Cambio climático y turismo

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Seminario Agua y Turismo, 2 de octubre de 2015

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Personal background

Amsterdam: Free University, economics, 1991-1997; prop. Spanish (UvA)

Amsterdam: 2008-2010

Baarn: born and raised, 1971-1990

Heredia (Costa

996

Norwich (

change &

eCLAT, 200

Visit to Antarctica: 2008

M

Ph

19

Vageningen: ESA,

010 -

Wageningen

- Town 37.000 inhabitants

- 6.500 staff
- 10.000 students

Domains:

- Food/nutrition
- Life sciences

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Beach tourism in the Netherlands

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Word-cloud of my publication titles

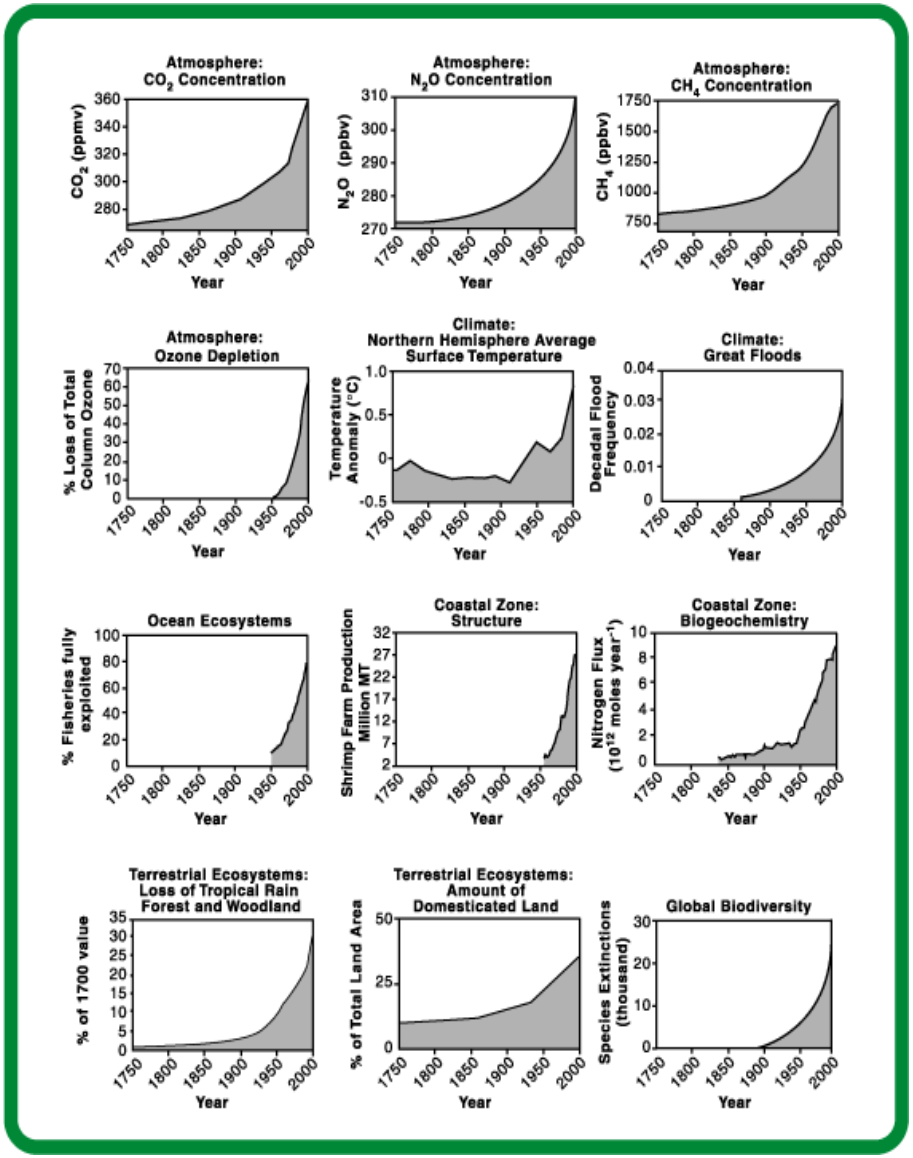
Keynote outline

- Brief general overview
- Two key themes:
    - Mitigation
    - Climate indices
- For each theme: looking back, where do we stand, future perspective
- Vulnerability and adaptation; water
- Options for collaboration

- But first an (even) broader context:
    - Anthropocene
    - Planetary Boundaries

Anthropocene

- Acknowledges the huge influence of human behaviour on the Earth's atmosphere
- 'Anthropo' refers to 'human'
- 'Cene' refers to a geological epoch, like Pleistocene, Holocene
- Epochs are 'normally separated by significant changes in the rock layers they correspond to'



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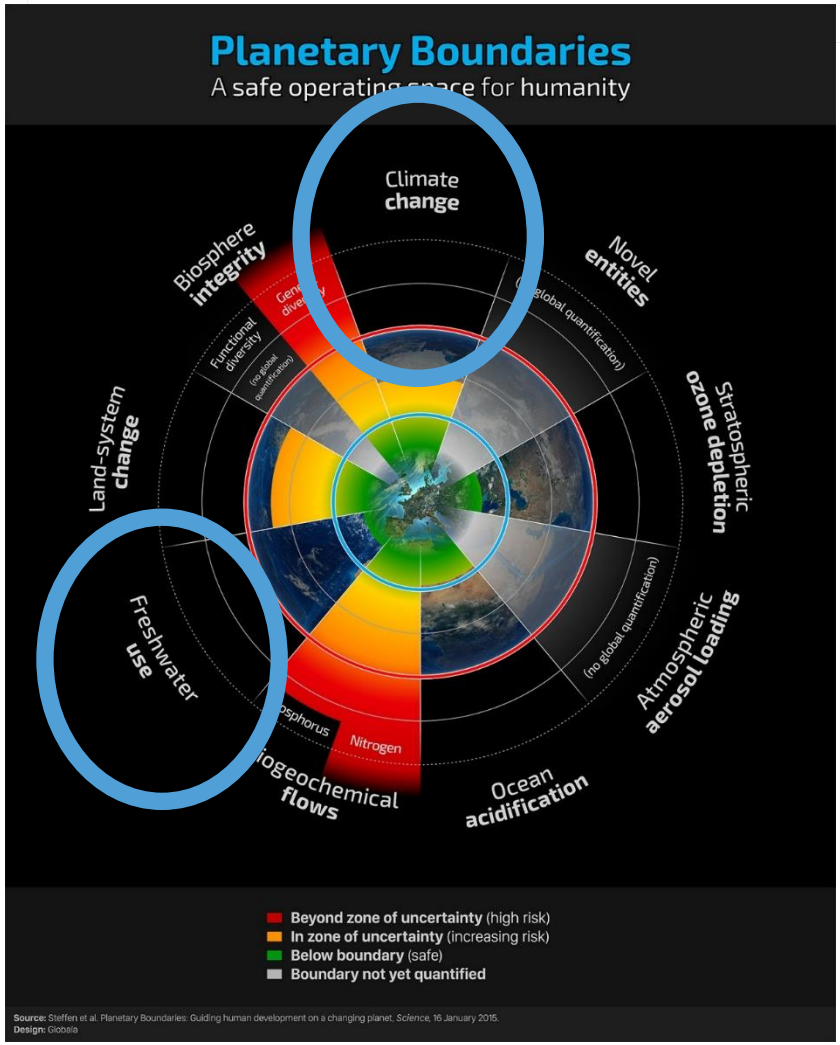
Planetary boundaries



- What about:
  - Biodiversity loss...
  - Land-system change...
  - Nutrient cycles...
- ...and tourism?

Steffen, W. et al. (2015), "Planetary boundaries: Guiding human development on a changing planet", Science 347 (6223)

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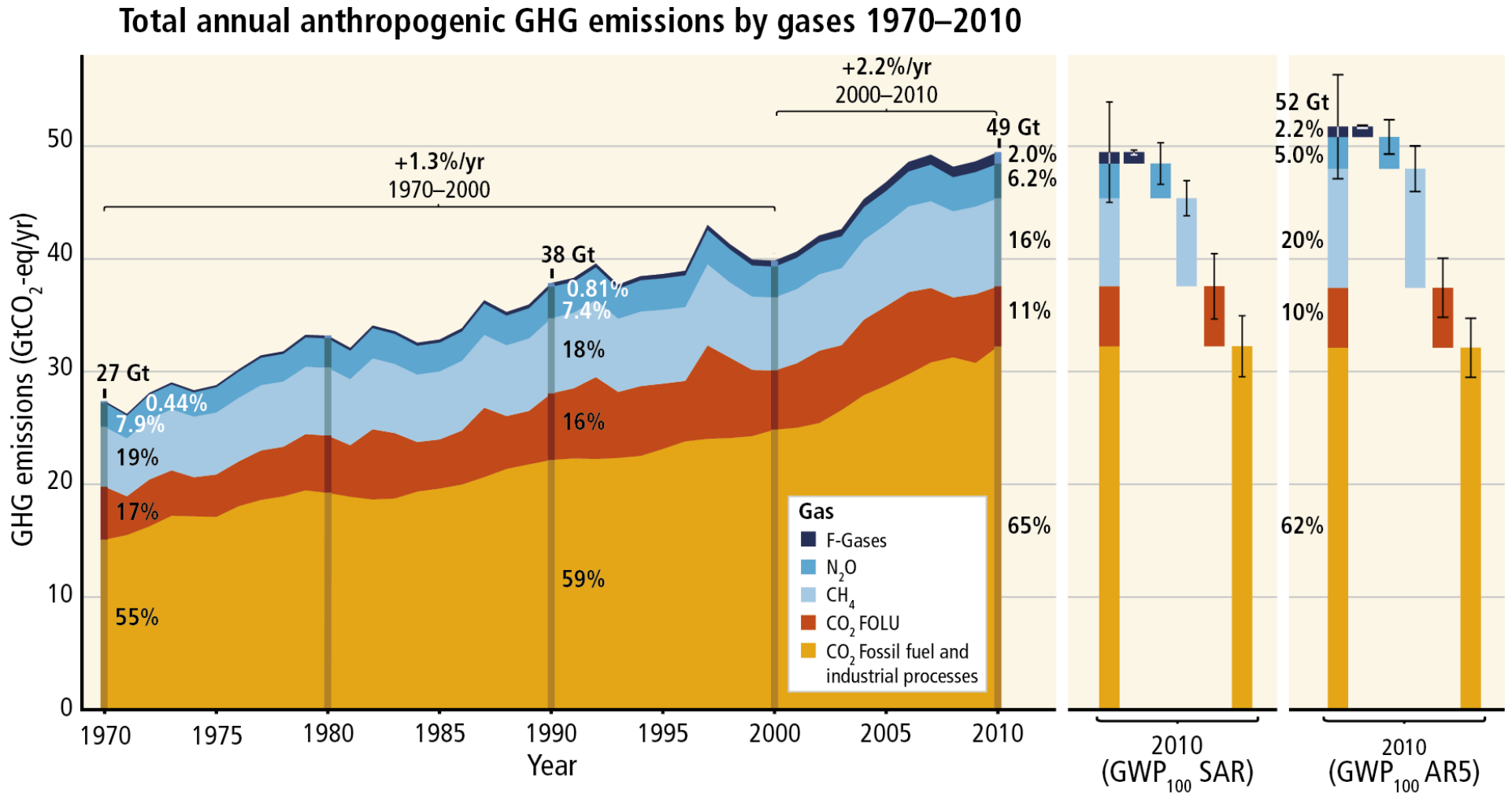
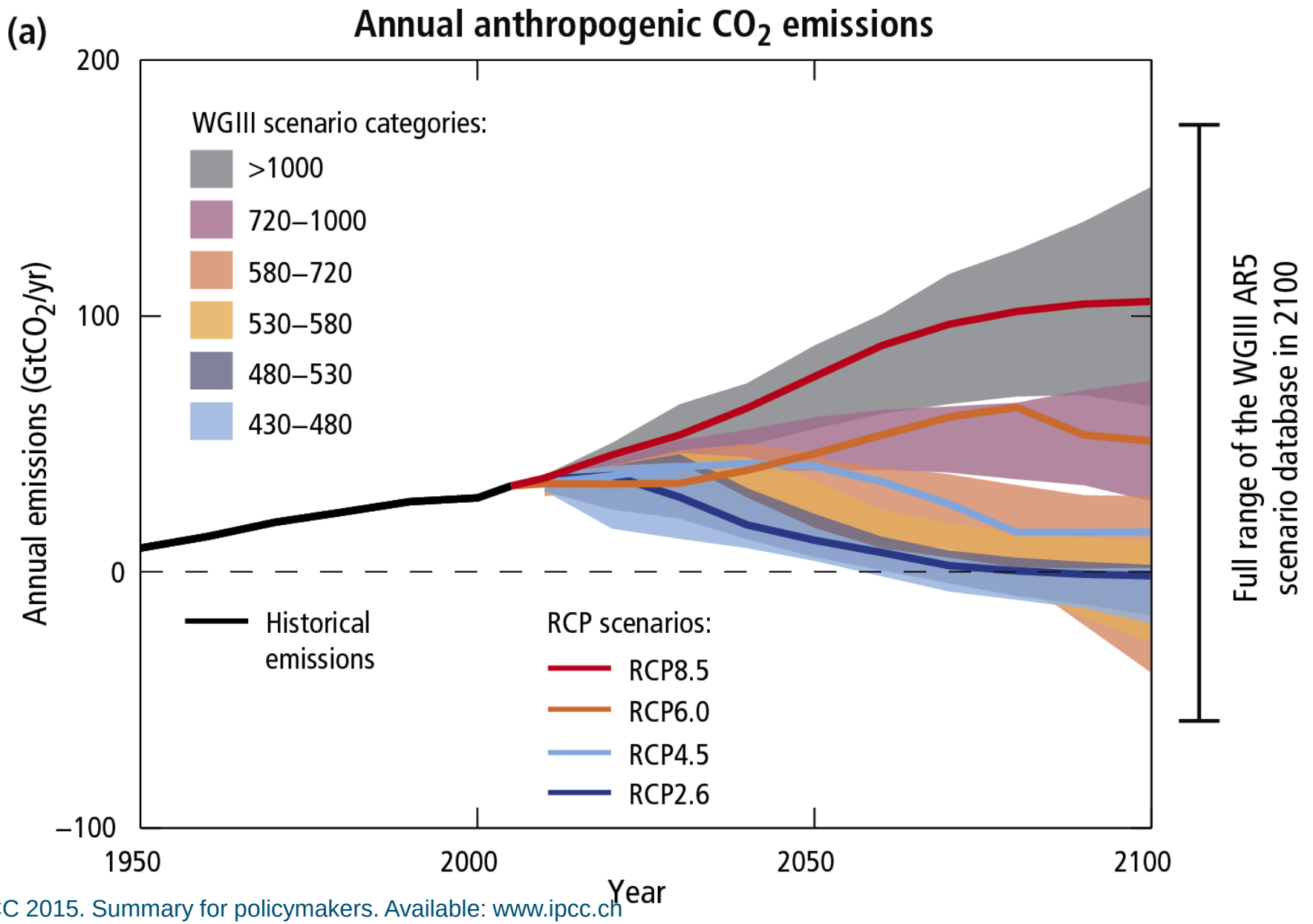
Central question to me

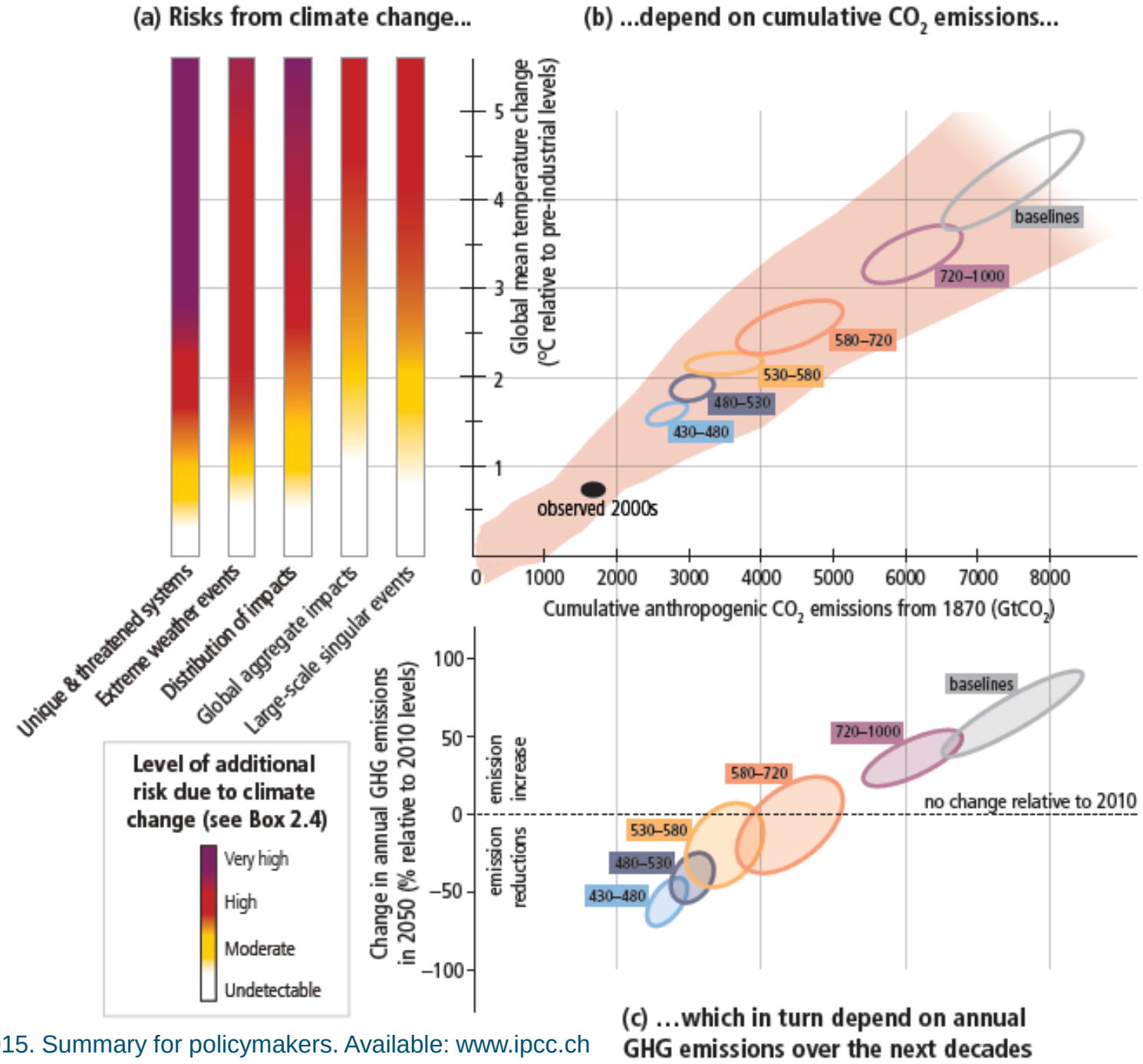
- How to connect all these (absolute!) global limits and the behaviour of individuals
- Individuals who do not ‘feel’ these limits
- Tragedy of the Commons

Decarbonizing?



