

부문별 기후변화 리스크 평가 및 적응

2022. 02. 22.

홍제우 부연구위원

한국환경연구원 국가기후변화적응센터



(CV) Hong Je-Woo

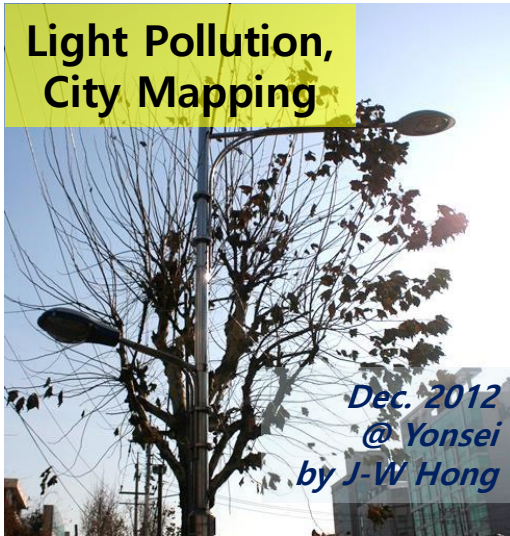
- 부연구위원, 한국환경연구원(KEI) 국가기후변화적응센터('20.1.~)
 - 국가 기후변화 적응대책 이행 지원 (2022)
 - 탄소중립·녹색성장 기후위기대응 기본계획
 - 제3차 국가 기후변화 적응대책 세부시행계획수립 & 이행점검
 - 중점관리지역(hotspot) 선정 및 모니터링
 - IPCC WGII 발간 대응
 - IPCC WGII 국내대응 주관기관 담당
 - MOTIVE(영향예측) & VESTAP(취약성평가), 한국기후변화평가보고서2020 (2020)
 - 한국일보 수요일컬럼(기후변화 설명서, '21.02.~'22.02.), 과학소년('22.01.~)
- 이학박사, 연세대학교 대기과학과('14.3.~'19.2.)
 - 우수학위논문상, 한국기상학회('19.10.)
 - 글로벌박사양성과정, 한국연구재단('15.3.~'18.2.)
- 공학석사, 서울대학교 생태조경·지역시스템공학부('11.3.~'14.2.)
- 공군학사장교, 교육특기, 강릉18전투비행단('07.3.~'10.6.)
- 이학사, 연세대학교 대기과학과('03.3.~'07.2.)
 - 기상기사('06.)



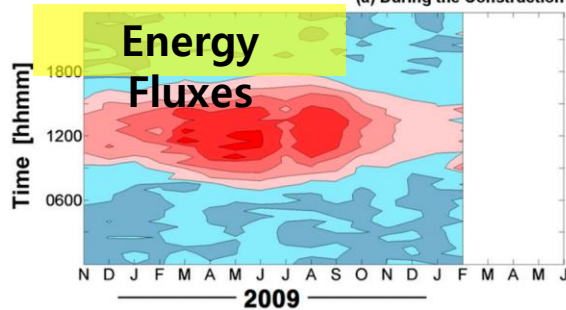
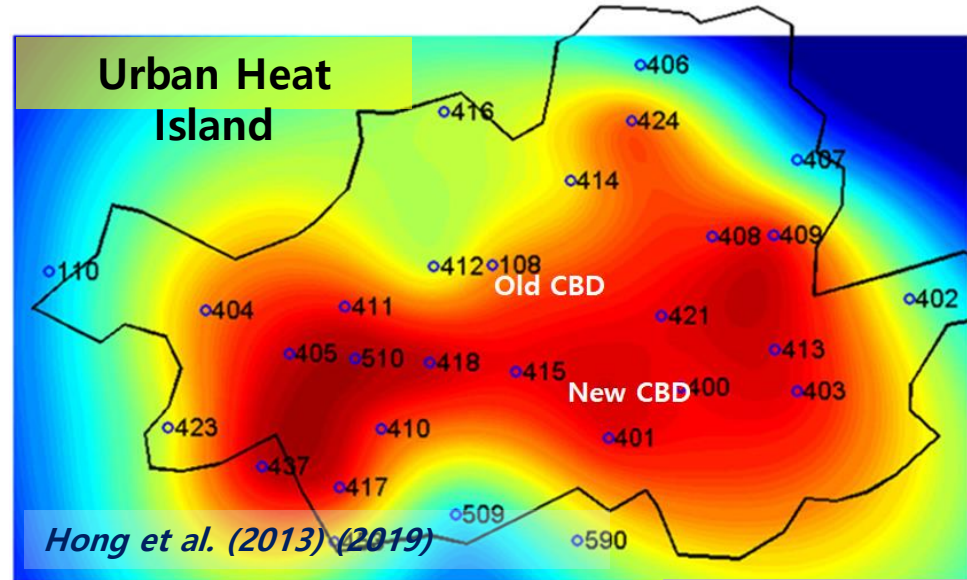
“우리 사는 땅” 1993, 최호철 작가



