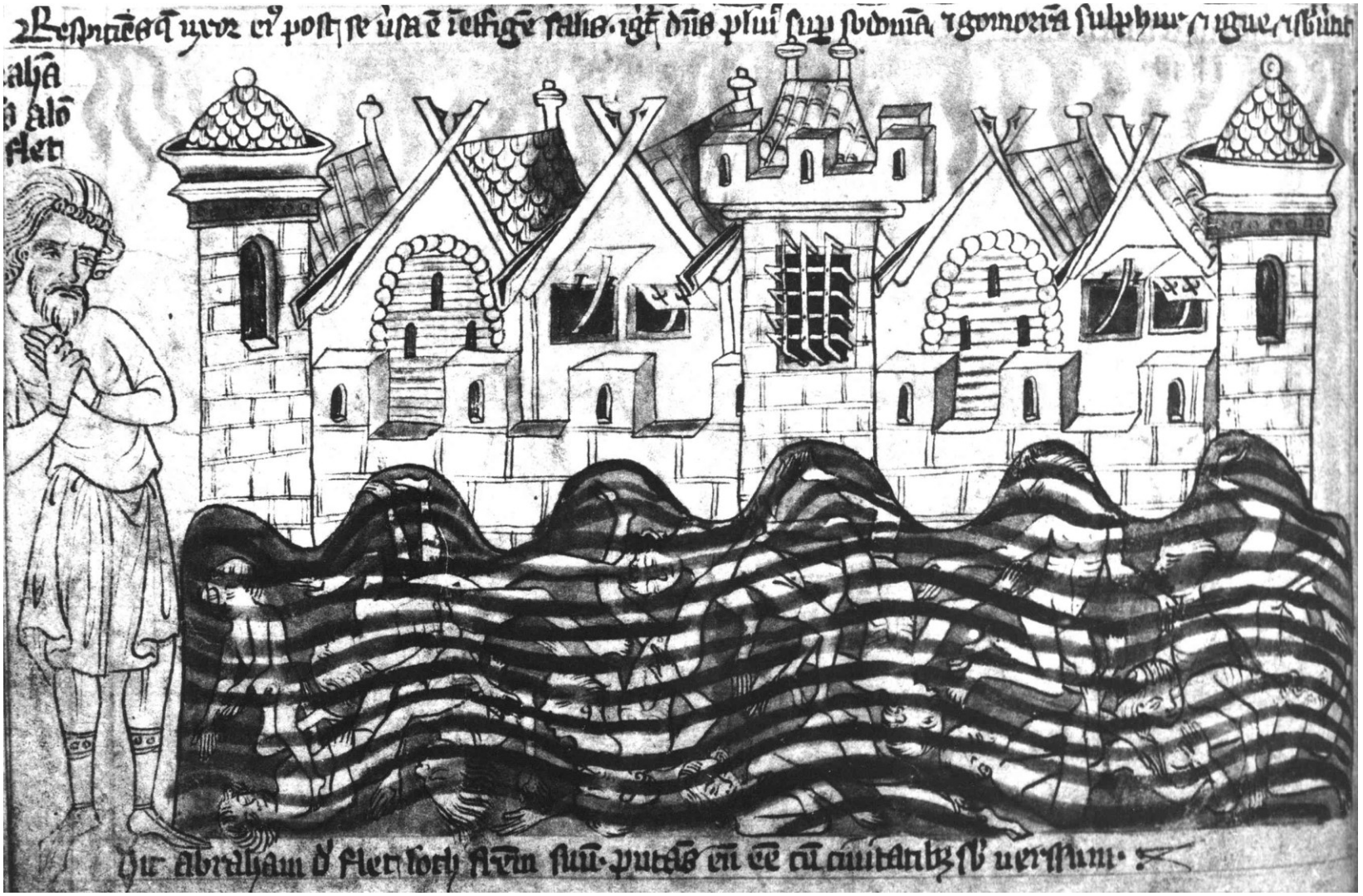
(Pfister, Brázdil, Climate of thePast, 2006)

Map of hunger 1770–1771 in Bohemia – Austrian Empress Maria Theresa with her son Joseph the Second as rescuers of Bohemia before famine (Fr. Stephan, 1774, the Map collection of the Charles University in Prague)