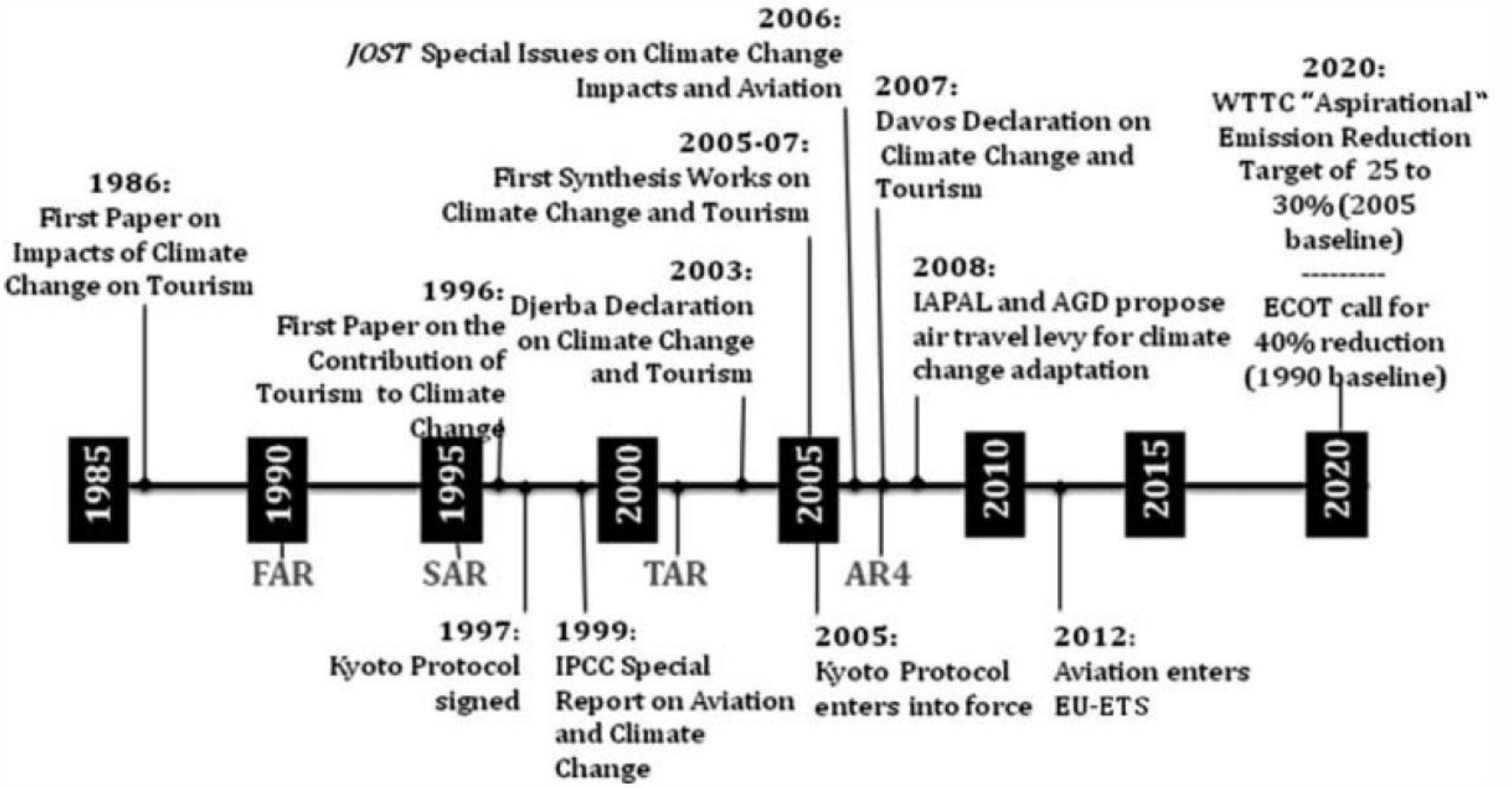
IPCC 2015. Summary for policymakers. Available: www.ipcc.ch


(a)
Annual anthropogenic CO_2 emissions
200
100
0
−100
Annual emissions ($GtCO_2$/yr)
WGIII scenario categories:
>1000
720–1000
580–720
530–580
480–530
430–480
Historical emissions
RCP scenarios:
RCP8.5
RCP6.0
RCP4.5
RCP2.6
1950
2000
2050
2100
Year
Full range of the WGIII AR5 scenario database in 2100



IPCC 2015. Summary for policymakers. Available: www.ipcc.ch

Timeline



Source: Scott, D. & Becken, S. (2010). Adapting to climate change and climate policy: progress, problems and potentials. Journal of Sustainable Tourism 18 (3): 285.

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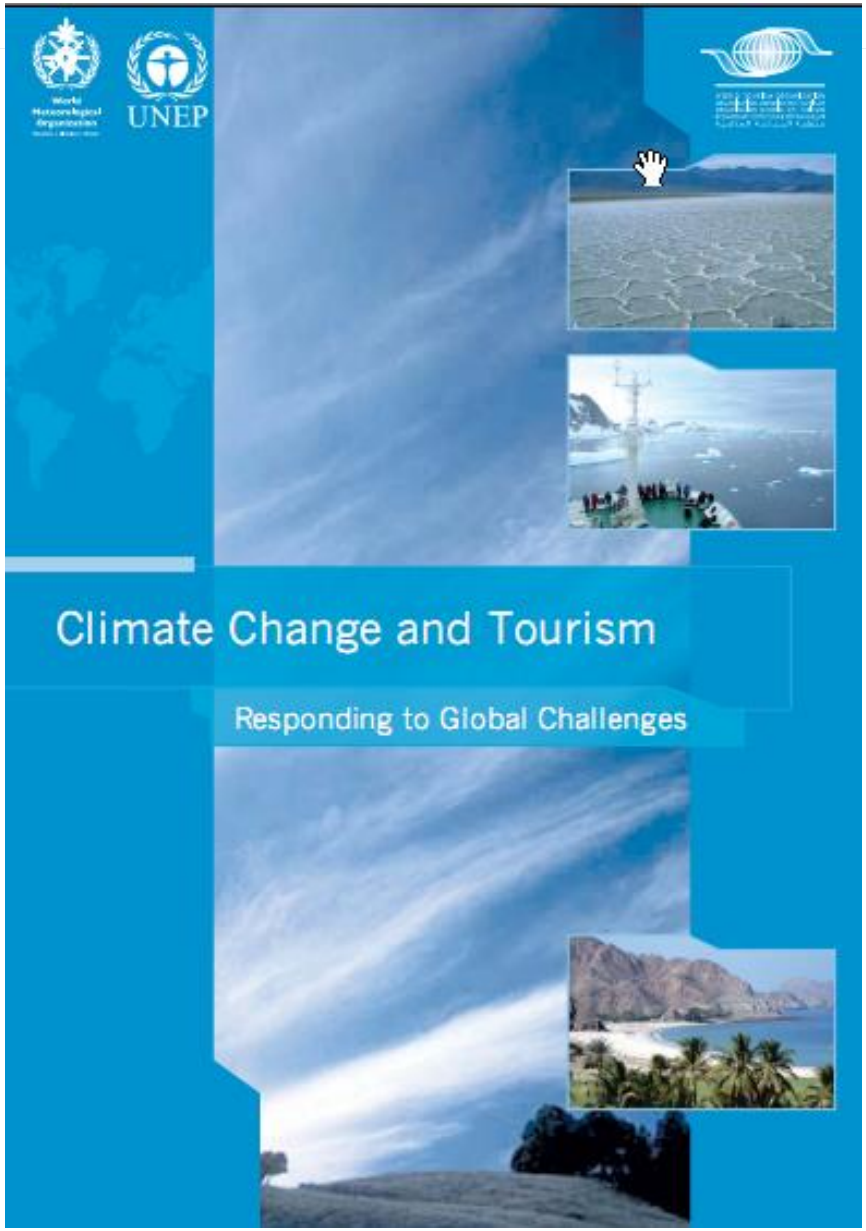
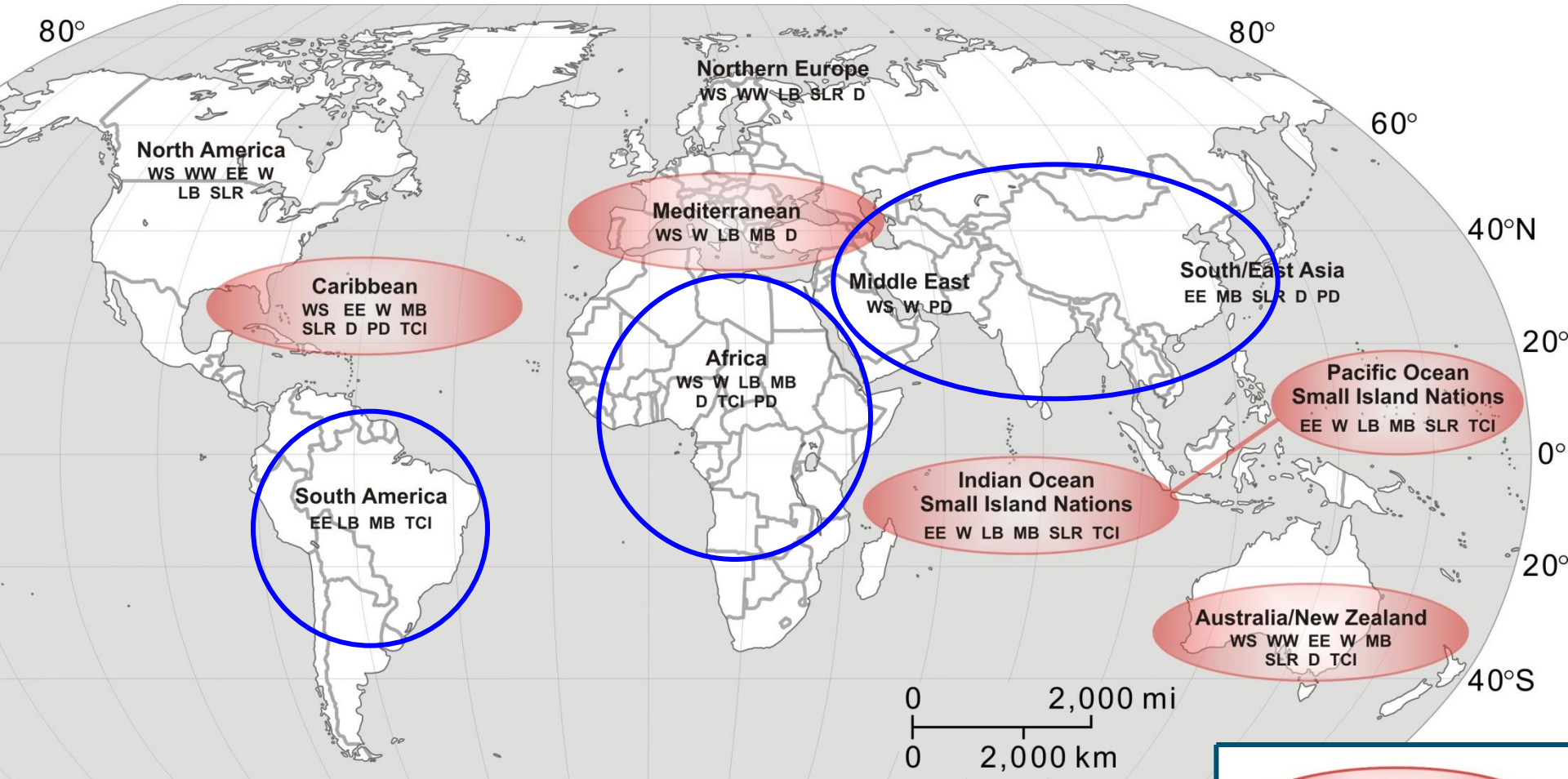
Climate change & Tourism

Source: UNWTO-UNEP-WMO (2008). Climate change and tourism: responding to global challenges. UNWTO, Madrid.



Tourism Vulnerability 'Hotspots'



WS = warmer summers

WW = warmer winters

EE = increase in extreme events

SLR = sea level rise

LB = land biodiversity loss

MB = marine biodiversity loss

W = water scarcity

PD = political destabilization

D = increase in disease outbreaks

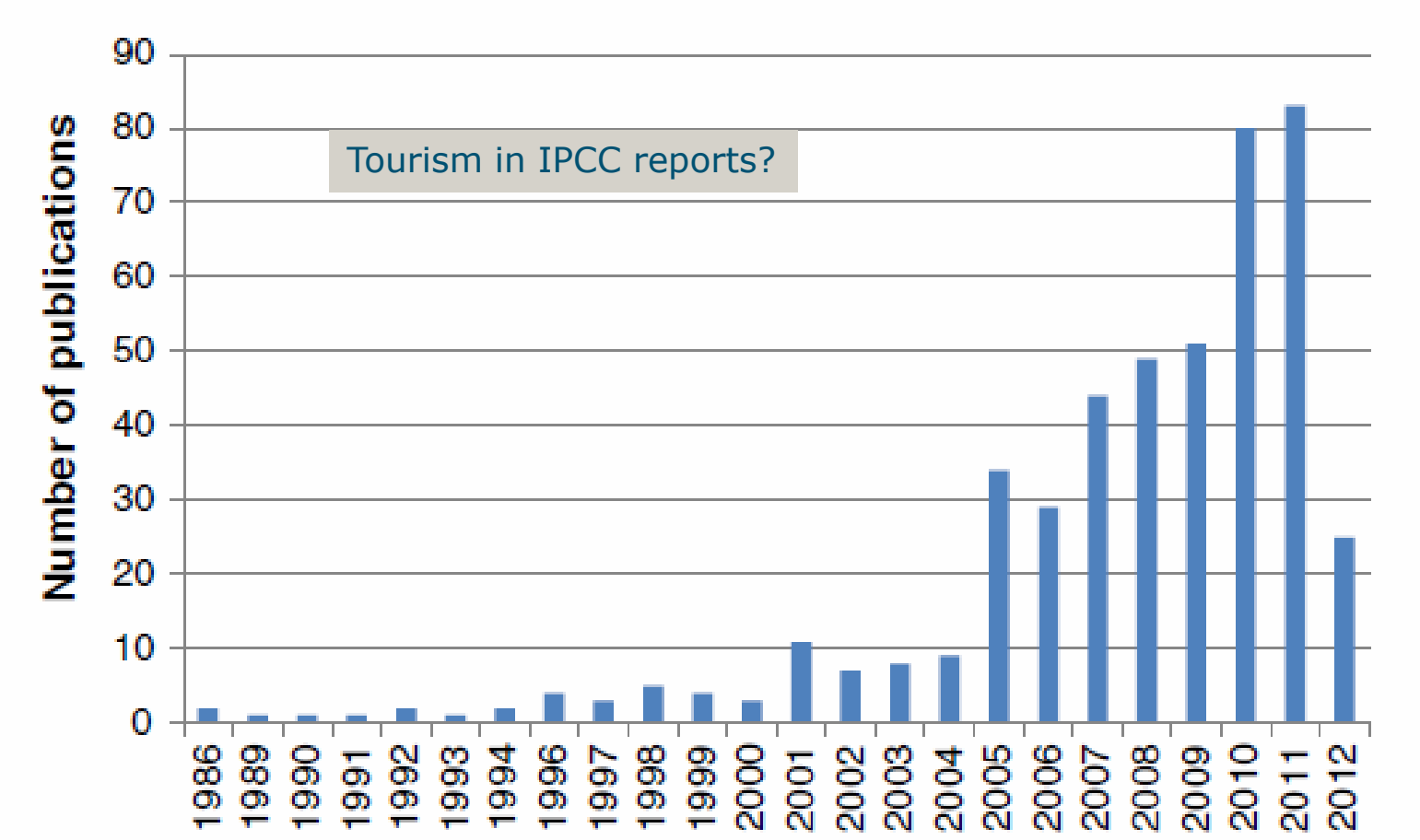
TCI = travel cost increase from mitigation policy

Hotspot

Regional

Knowledge Gaps

Climate change and tourism publications, 1986-2012



Becken (2013). A review of tourism and climate change as an evolving knowledge domain. Tourism Management Perspectives 6: 53–62

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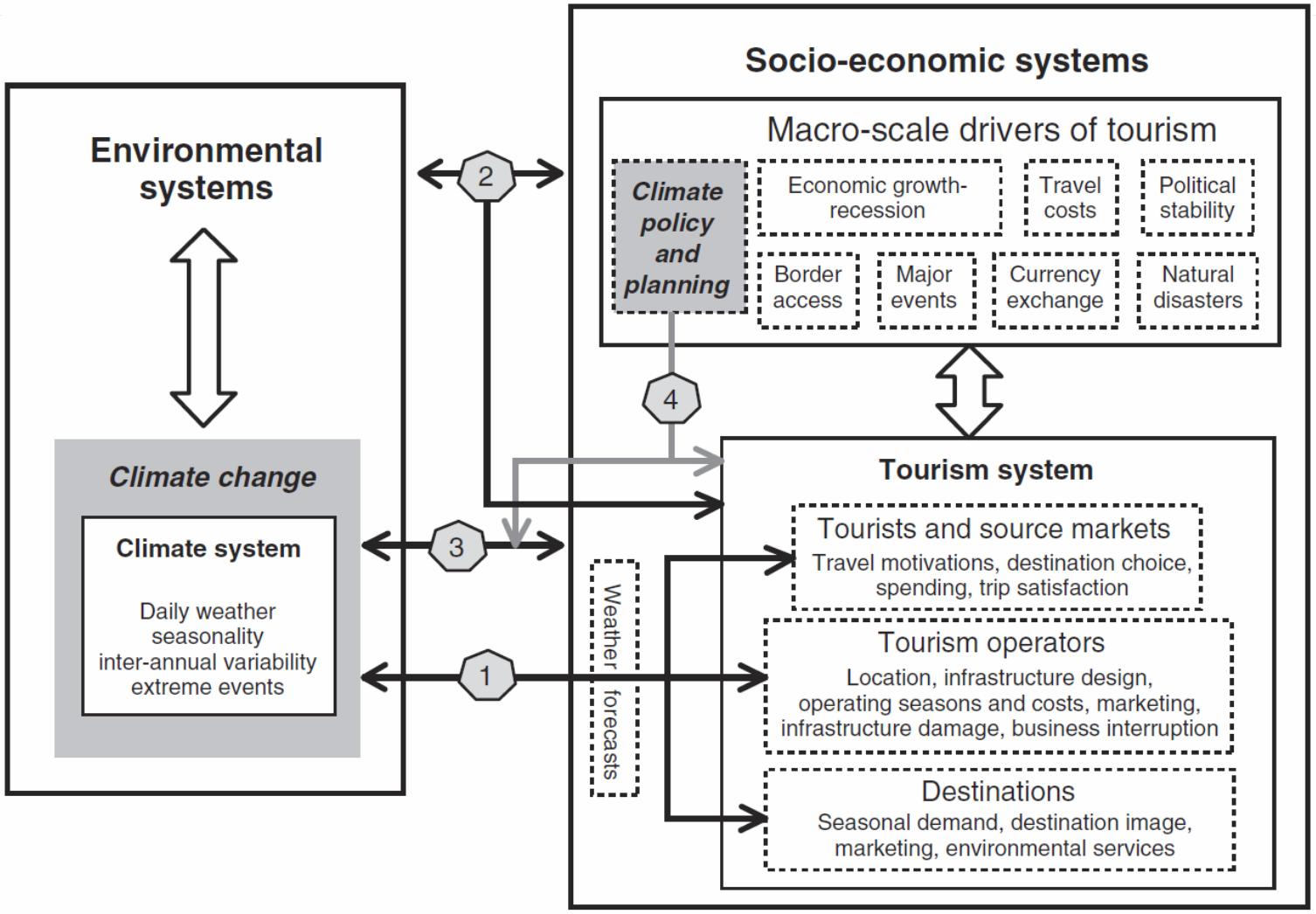
CC impact pathways on tourism



Scott D, Gössling S, Hall CM. International tourism and Climate Change. WIREs Clim Change 2012, 3:213–232. doi: 10.1002/wcc.165

Emissions and mitigation

Leading questions

- What is tourism's contribution to greenhouse gas emissions (and radiative forcing)?
- What options are there to reduce emissions?
- How effective are they?