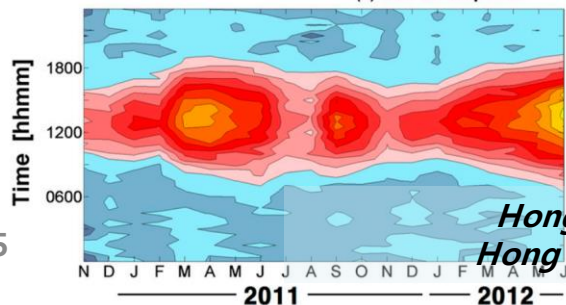
Research Topics



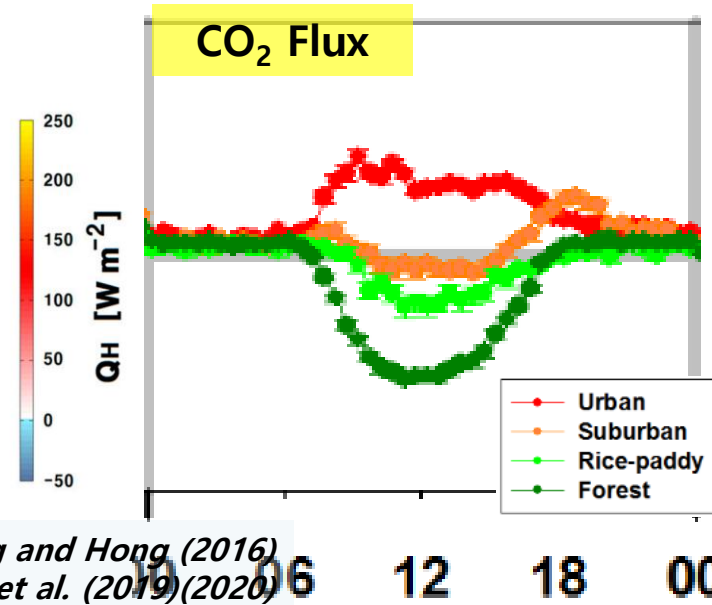
(a) During the Construction



(b) After Development

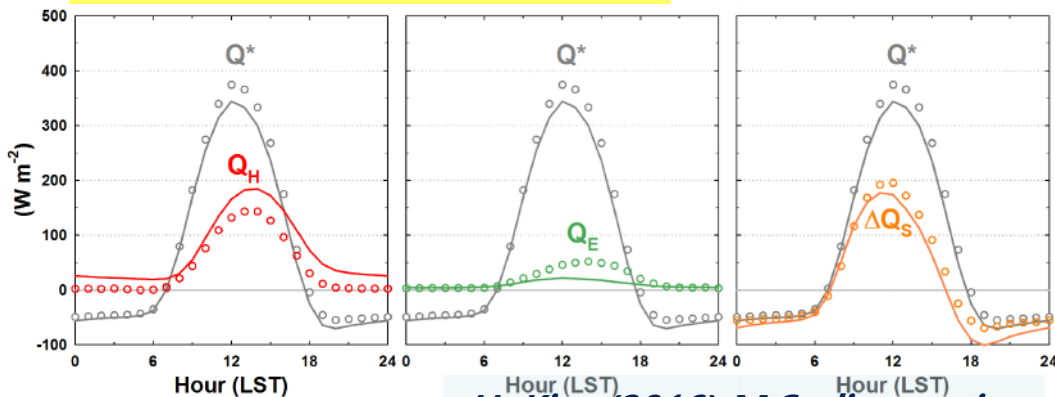


Hong and Hong (2016)
Hong et al. (2019) (2020)