7.4 Percepce hydrometeorologických extrémů a jejich dopadů

The Bible - weather as action of the God - example: Noah deluge

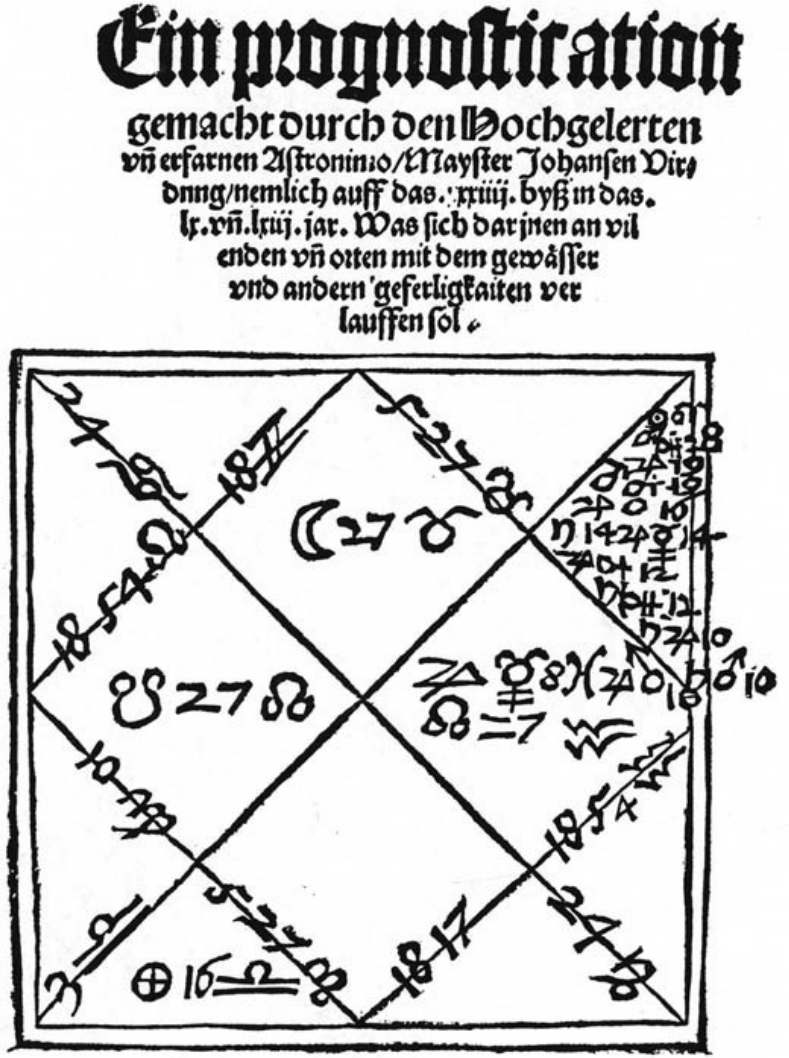
Destruction of the biblic town of Sodom by flood and fire