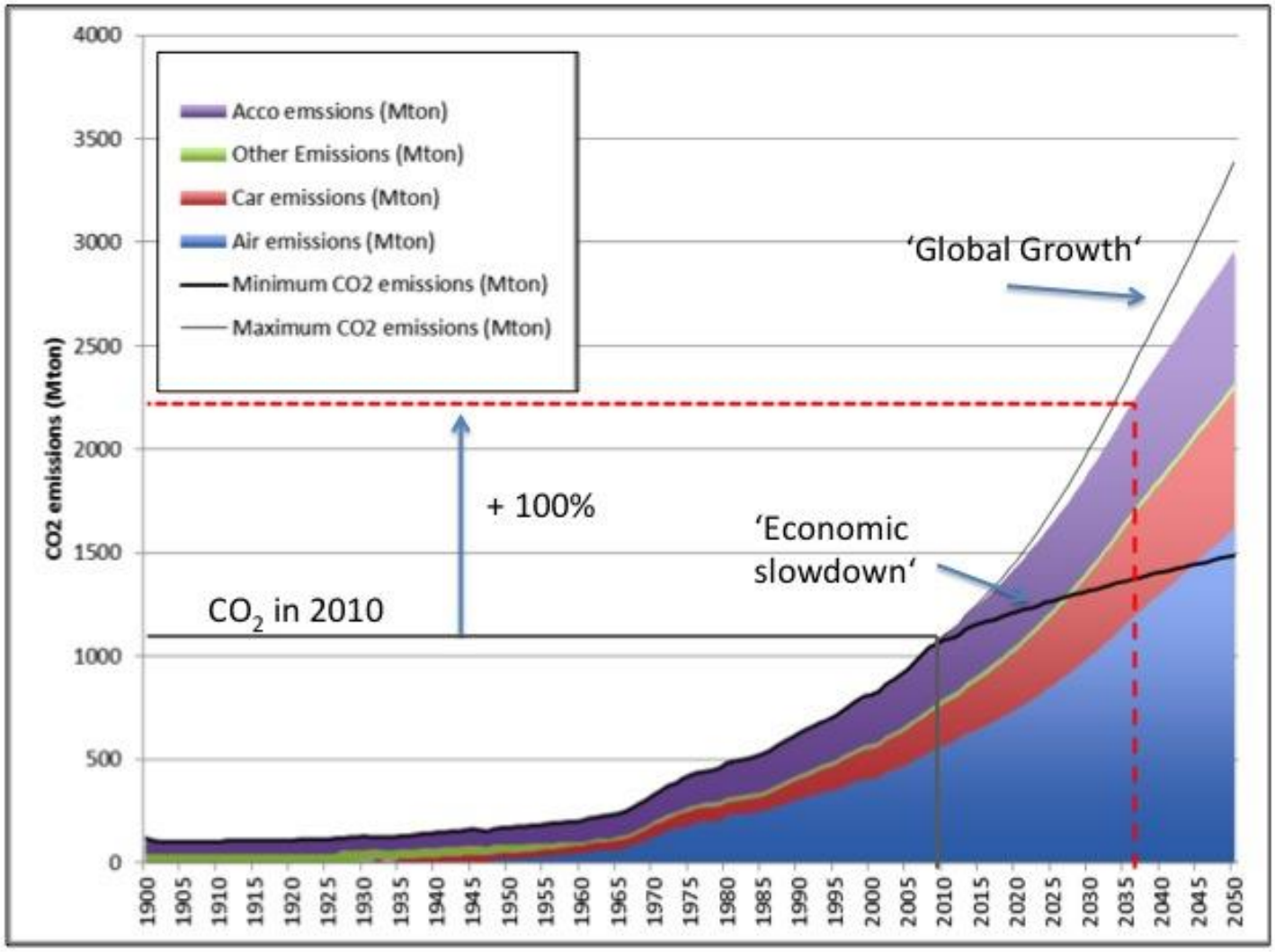
Tourism

- Transport
- Accommodation
- Activities

Subsector	CO_2 (Mt)	Percentage
Air transport	515	40
Car transport	420	32
Other transport	45	3
Accommodation	275	21
Activities	48	4
Total	**1,304**	**100**
Total world	26,400	
Tourism contribution		5

Scott, D., Amelung, B., Becken, S., Ceron, J.-P., Dubois, G., Gössling, S., Peeters, P., Simpson, M. 2008. Climate Change and Tourism: Responding to Global Challenges. *United Nations World Tourism Organization (UNWTO), United Nations Environment Programme (UNEP) and World Meteorological Organization (WMO), UNWTO: Madrid, Spain.*

CO_2 emissions 1900-2050



Gössling, S. and Peeters, P. 2015. Assessing tourism's global environmental impact 1900-2050. Journal of Sustainable Tourism, 23(5): 639-659.

Emission growth aviation

„By 2020, global international aviation emissions are projected to be around 70% higher than in 2005 even if fuel efficiency improves by 2% per year. ICAO forecasts that by 2050 they could grow by a further 300-700%.“

European Commission 2015. Available: http://ec.europa.eu/clima/policies/transport/aviation/index_en.htm

Beckham-related issues

- Estimated 97% of world population do not participate in international aviation in a given year
- Small share of travellers responsible for comparably large share of emissions
- Individual journeys highly energy-intense

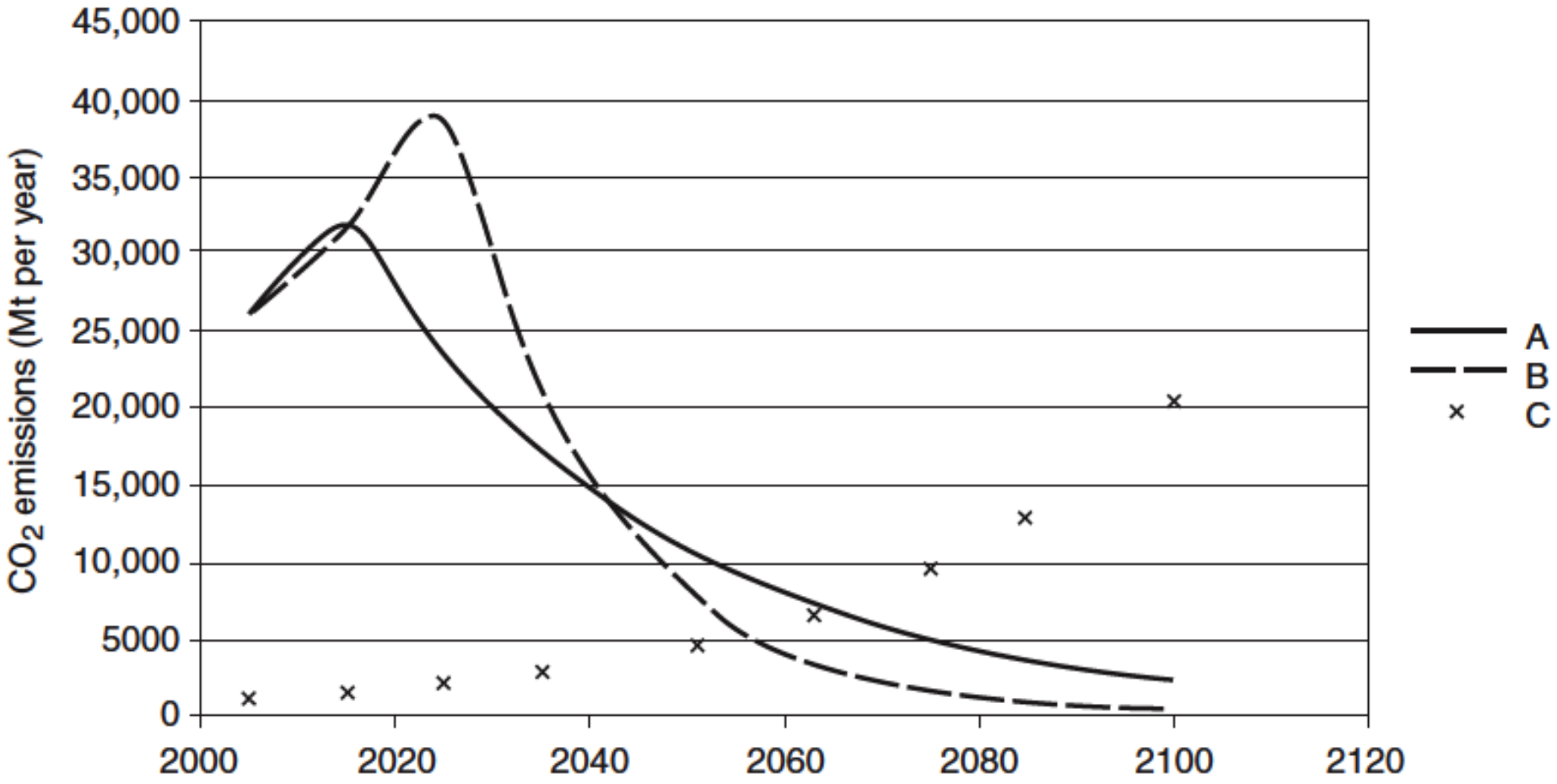
Avoiding dangerous interference with the climate system

Global CO_2 emissions need to decline by 40-70% by 2050 and by 100% before 2100.

In tourism, emission growth by 169% by 2050 expected compared to 2010.

Gössling, S. and Peeters, P. 2015. Assessing tourism's global environmental impact 1900-2050. Journal of Sustainable Tourism, 23(5): 639-659.

Tourism emissions vs. decarbonization needs



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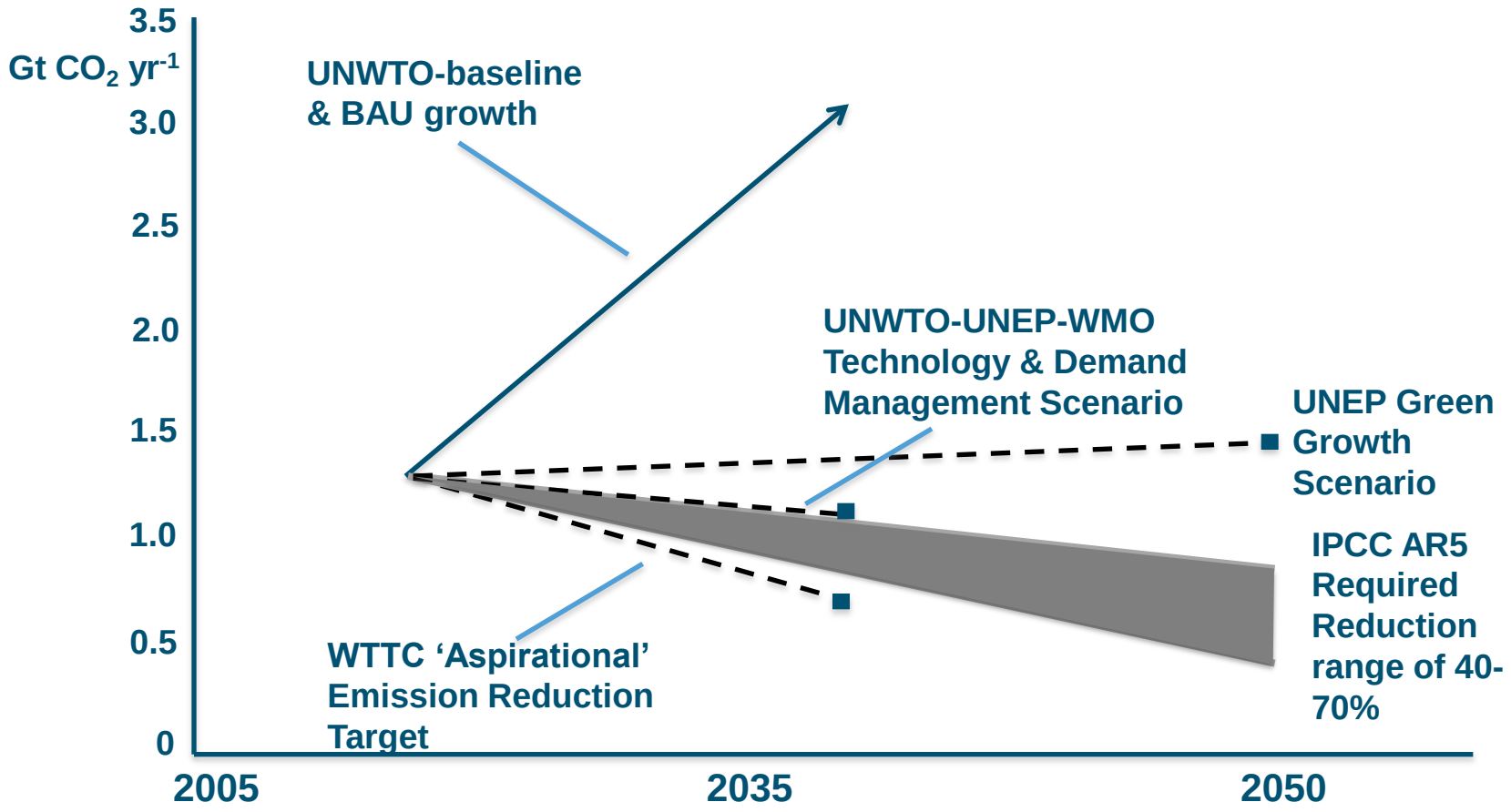
Scott, D., Peeters, P., and Gössling, S. 2010. Can tourism deliver its 'aspirational' emission reduction targets? Journal of Sustainable Tourism 18(3), 393-408.

Growth and industry perspectives

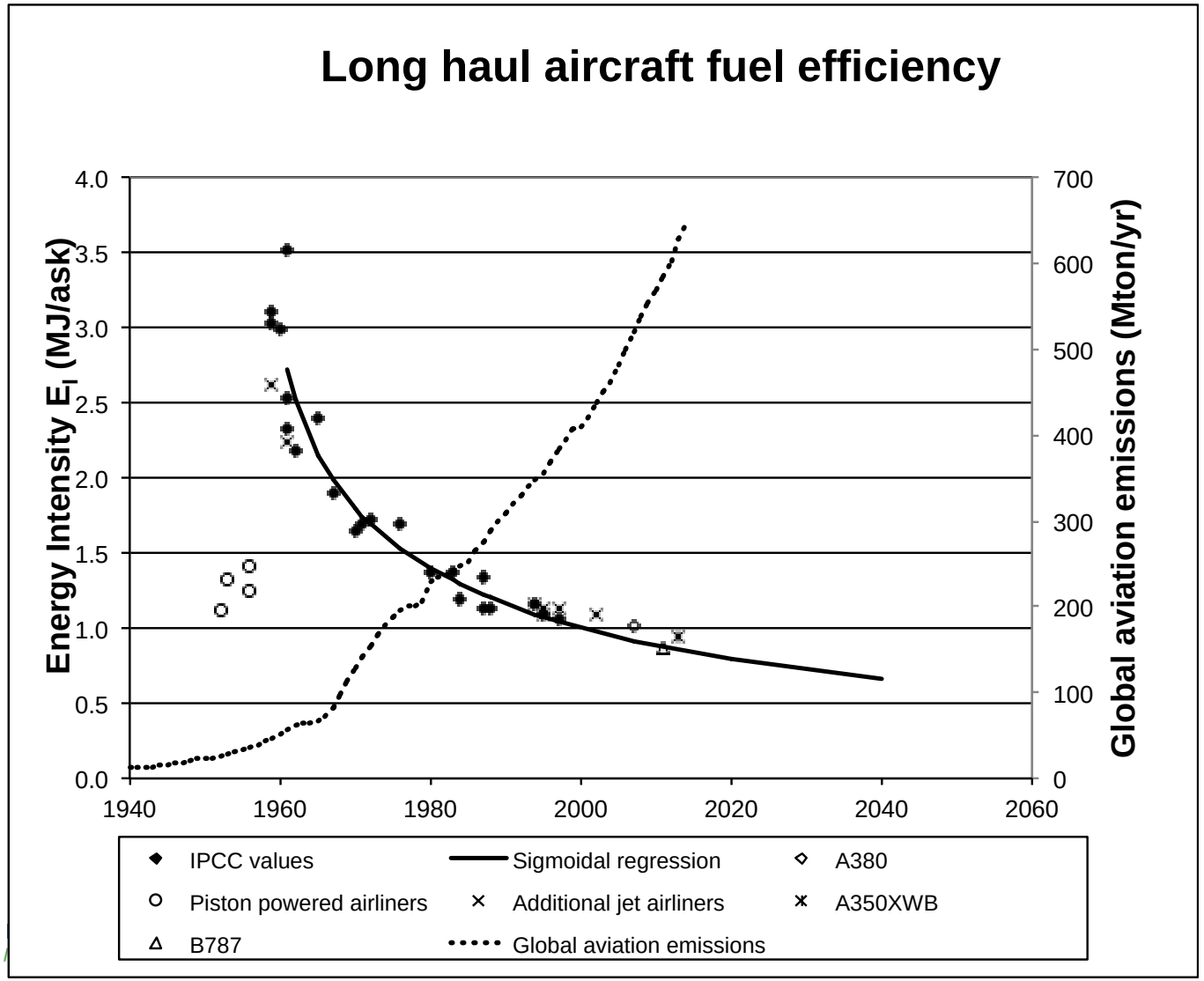


Scott, D., Hall, C.M. and Gössling, S. 2015. A review of the IPCC Fifth Assessment and implications for tourism sector climate resilience and decarbonisation. Journal of Sustainable Tourism, http://dx.doi.org/10.1080/09669582.2015.1062021

Reducing carbon

- Governance: Taxes & regulations
- Tourists: Changes in consumer behaviour
- Technology & carbon management

Energy efficiency gains and absolute emission growth



Peeters, P., Higham, J., Kutzner, D., Cohen, S. and Gössling, S. 2015. Are technology myths stalling aviation climate policy? *Transportation Research Part D*, submitted

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Implications

- We know the mitigation challenge quite well
- The contribution tourism has to/should make is open to debate, but it must be significant:
  - Ultimately, we will have to travel (fly) less.
- But making it happen is a huge challenge:
  - Technology not enough
  - Voluntary behavioural change does not happen
  - Taxes/regulations strongly resisted → political suicide

→How to move forward?