Research Topics : *Collaborations*

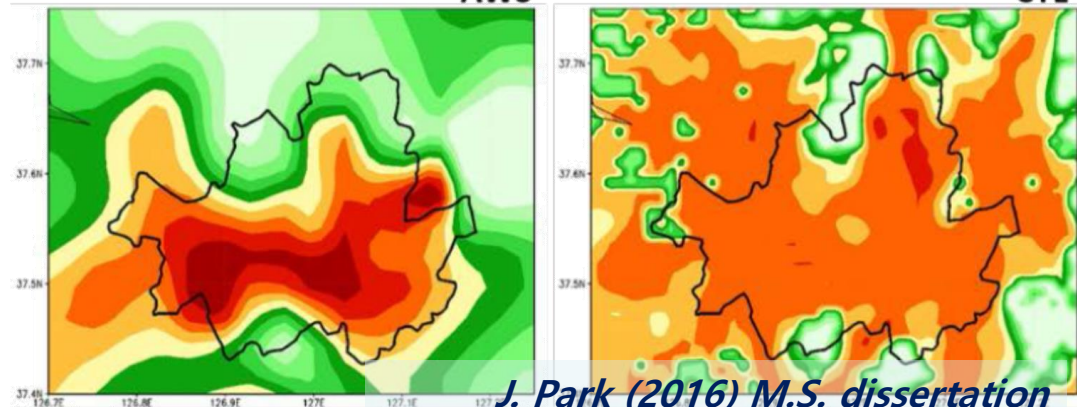
Land Surface Model (JULES)



H. Kim (2016) M.S. dissertation
Kim et al. (2019)

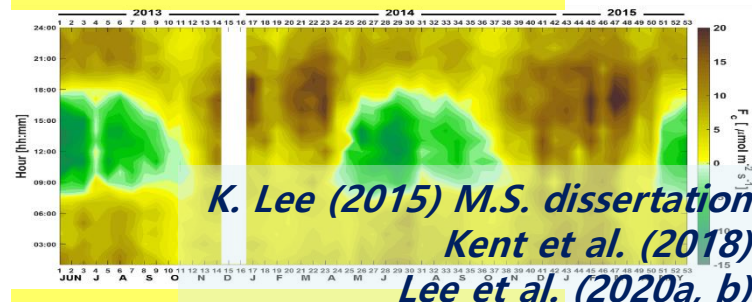
(Polar) WRF Model

AWS CTL



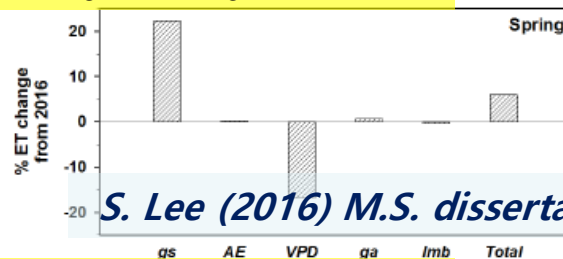
J. Park (2016) M.S. dissertation
U.-Y. Byun (2017) Ph.D. dissertation
Kim et al. (2020)

Seoul Forest Park



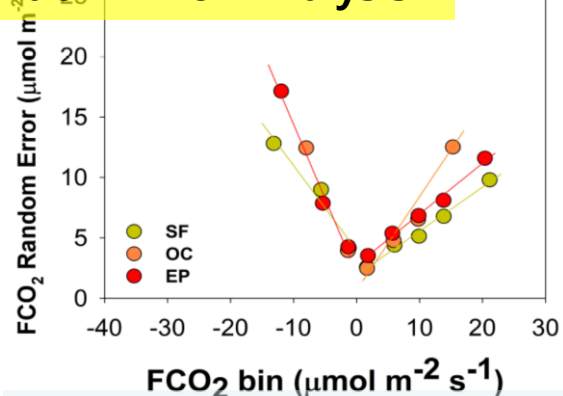
K. Lee (2015) M.S. dissertation
Kent et al. (2018)
Lee et al. (2020a, b)

ET analysis (Jeju forest)