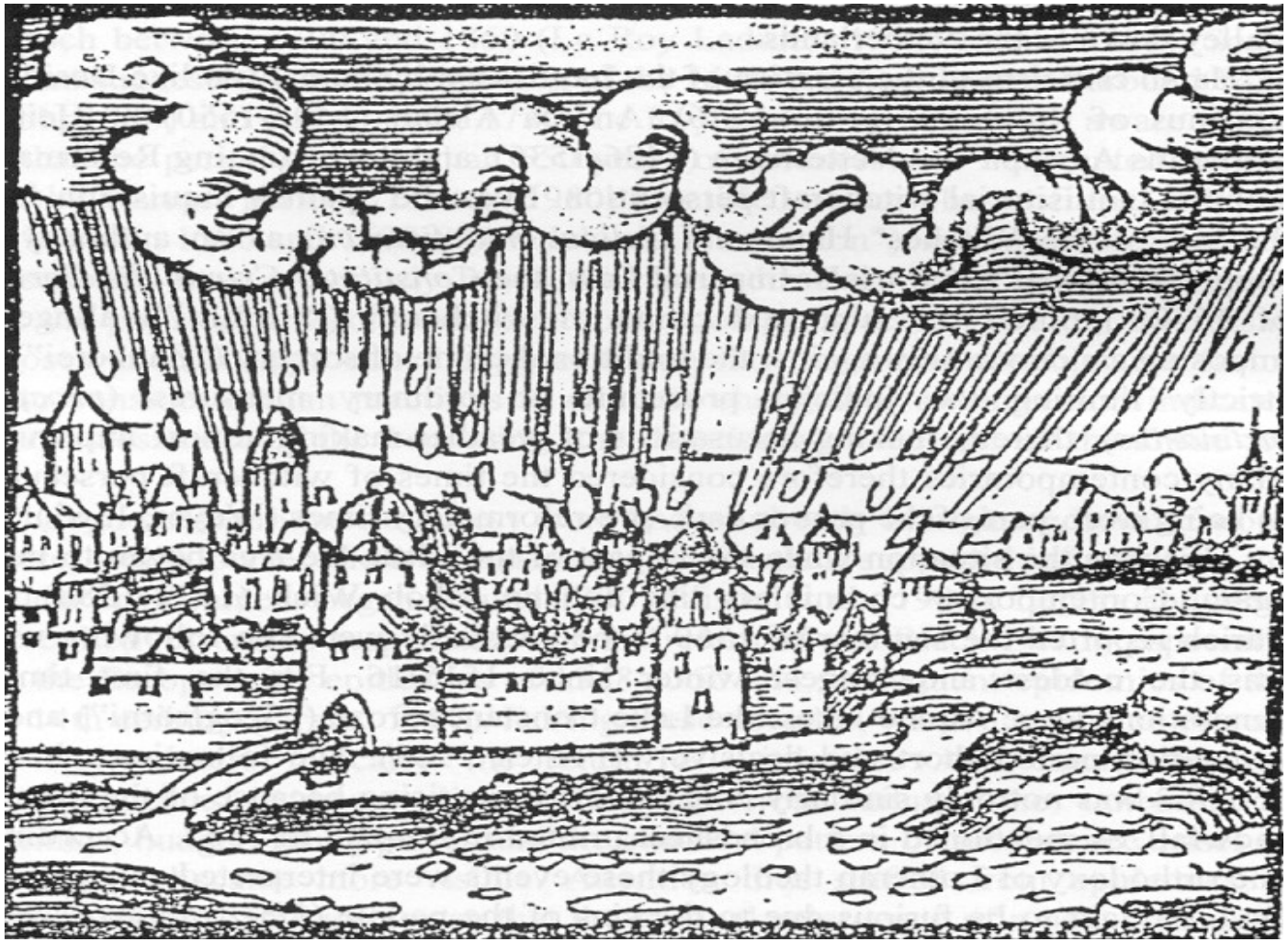
The Velislav Bible around 1340 (Brázdil and Kotyza, 1995)

Catastrofic visions - apocalypsis

Konjunkce planet předpovězená na únor 1524 astronomem Johannem Stoefflerem měla způsobit katastrofální povodně – příklad tištěných astrometeorologických předpovědí



Increase in weather disasters - responses in the society - witchcrafts



Hailstorm hits a town from a broadsheet Leipzig 1562 (Behringer, 1999)

Witches cause a hailstorm

Behringer (1999)

Weather extremes:

- action of the God

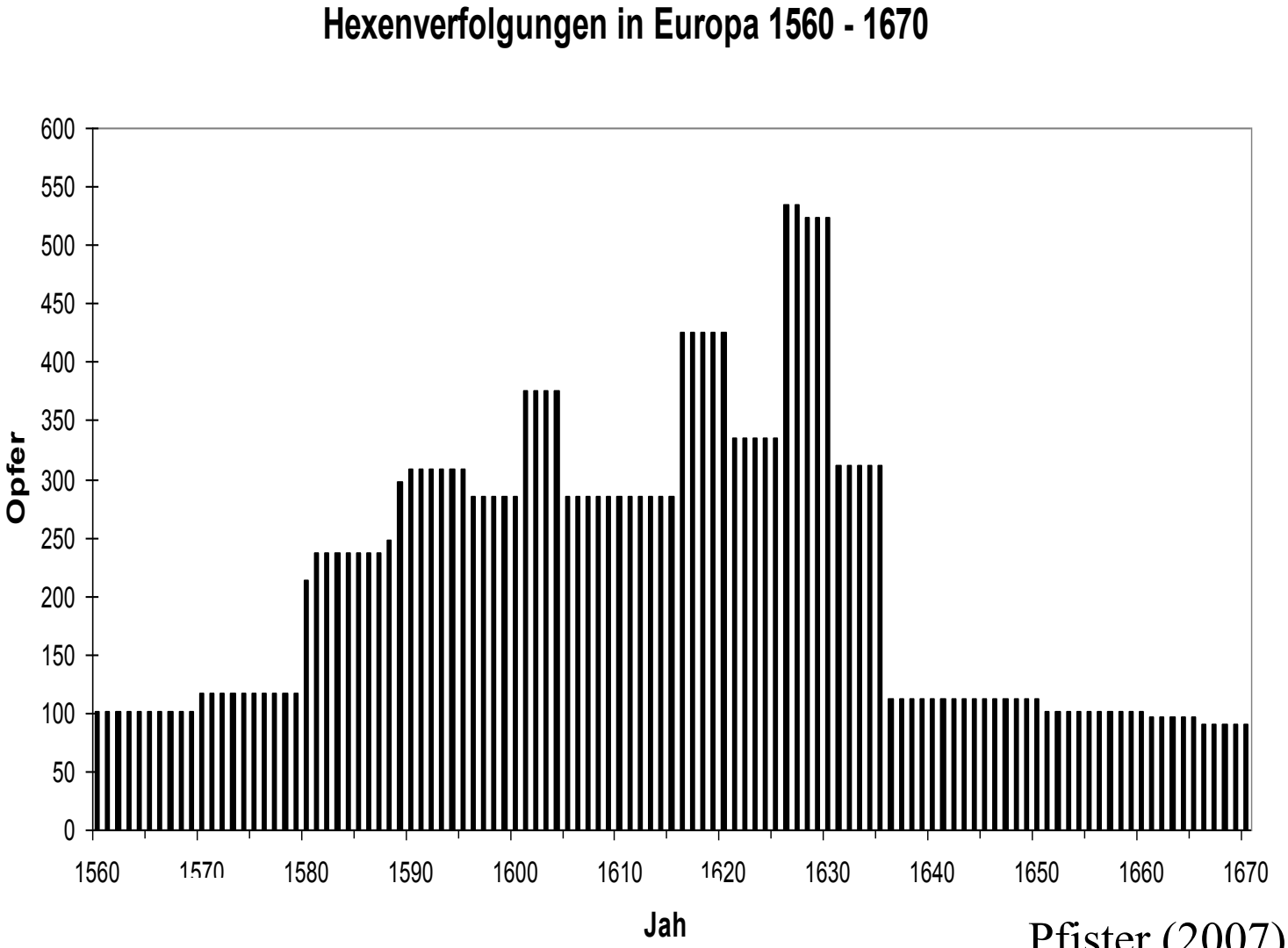
- action of the Devil

- action of witches

Malleus maleficarum (1486) líčí, jak dva čarodějové z Bernu „*dokázali přivolat ty nejprudší vichřice a ty nejničivější větry a blesky … někdy také zasáhnout bleskem, koho chtěli …*“

Witchcraft burnings in Europe, 1560-1670

Average number of victims per year



Pfister (2007)

Čarodějnické procesy v českých zemích – Velké Losiny

Památník v Lázních Jeseník

7.5 Shrnutí

a) Sektory lidské činnosti nejcitlivější na působení klimatu a jeho extrémů:

- agrární společnost – zemědělská produkce
- současná společnost – doprava

b) Poučení z dopadů v minulosti

c) Permanentní působení hydrometeorologických extrémů – rostoucí škody a lidské oběti

d) Budoucí dopady klimatu:

- snížení negativních dopadů
- znalost variability klimatu z minulosti
- klimatické scénáře, adaptace, zmírnění dopadů

Literatura:

Kates, R. W., Ausubel, J. H., Berberian, M., eds. (1985): Climate Impact Assessment. Studies of the Interaction of Climate and Society. Wiley, Chichester, New York, Brisbane, Toronto, Singapore.

Behringer, W., Lehmann, H., Pfister, C., eds. (2005): Kulturelle Konsequenzen der “Kleinen Eiszeit”. Vandenhoeck & Ruprecht, Göttingen.

Pfister, C., Brázdil, R. (2006): Social vulnerability to climate in the “Little Ice Age”: An example from Central Europe in the early 1770s. Climate of the Past, 2, 115-129.

Behringer, W. (2010): Kulturní dějiny klimatu. Od doby ledové po globální oteplování. Paseka, Praha – Litomyšl. ISBN 978-80-7432-022-4

Pfister, C. (2010): The vulnerability of past societies to climatic variations: a new focus for historical climatology in the twenty-first century? Climatic Change, 100, 25–31