→Issue for destinations: which source markets to target?

→Amsterdam case (Paul Peeters)

Climate indices

Climate as a resource

- Climate and climatic differences drive major tourist flows in the world
- Main one: northern Europe to Mediterranean
- Climate change changes the climate resources and can thus affect the tourist flows
- Early-mid 2000s: let's study how!

- One way: index such as Mieczkowski's (1985) Tourism Climate Index (TCI)

Tourism Climatic Index (TCI)

- Mieczkowski 1985
- Assess climatic elements relevant to the quality of tourism
- 7 monthly climatic variables grouped in 5 sub-indices:
  - **CID**: Daytime Thermal Comfort Index (ºC)
  - **CIA**: Daily Thermal Comfort Index (ºC)
  - **P**: Total Monthly Precipitation (mm)
  - **S**: Hours of Sunshine (h/day)
  - **W**: Wind Speed (km/h)

$$TCI = 2 \cdot [(4 \cdot CID) + CIA + (2 \cdot P) + (2 \cdot S) + W]$$

TCI example

Rating scheme

Rating	Effective temperature (°C)	Mean monthly precipitation (mm/month)	Mean monthly sunshine (hours/day)	Wind speed (km/h)		
				Normal	Trade wind	Hot climate
5.0	20 - 27	0.0 – 14.9	> 10	< 2.88	12.24 – 19.79	
4.5	19 – 20 & 27 - 28	15.0 – 29.9	9 – 10	2.88 – 5.75		

Ex. BARCELONA (June)

	CID	CIA	P	S	W
Value	25.6	18.9	36	7.8	11.9
Rating	5	4	4	3.5	4

TCI = 86

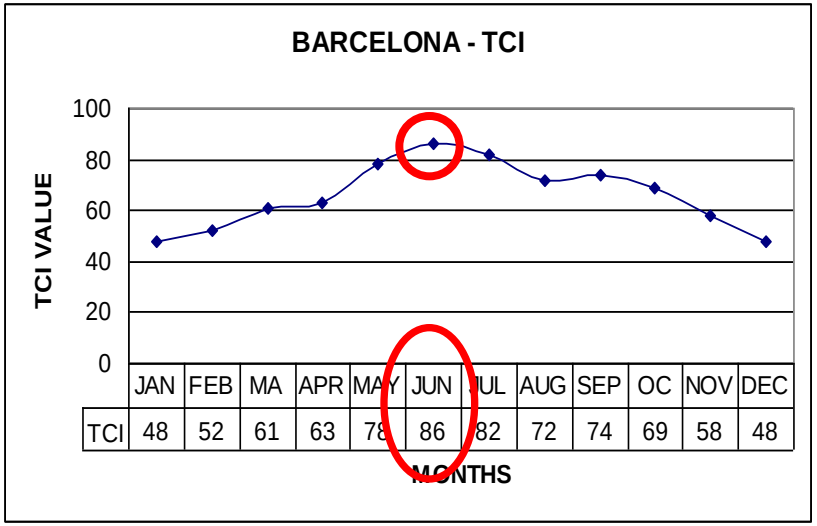
$$TCI = 2 \cdot [(4 \cdot CID) + CIA + (2 \cdot P) + (2 \cdot S) + W]$$

TCI example (continued)

Numerical value of indices	Mapping category
90-100 80-89	Excellent
70-79 60-69	Very good and good
50-59 40-59	Acceptable
30-39 20-29 10-19 9- -9 -10- -20	Unfavorable

TCI (June) = 86

EXCELLENT



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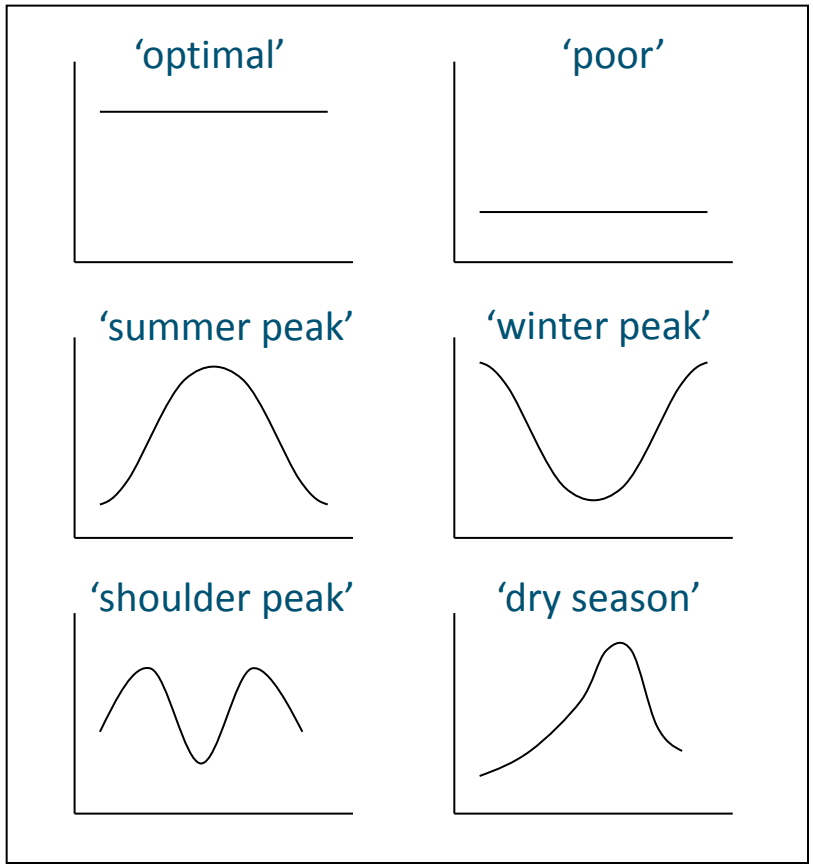
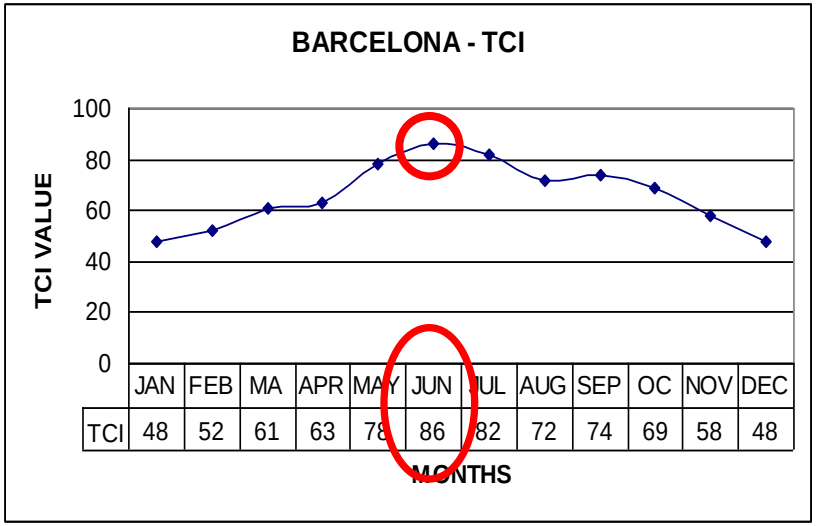
TCI example (continued)

Conceptual Distributions



TCI (June) = 86

EXCELLENT



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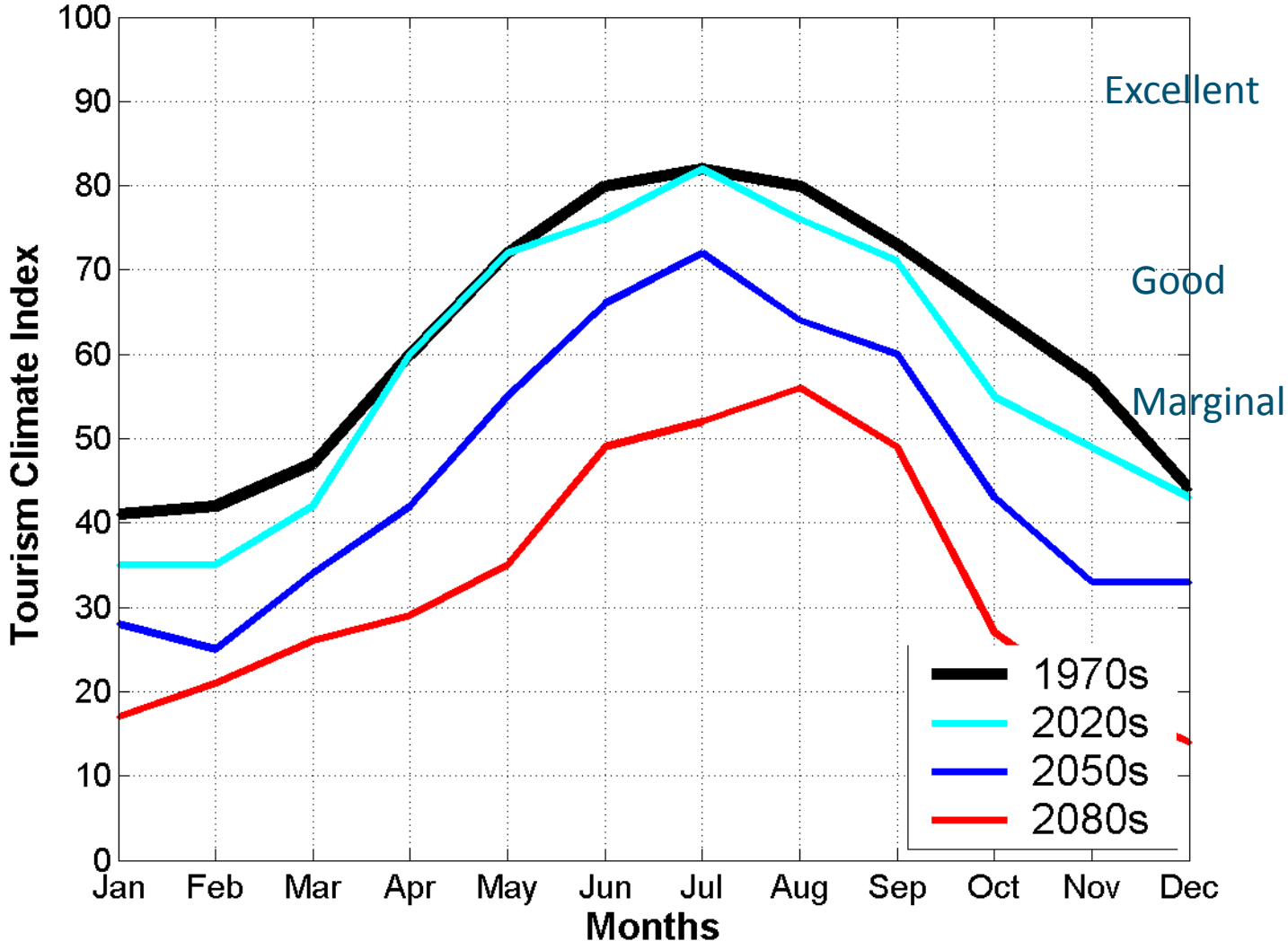
Tropics (Rio de Janeiro)



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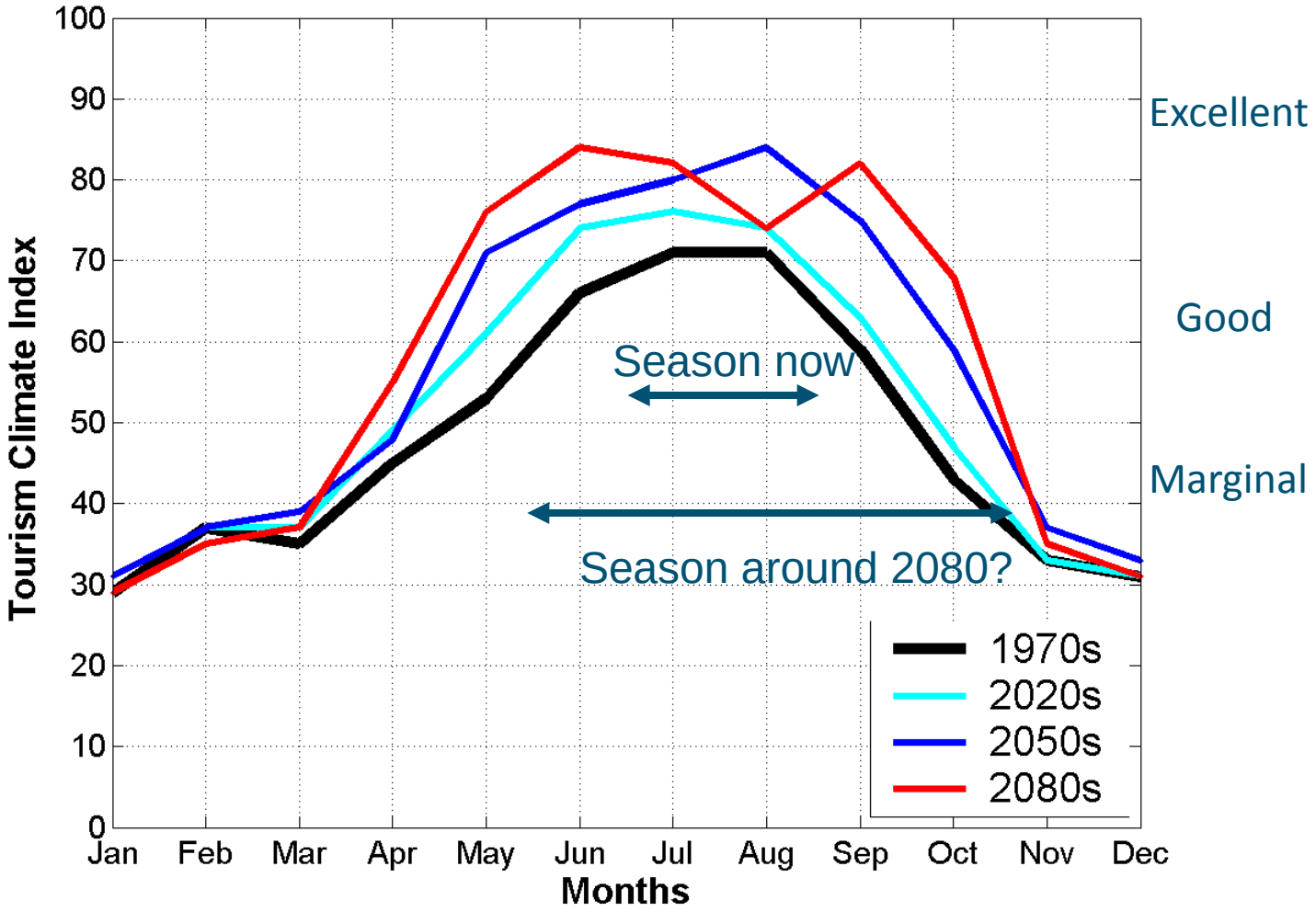
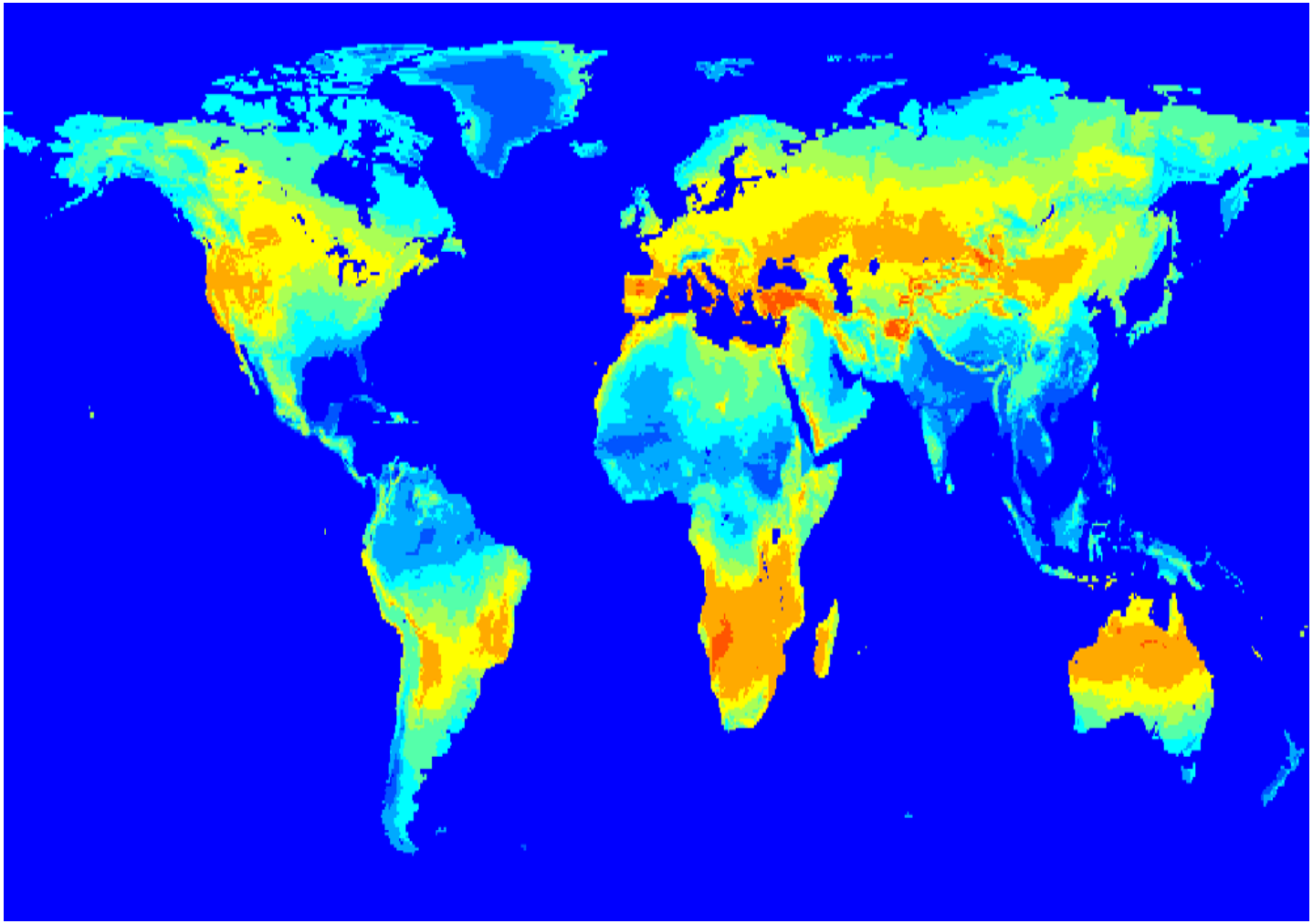
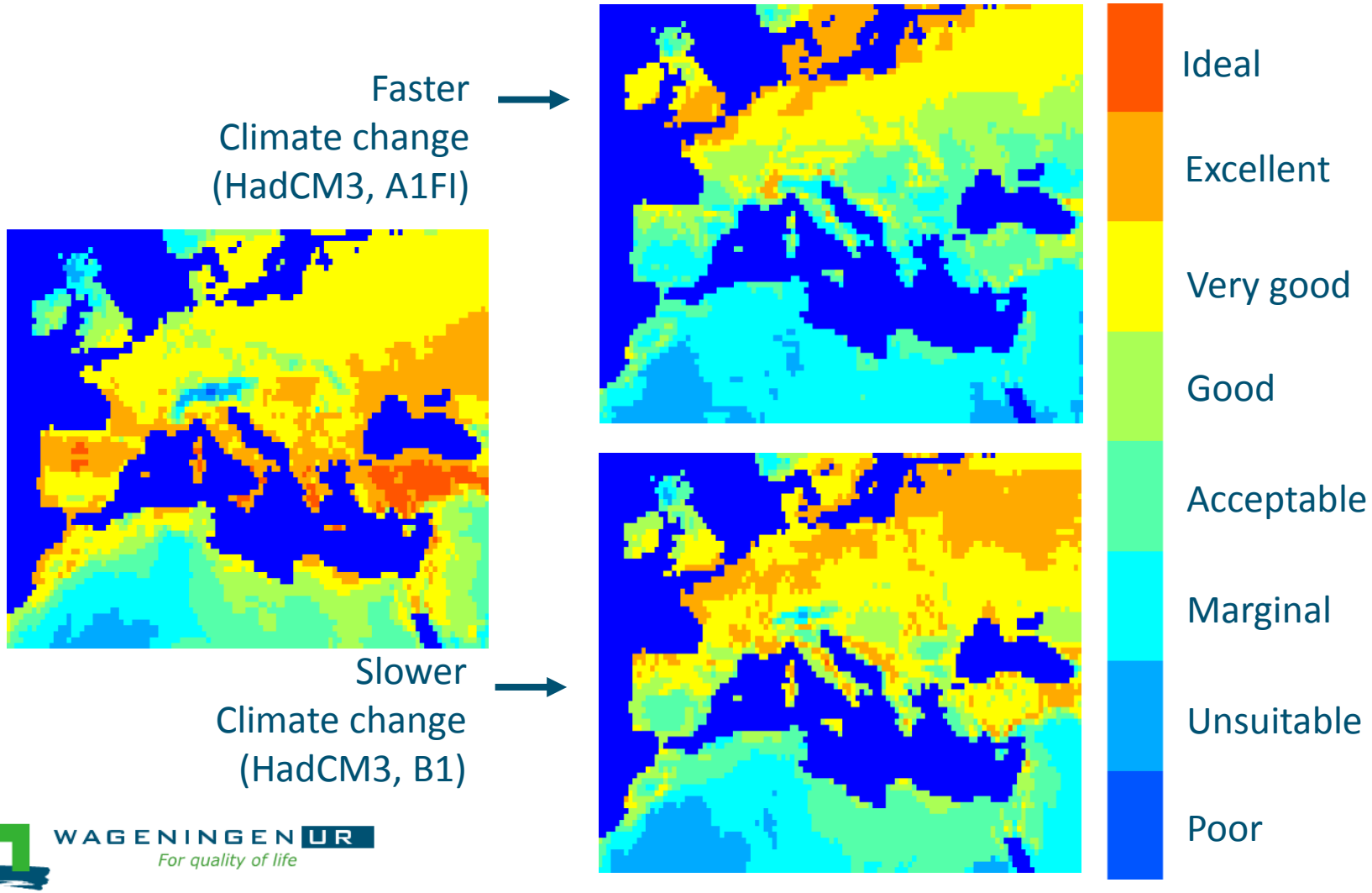
Moderate zones (Amsterdam)



TCI analysis based on grids



Tourism conditions in summer: now and around 2100



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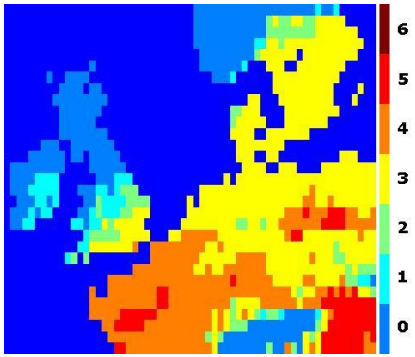
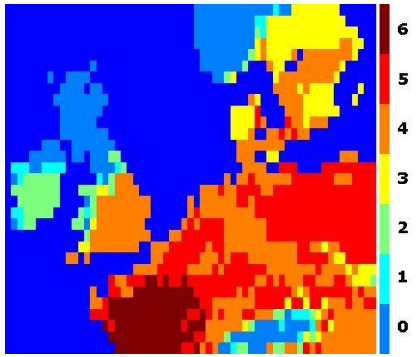
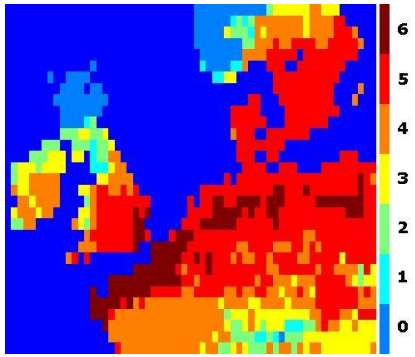
Number of 'very good' months HadCM3 model

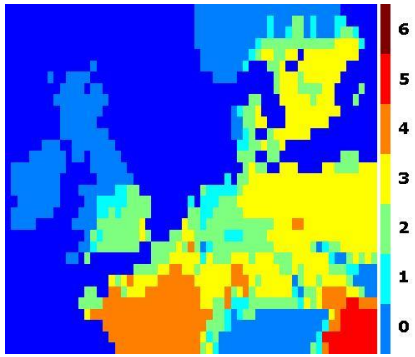
SRES A1F







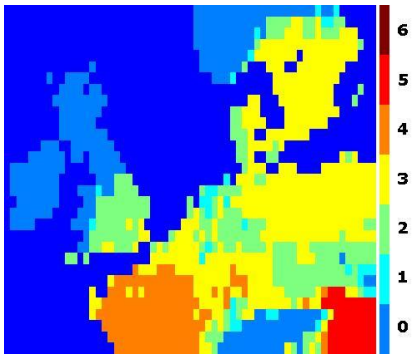
Baseline, 1970s

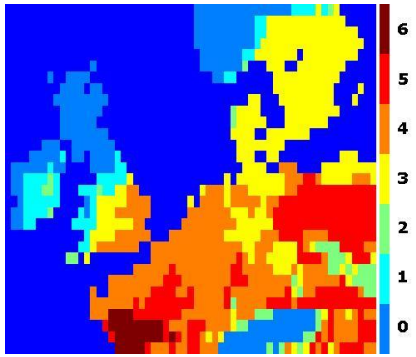


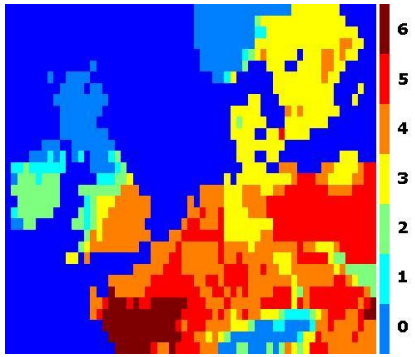
2010-2039 ('2020s')

2040-2069 ('2050s')

2070-2099 ('2080s')







SRES B1A

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Reflection

- By trying to explore the effects of climate change on climate resources for tourism
- We found out that we know very little about the current relationships
- M-TCI mainly based on expert opinion, not on empirical information, monthly data, not activity specific

- We have to understand the current relationships to explore the impacts of climate change (see Butler)

→ Take a step back and address the fundamentals first

2008-15: Conducted multiple surveys of tourist climate preferences in varied tourism environments

(Scott et al. 2008; Rutty & Scott 2010, 2013, 2014, 2015; Rutty et al. 2014; Hewar & Scott 2015)

Major questions …

Western Europe, Canada + US, Caribbean, China

- What weather conditions are **ideal** while on holiday?
- How **resilient** are tourists to weather?

  *… what are the **limits** of acceptability, when will they change travel patterns, when is holiday satisfaction affected*

- Are these preferences and thresholds **culturally robust** or do they vary around the world?

  Is a single climate index for global tourism feasible?

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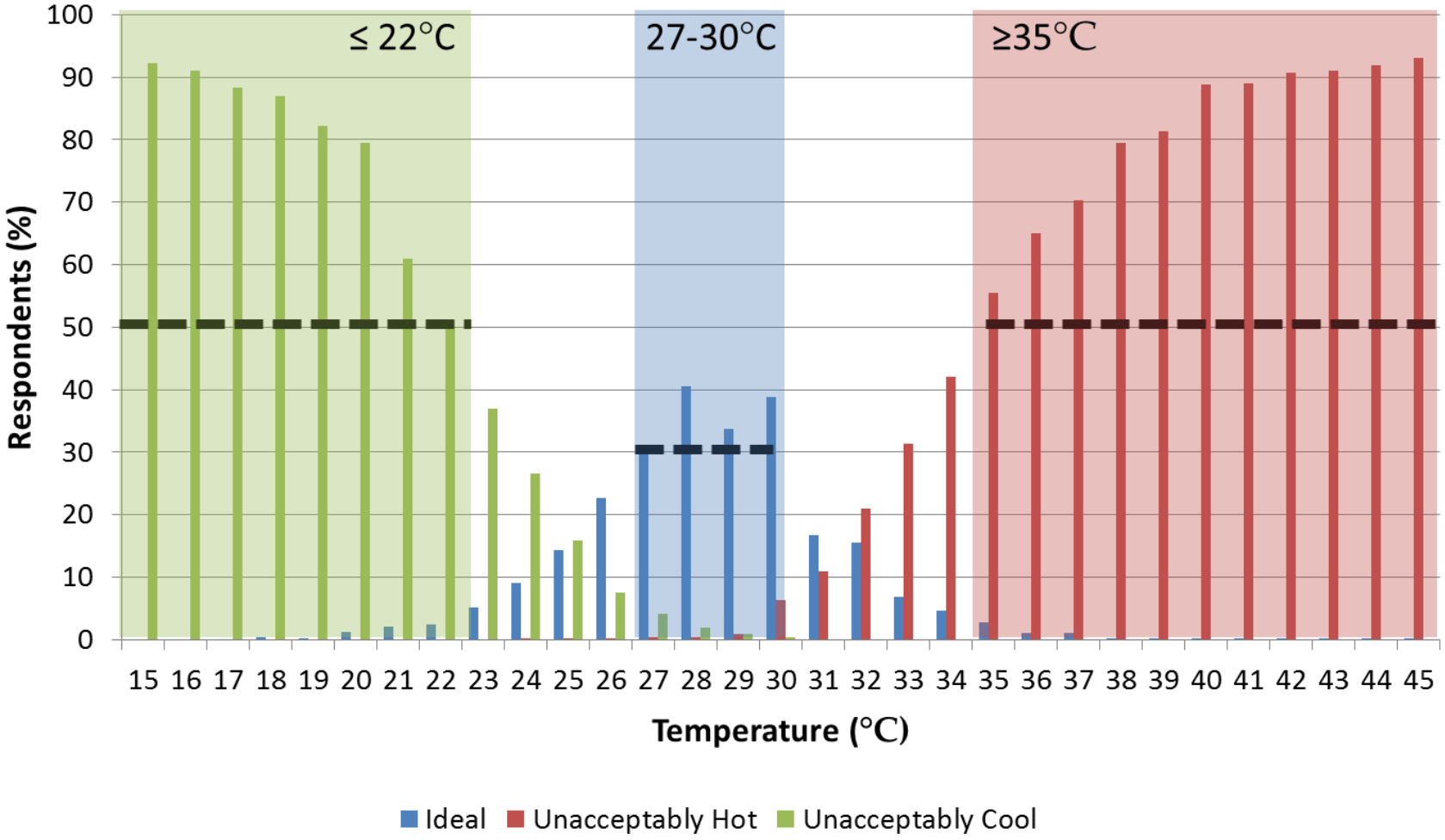
What is 'Too Hot' for Tourism?: Temperature Preferences for Coastal Tourism



Scott & Rutty 2010, 2013

Specification of a Holiday Climate Index for Urban and Beach Destinations

What's in a name? – 'holiday' (leisure tourism) more accurately reflects what the index is designed for

Design Principles:

- designed to overcome all of the limitations of the M-TCI
- Incorporates Thermal, Aesthetic and Physical facets of climate
- overriding effect of the Physical facet is accounted for *… but differently than CIT*
- variable rating scales and weighting based on stated tourist preferences
- is adjusted for the climatic requirements of major types of destinations/holidays, where most of global tourism occurs (urban and 3S)

Design principles (continued)

- utilizes daily data (station or gridded)
- rating scale (0-100) user friendly and highly interpretable
- three main types of outputs: (1) average monthly index ratings, (2) probability of optimal and unacceptable ratings (i.e., % of days), (3) sub-index indicators - number/probability of days physical override conditions occur (by wind or rain) or when thermal comfort thresholds are exceeded (too hot or cold).

HCI Specification: Variable Weightings

	Tourist Rankings of Weather Variables								Index Weighting (%)		
	Beach					Urban			HCI -B	HCI -U	M-TCI
	4	2	2	2	3	1	1	1	30	40	50
	2	1	1	3	1	3	3	3	35	20	20
	1	3	3	1	2	2	2	2	25	30	20
	3	4	4	4	4	4	4	4	10	10	10
	Morgan et al. (2000)	Scott et al.	Credoc (2009)	Moreno (2010)	Rutty & Scott	Scott et al. 008)	Credoc (2009)	Rutty & Scott (2010)			Mieckowski (1985)

Index Formulas:

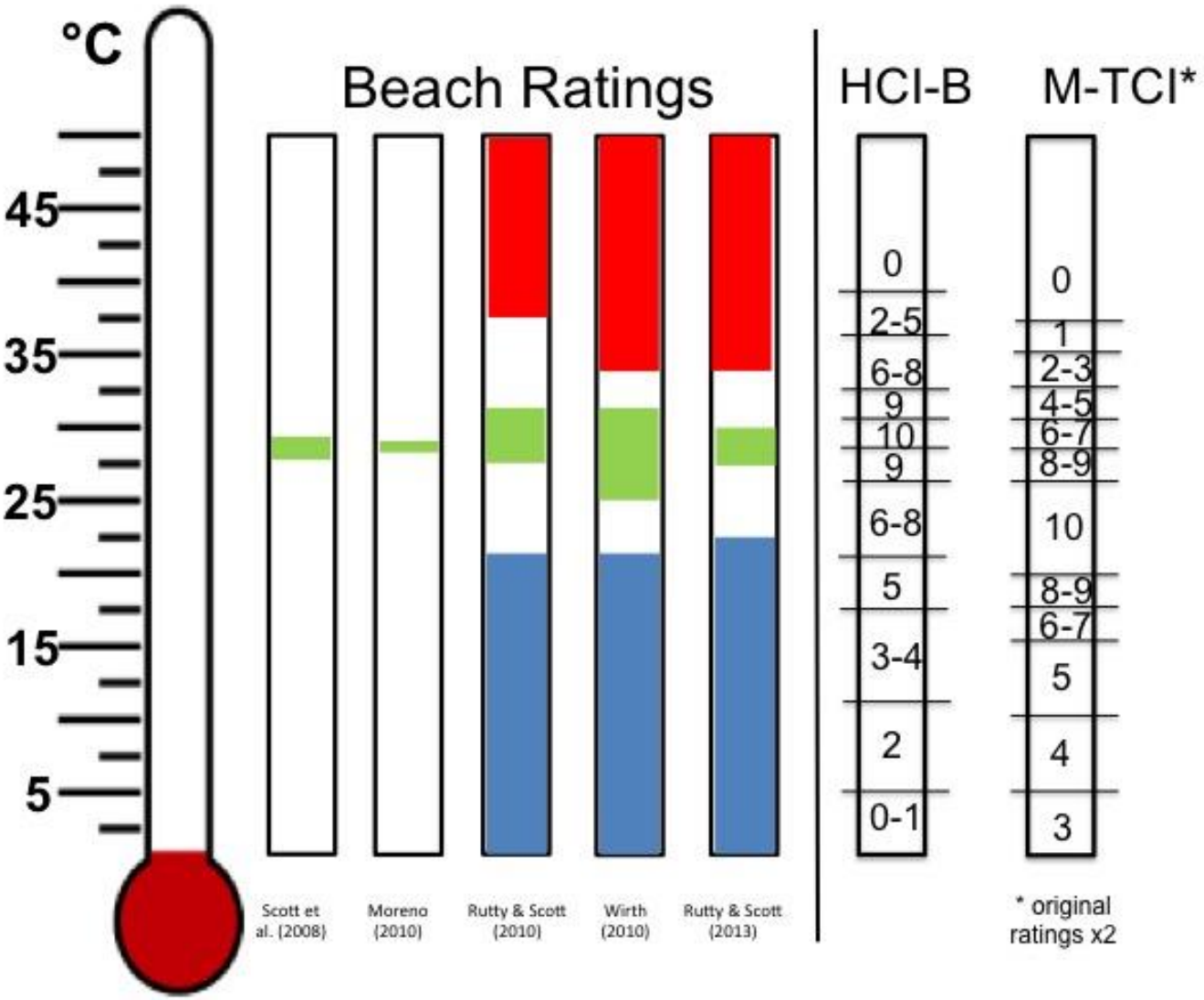
HCI-u = T*.4 + A*.2 + P (R*.3 + W*.1)

HCI-b = T*.3 + A*.35 + P (R*.25 + W*.1)

M-TCI = CID.4 + CIA.1 + R.2 + S.2 + W.1

A high HCI rating cannot be achieved with low P (R + W) score, operationalizing the over-riding effect of P.

Tourist Preferences and Thermal Ratings in HCI-beach vs M-TCI



indoor water parks
air temperature

Unacceptably Hot

Ideal

Unacceptably Cool

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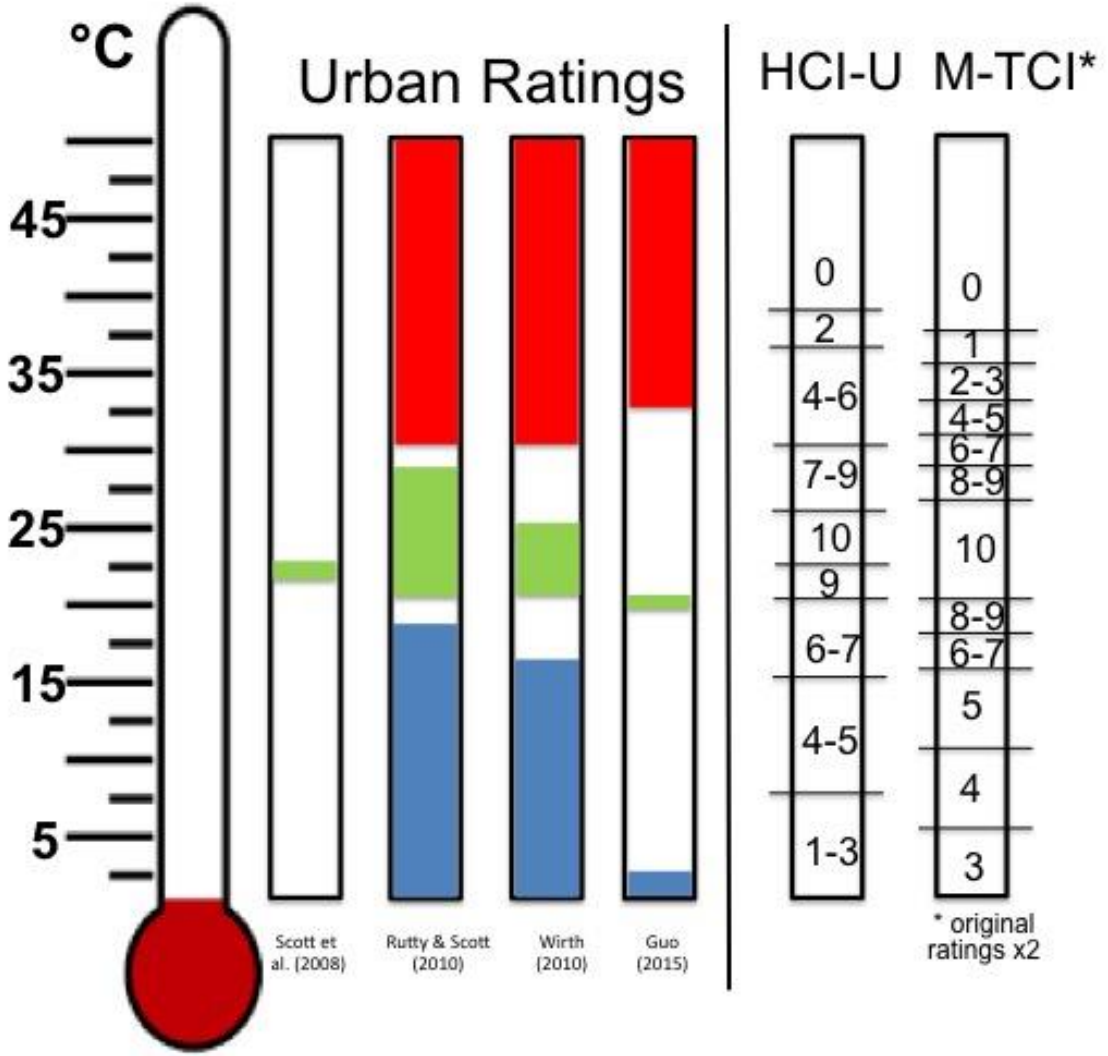
Tourist Preferences and Thermal Ratings in HCI-urban vs M-TCI



Unacceptably Hot

Ideal

Unacceptably Cool

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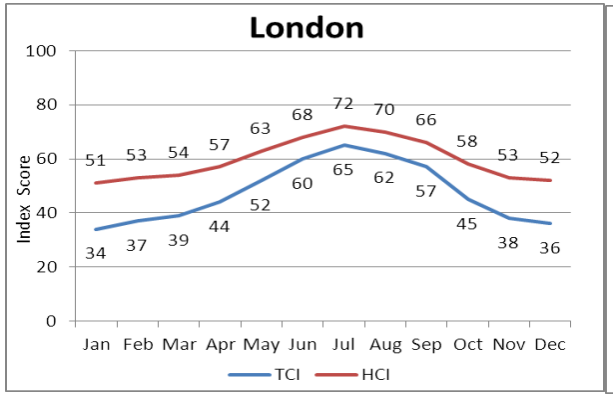
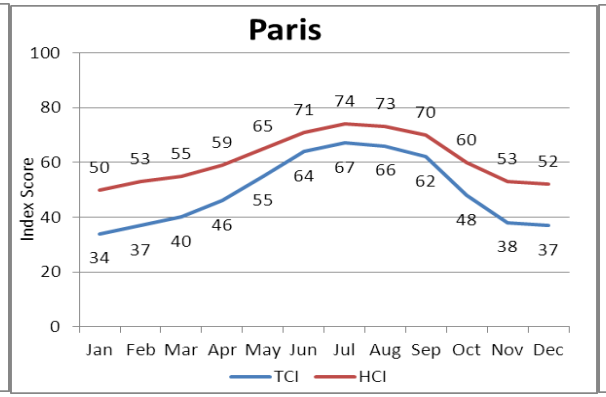
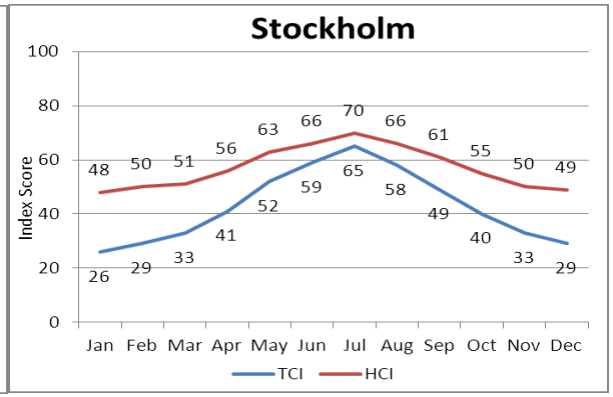
Comparing HCI-urban and M-TCI Ratings Across Europe

Comparison of Monthly Average Rating (1961-1990)

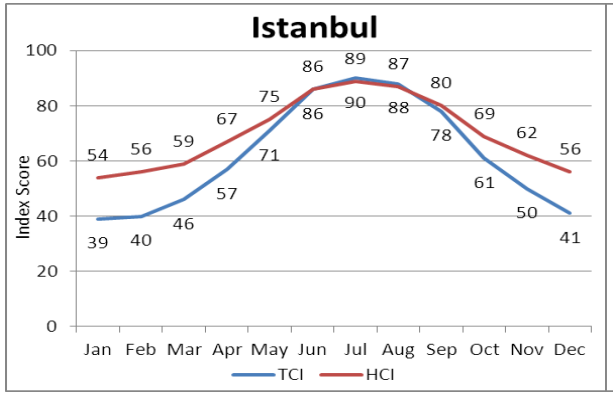
Central-Northern

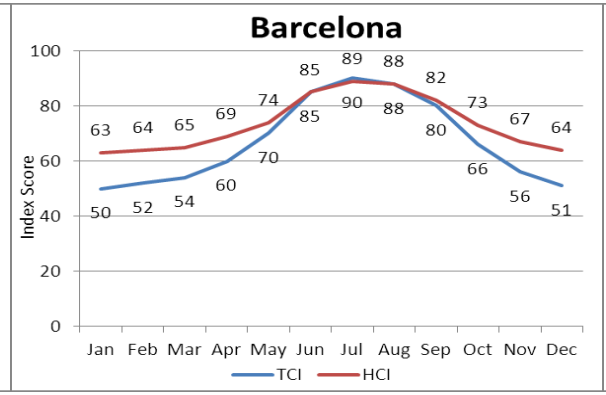


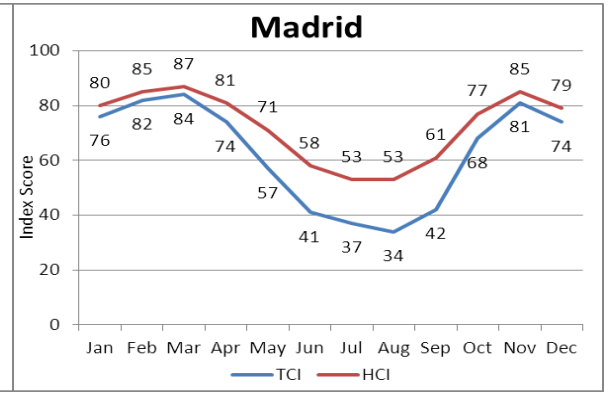




Southern-Mediterranean







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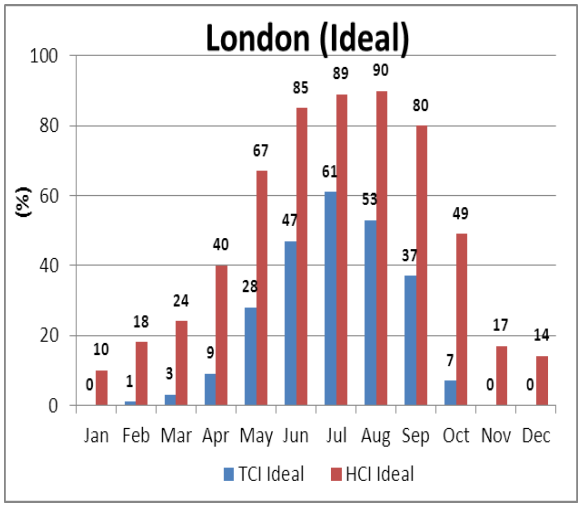
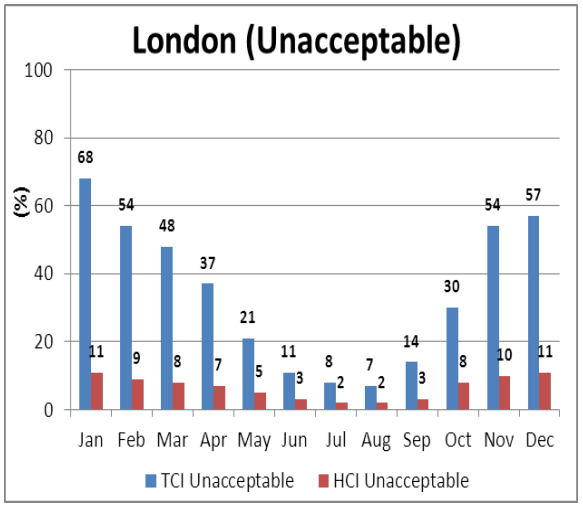
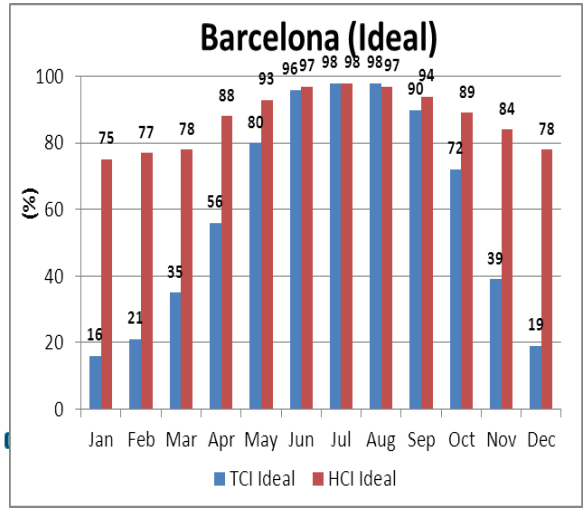
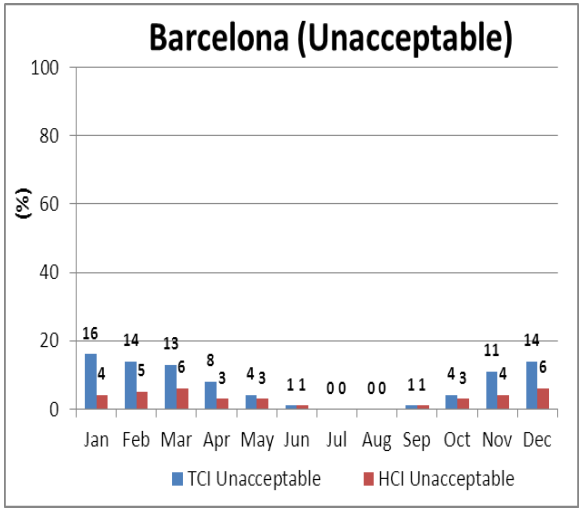
Probability (%) of Ideal and Unacceptable Days (1961-1990)

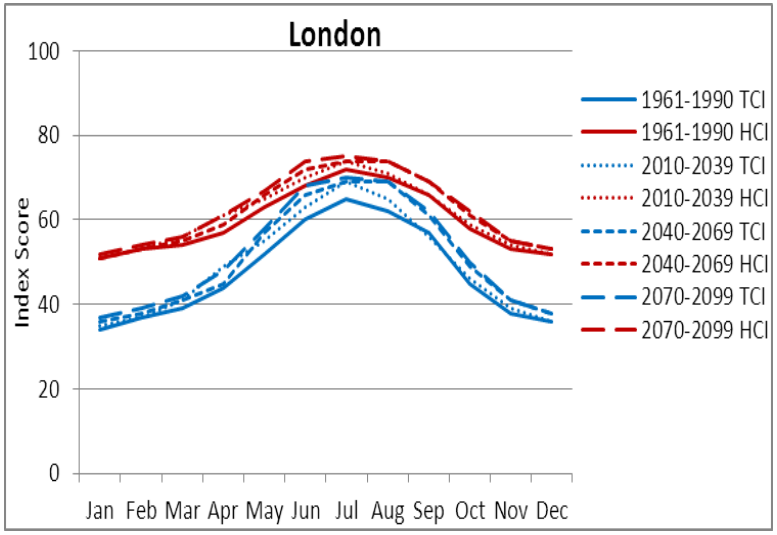


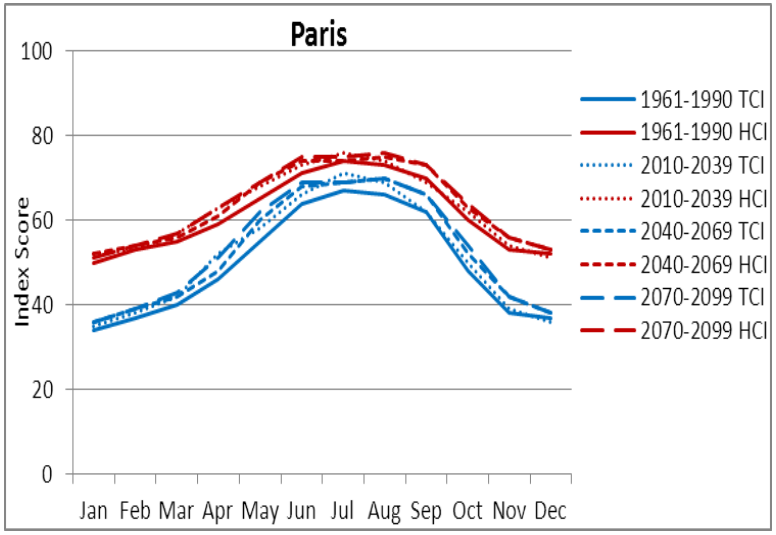


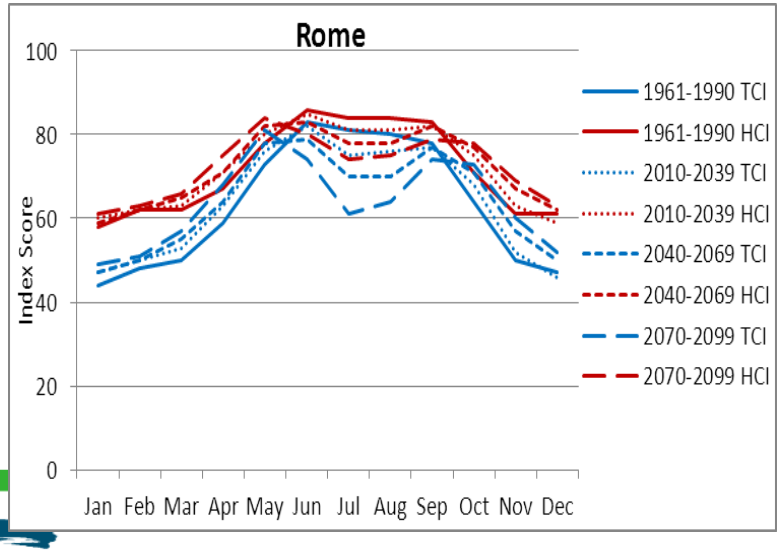


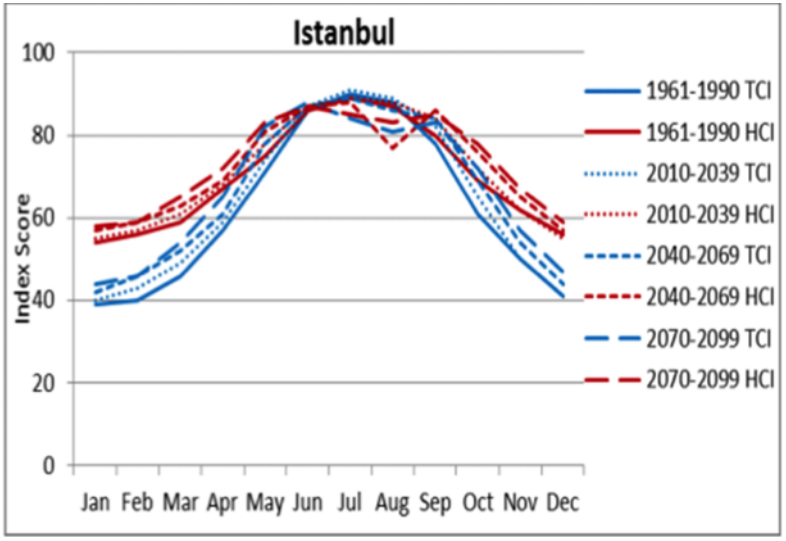


Projected Future Climate Ratings

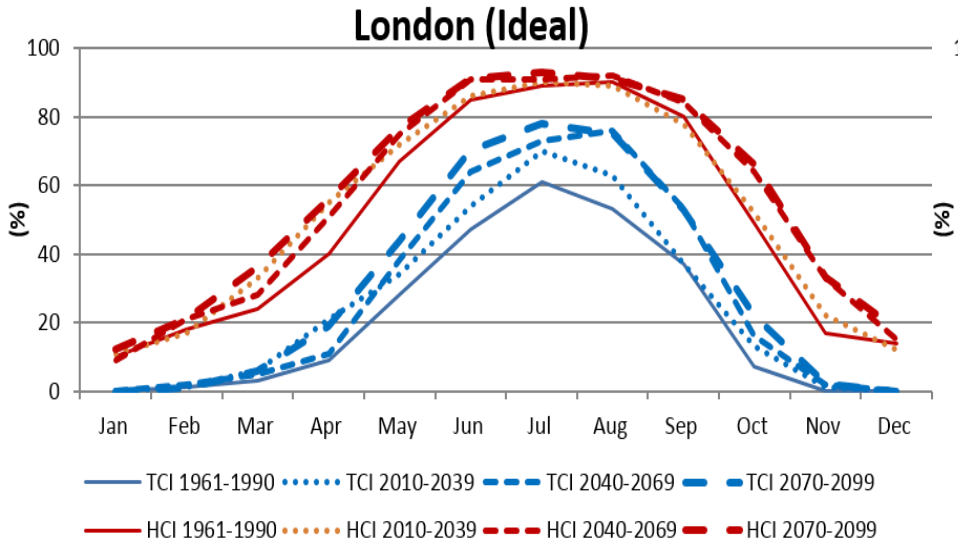


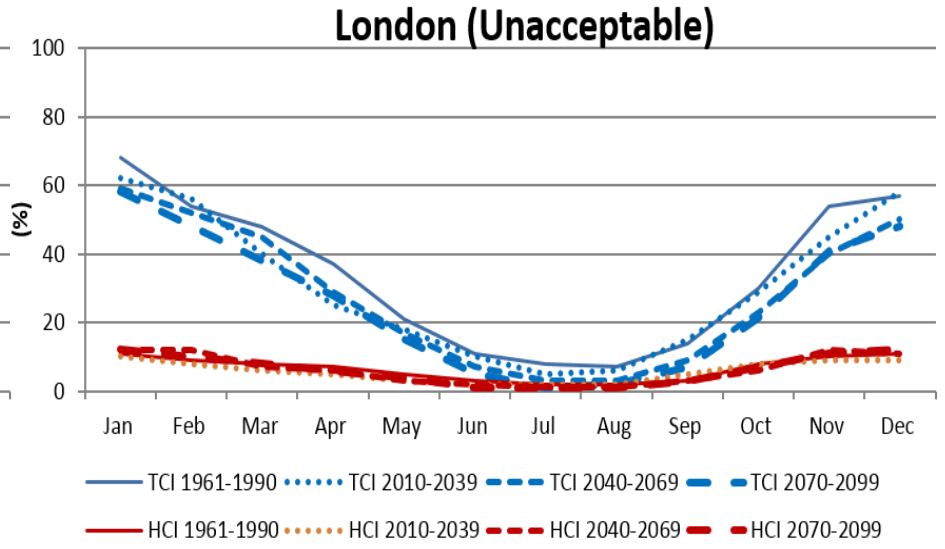


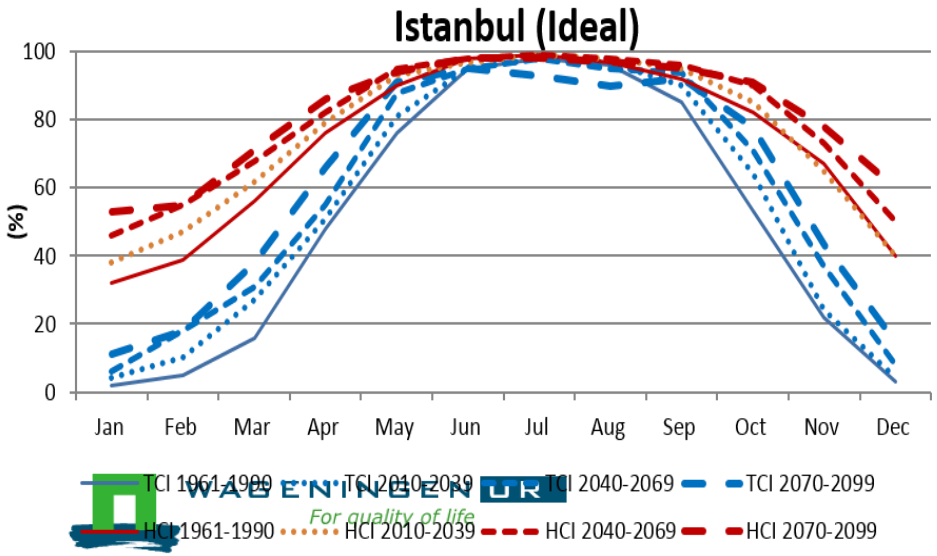


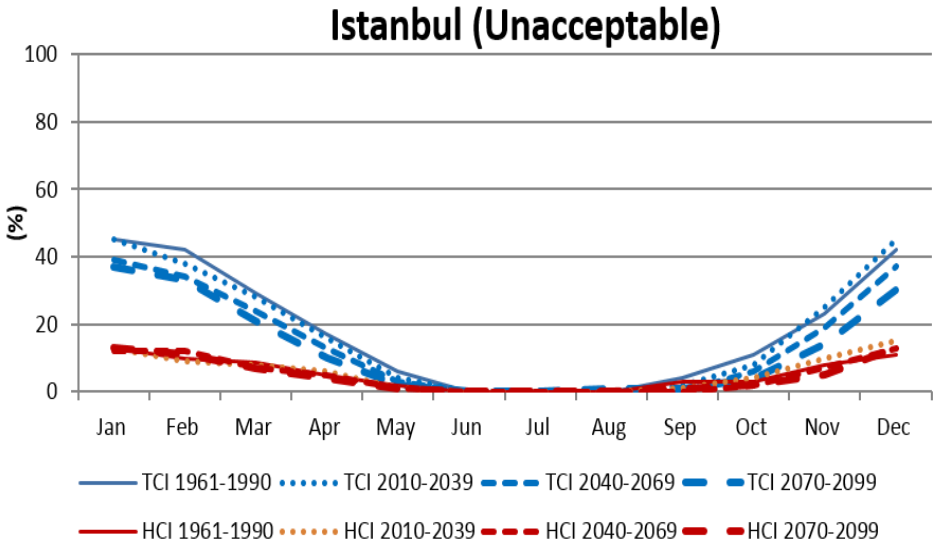


Probability (%) of Future Ideal & Unacceptable Days









Approach

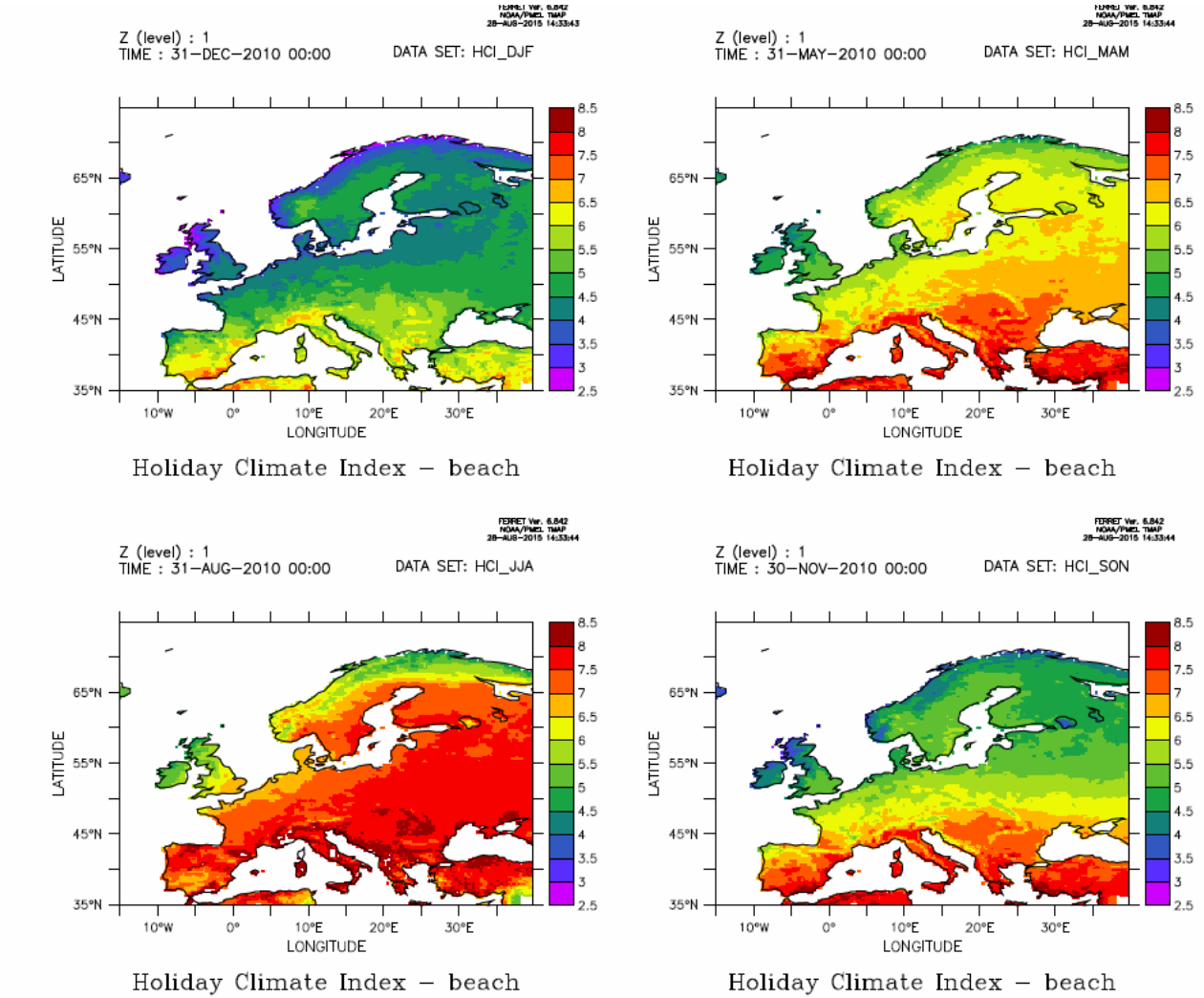


Figure 2: Average 1981-2010 Holiday Climate Index (beach tourism) for the 4 seasons.

Conclusions indices, future research

- HCI superior to TCI in many respects
- But many issues unresolved:
  - Stated preferences vs actual behaviour
  - Micro-climates
  - Intercultural differences
  - Generalizations possible? Are indices useful?

Vulnerability and adaptation

Vulnerability

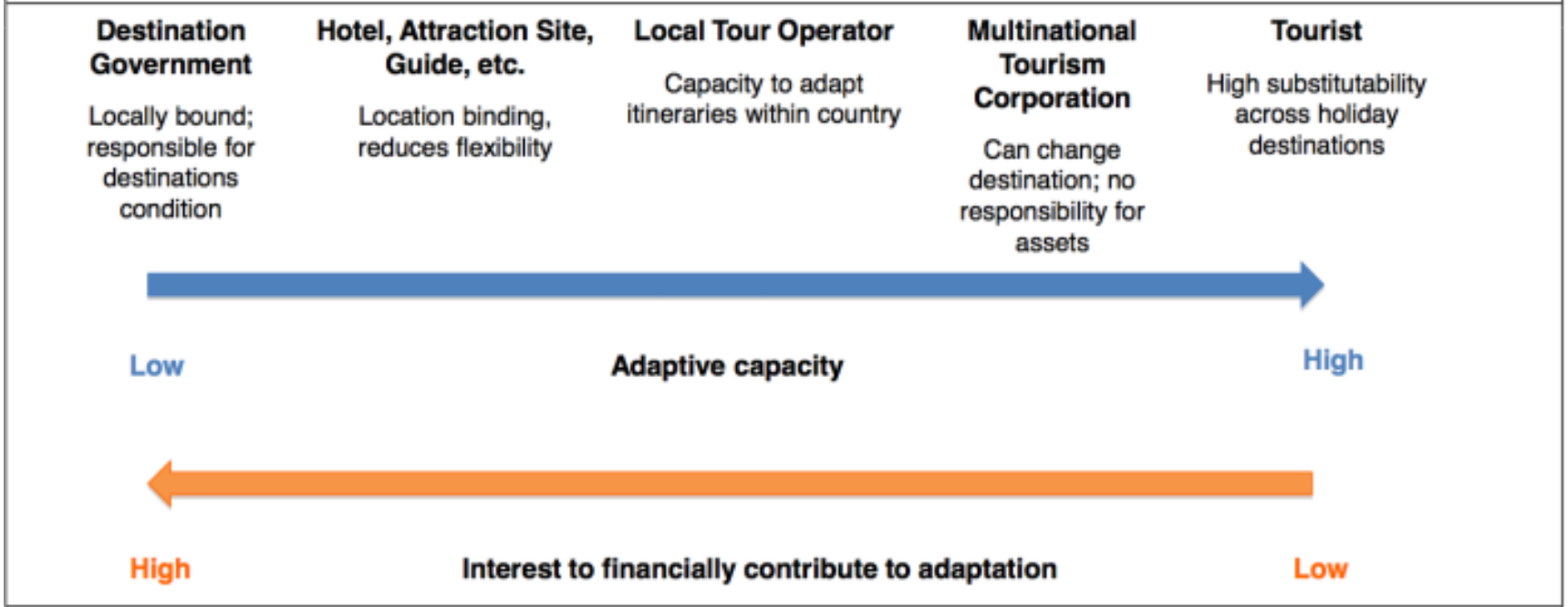
- Starting from bottom-up
- No need for climate scenarios: start from business/resort perspective

Vulnerability

- Exposure:
  - Things that can be affected by climate change (populations, resources, property, and so on)
  - The change in climate itself (sea level rise, precipitation and temperature changes, and so on)
- Sensitivity
  - Sensitivity is the degree to which a system will be affected by, or responsive to climate stimuli
- Adaptive capacity
  - Adaptive capacity refers to the potential or capability of a system to adjust to climate change
  - Wealth, technology, education, institutions, information, infrastructure, social capital

Adaptive capacity

Figure 1: Adaptive capacities of tourism stakeholders



Source: Authors, based on Scott and Jones, 2006

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Beach tourism vulnerability index

Perch-Nielsen (2010). The vulnerability of beach tourism to climate change—an index approach. Climatic Change 100:579–606

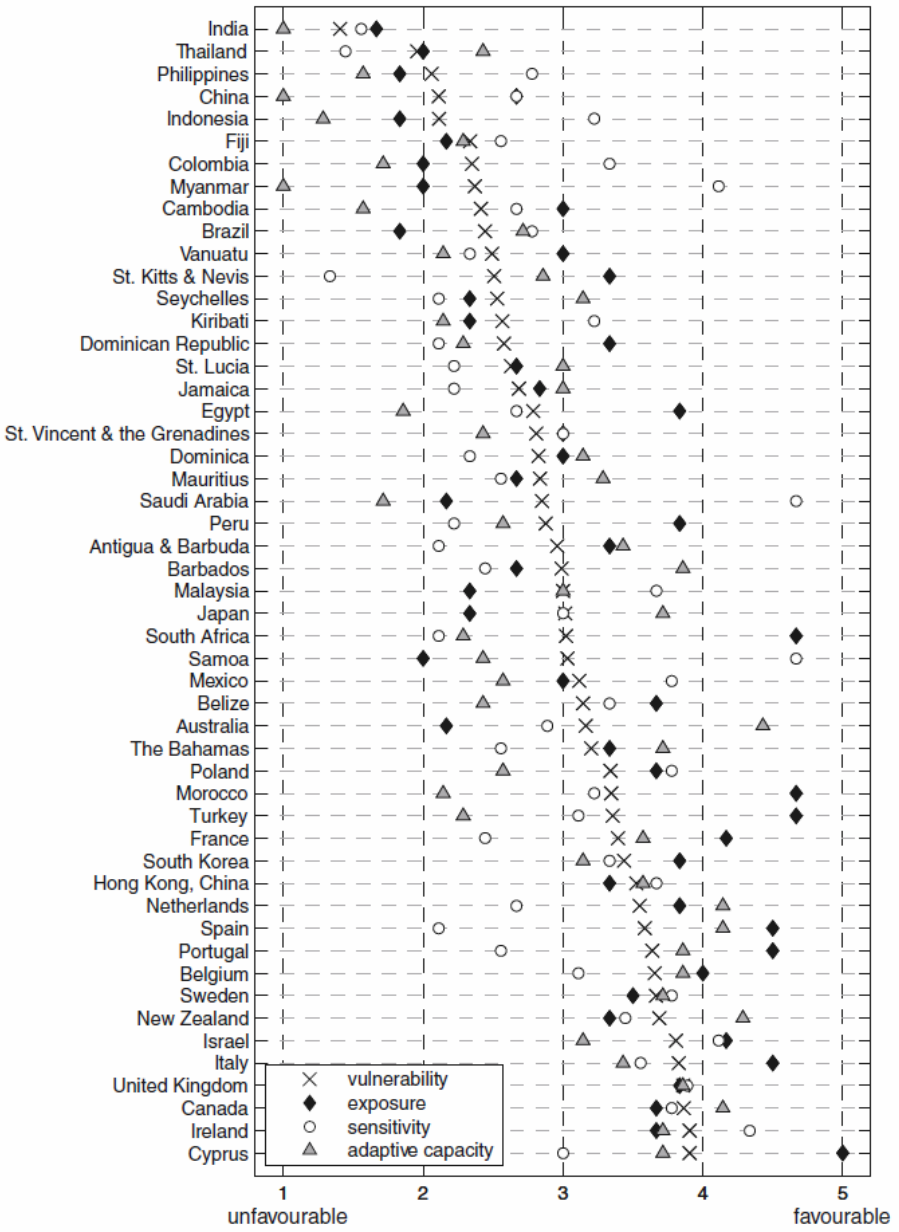

Fig. 1 List of countries showing the relative vulnerability of beach tourism to climate change. Results for exposure (♦), sensitivity (○), adaptive capacity (△) and all combined (×) are shown for the standard transformation and weighting

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Vulnerability assessment: 5 steps (Fiji)

(Moreno & Becken, 2009)

Step 1. System analysis

Highly dependent on tourism

Key activities are related to the marine environment: beach, diving, …

Step 2. Climate & activity-hazard subsystems

Step 3. Vulnerability

Step 4. Integration of individual vulnerability assessment

Step 5. Communication of results

Local councils

National bodies

NGOs

Activity-hazard	Exposure	Sensitivity	Adaptive Capacity	Overall
1. Beach-cyclones	High	Very High	Moderate	Moderate
2. Snorkelling-coral bleaching	High	High	Low	High

Step 3: Vulnerability analysis
Visualisation of beach – cyclone subsystem

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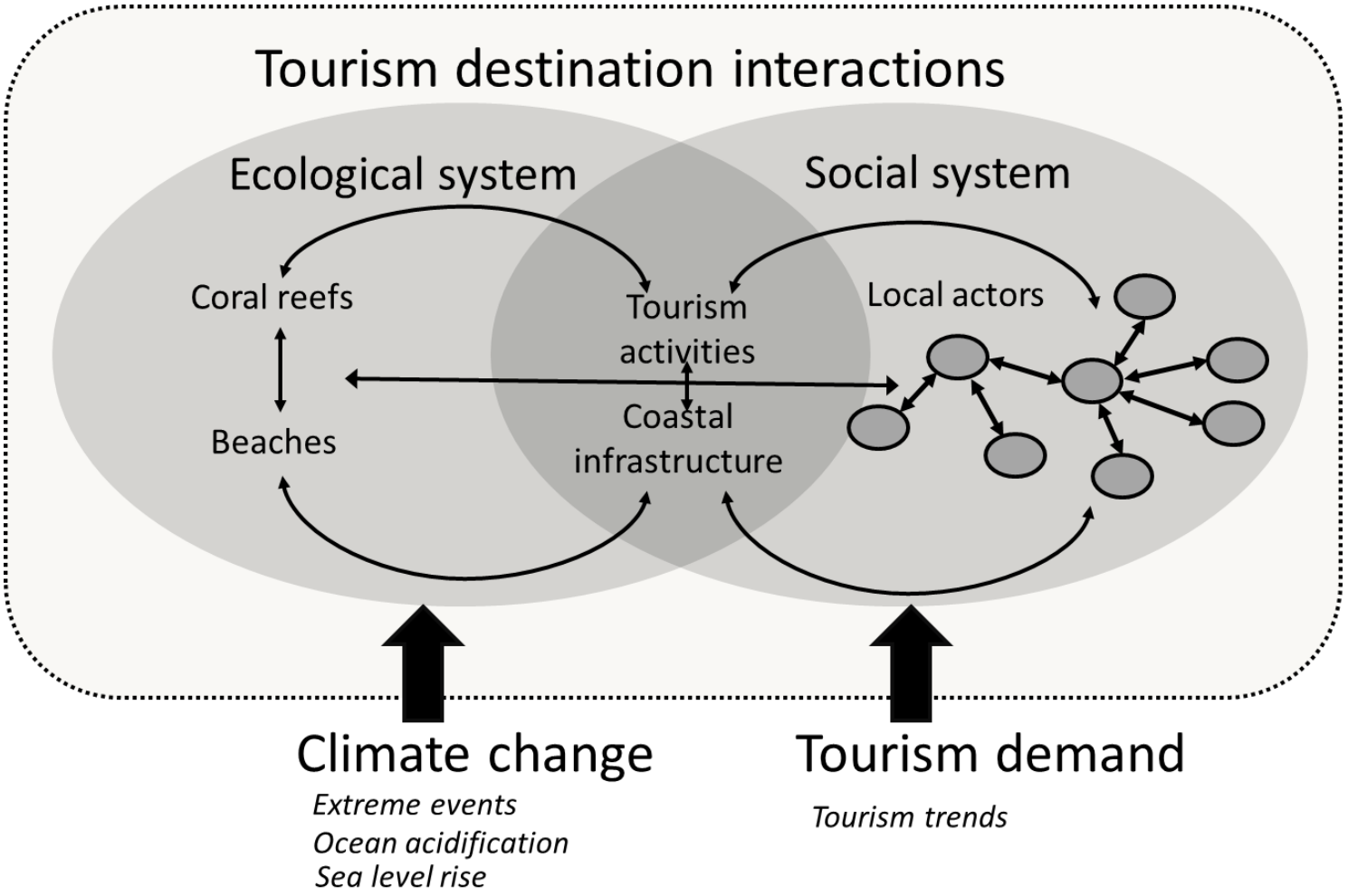
Future: agent perspective?

- How do stakeholders repond to the impacts of climate change (policy)?
- How do they interact with each other?
- Who talks to whom?
- Who are the powerful actors? E.g. role of insurance

- Agent-based modelling
- Workshop in January on ABM and tourism

Interactions in socio-ecological tourism systems



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More information: Jillian Student, jillian.student@wur.nl

Water and tourism

Looking for collaboration

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Water Footprint of tourism

Table 4 Estimated water use in L per guest night for each category and corresponding sub divisions included in the water-use framework for tourism

Categories of water-use	Sub division	Estimated water use in L per guest night	Sources
Accommodation[A]	Size, type & facilities Services Property management	750-2125 L 150-625 L 250-1625 L	(Becken, 2014; Gössling, 2015; Gössling et al., 2012; Pratt, 2011; UNWTO, 2013; authors interpretation)
Activities		10-30 L	(Gössling, 2015; Hadjikakou et al., 2013)
Food and drinks	Cuisine Beverages	4625-8375 L 940-1880 L	(Gössling, 2015; authors interpretation)
Travelling	Mode of transport Fuels	42-52 L 5-2500 L	(Gössling, 2015; authors interpretation)
Energy use	Accommodation Activities	45-55 L 10-30 L	(Gössling, 2015; authors interpretation)
Construction & development		9-11 L	(Rosselló-Batle, Moià, Cladera, & Martínez, 2010; authors interpretation)

[A] Accommodational water-use estimates are based on percentages that do not add up to 100% (c.f. Section 3.1.1).

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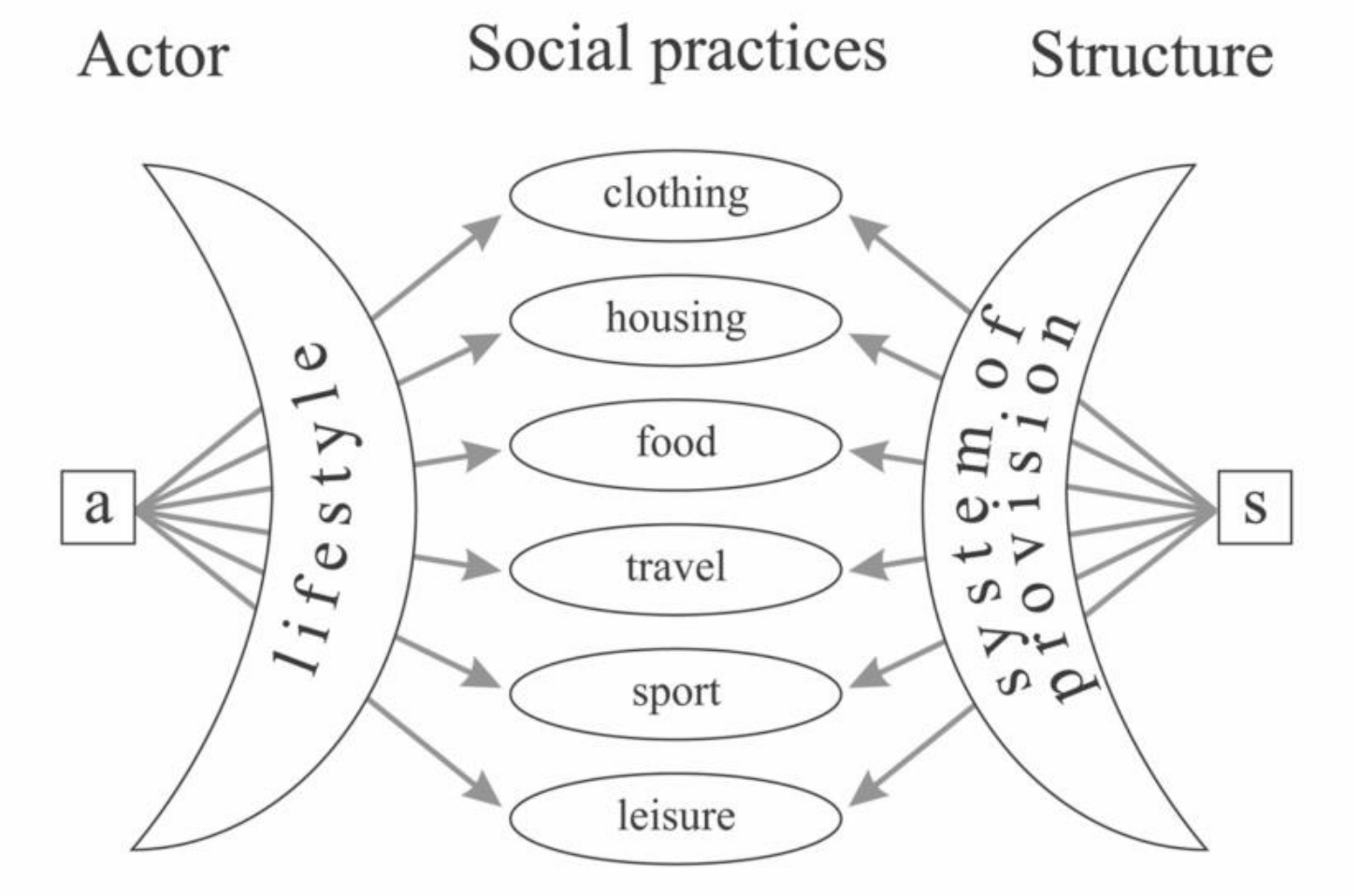
Social Practices Model



Spaargaren, G. (2011). Sustainable Consumption: A Theoretical and Environmental Policy Perspective. Society & Natural Resources: An International Journal, 16, 687–701.

Which are the key principles and conditions for sustainable water use practices for island tourism destinations?

- As part of the process, the following sub-research questions will also be addressed:
- 1. What is the water footprint of the tourism sector's main components (i.e. transport, accommodation, attraction) in Texel and other specific island destination settings?
- 2. Within these tourism sector components, how can integrating practice based knowledge and water accounting indices characterize and quantify tourism-related water use in order to identify the most relevant and distinct sets of tourism water practices?
- 3. What transition dynamics are needed and possible for the identified tourism water practices?
- 4. How do various water conservation innovations align with these transition dynamics and what is their effectiveness?

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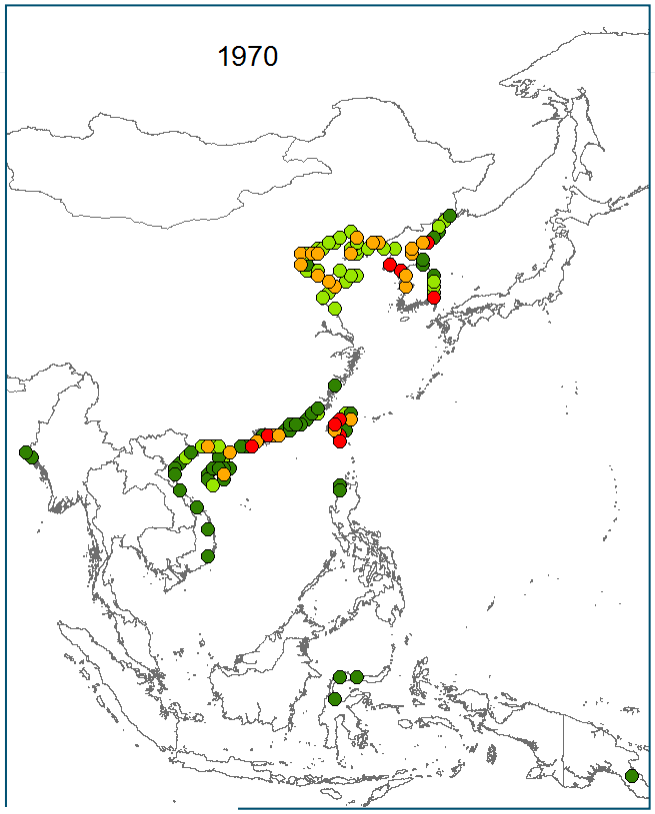
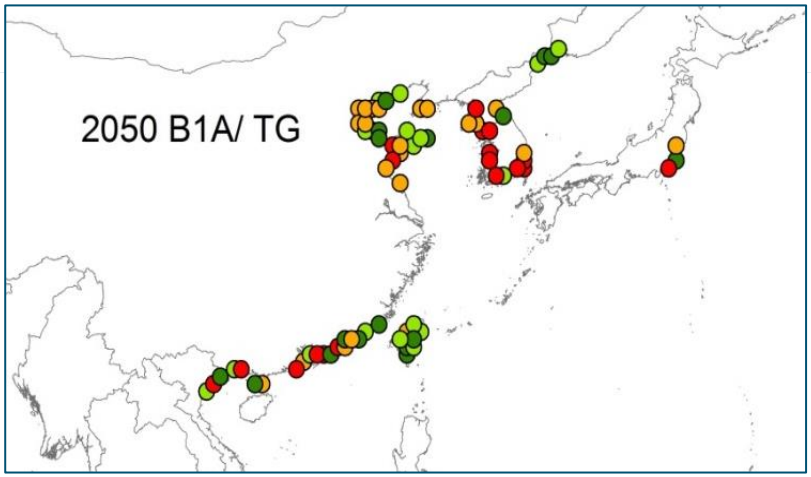
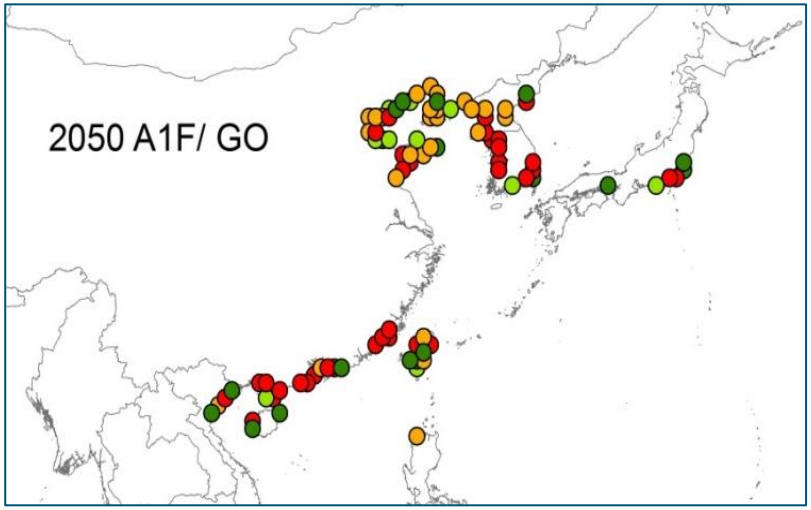
Hotspots and potential hotspots

(TCI>50 for 6 months; TCI>70 for 4 monhts))







Legend

- ICEP >5
- ICEP -1- 5
- ICEP-5- -1
- ICEP<-5

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Some findings

- The number of areas with a suitable climate decreases significantly
- Rapid increase in eutrophication potential, in particular for large rivers
- In 1970 30% of (potential) hotspots are calculated to have eutrophication problems; for 2050 this percentage is at least 50%

- Tourism development ambitions may provide a strong rationale for reducing water pollution and nutrient loads.

Follow-up: Blue Flag beaches

- MSc thesis project:
  - How is water quality projected to develop under scenarios of (climate) change?
  - Will beaches still meet the Blue Flag criteria for water quality?
  - How important is water quality for beach tourists in the first place???

- Any options for collaboration?
- Good water quality data?

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Concluding remarks

- From looking forward to looking back (!)
- From global/general to local/specific
- From top-down to bottom-up

- From partial analysis to holistic

- From 'just' climate change to global change

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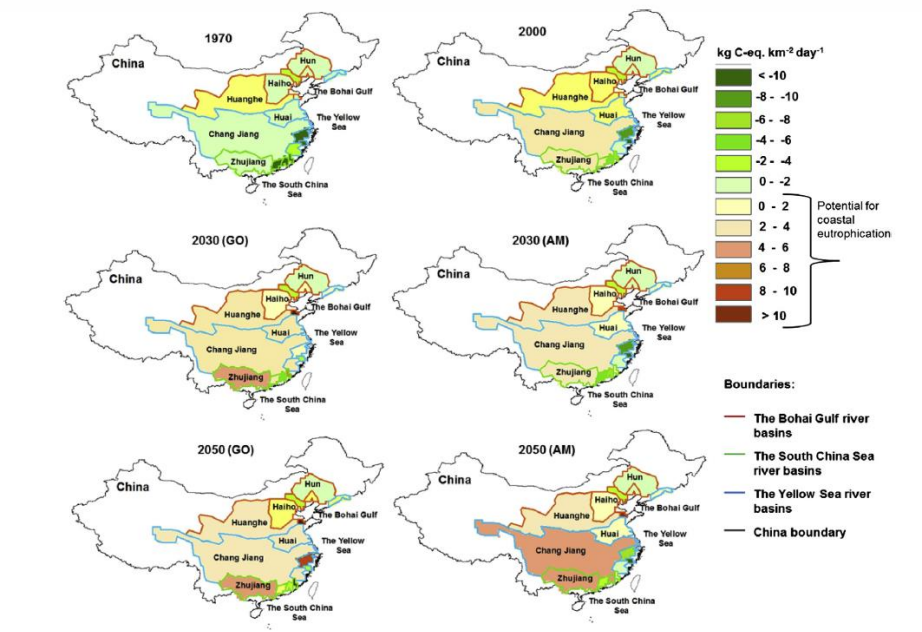
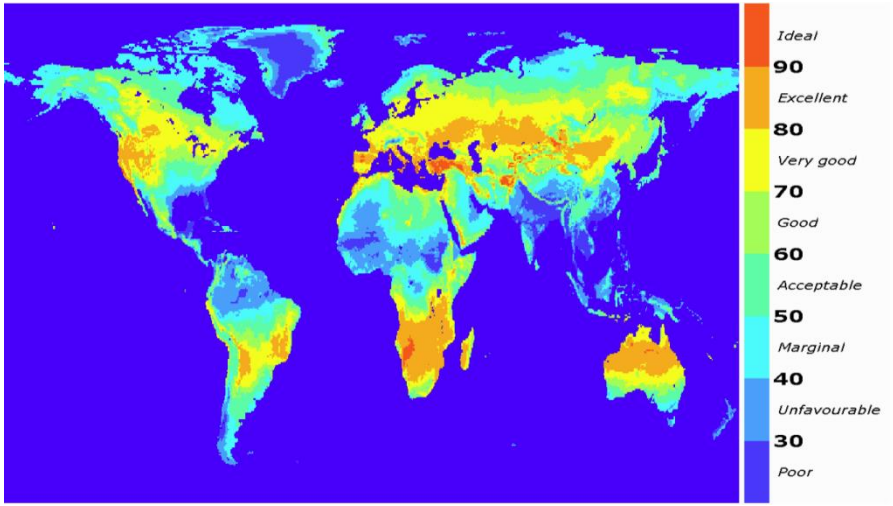
Background





Combined effect on tourism?

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