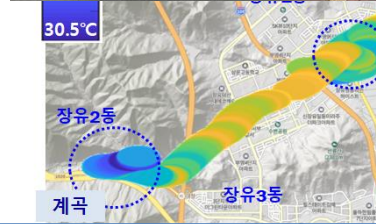
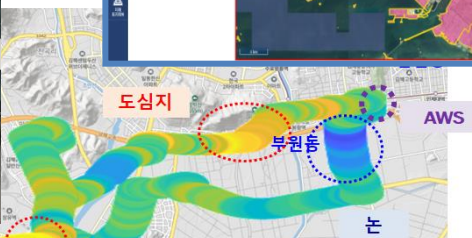
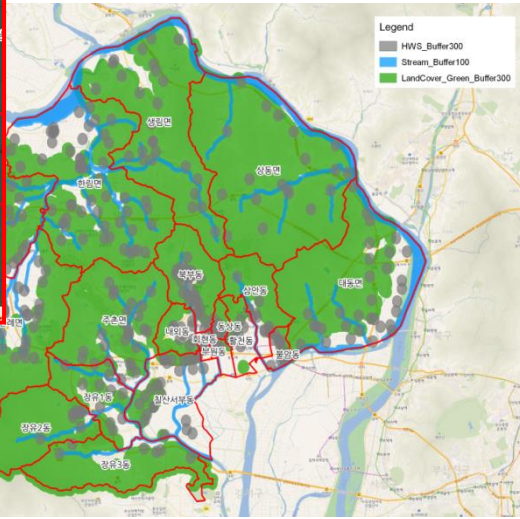
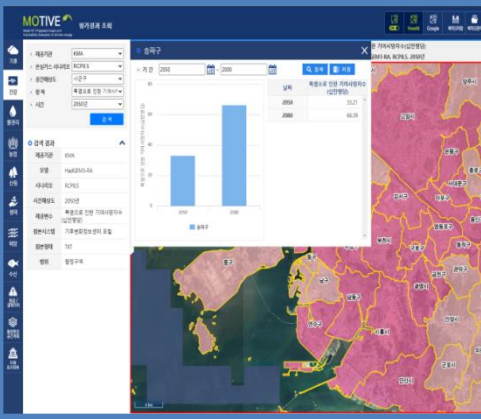
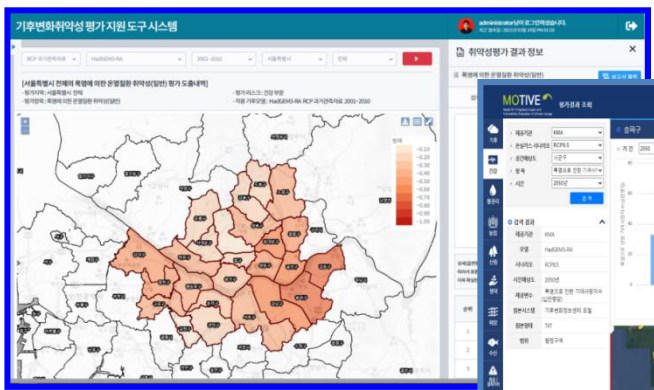


S. Lee (2016) M.S. dissertation

Random Error Analysis



S.-D. Lee (2017) M.S. dissertation



한국 기후변화 평가보고서 2020
- 기후변화 과학적 근거 -

한국일보 칼럼니스트

2021.09.07
경제위기가 오면 도시열섬이 약해진다?
홍제우 한국환경연구원 부연구위원

2021.09.06
대선이 끝나도 네거티브의 얼룩은 남는다
이상준 중앙대 명예교수-전 국회의원

1 빈곤층 감소와 사회안전망 강화	2 식량안보 및 지속가능한 농업 강화	3 건강하고 행복한 삶 보장	4 모두를 위한 양질의 교육	5 성평등 보장	6 건강하고 안전한 물관리
7 에너지의 친환경적 생산과 소비	8 좋은 일자리 확대와 경제성장	9 산업의 성장과 혁신 활성화 및 사회기반시설 구축	10 모든 종류의 불평등 해소	11 지속가능한 도시와 주거지 조성	12 지속가능한 생산과 소비
13 기후변화와 대응	14 원안상태에 보장	15 유상생태계 보양	16 평화·정의·포용	17 지구촌 협력 강화	

2020년 이상기후 보고서

메가트렌드 대응 '국토정보 TF' 회의 안

2021. 9. 3.

- 메가트렌드 대응 국토정보 TF 추진계획
- 메가트렌드 대응 국토교통 정책 혁신 추진방향
- 메가트렌드에 따른 공간정보의 미래 변화상

국토교통부 국토정보정책관

제3차 국가 기후변화 적응대책
I 2021 - 2025 I

IPCC 6차 보고서 심포지엄

정책결정자를 위한 기후과학 전망과 위기 대응 방안

2021년 8월 31일(화) 13:00~18:00
전경련회관 컨퍼런스센터 에메랄드홀 (유튜브 [YouTube](#) 생중계 진행)

오피니언 | 칼럼

- ('21.2) 기후변화 적응
- ('21.3) 2050탄소중립
- ('21.4) 기후변화 대응법
- ('21.5) 탄소중립
- ('21.6) 기후변화 회의론 - 가짜뉴스
- ('21.7) 폭염
- ('21.8) 탄소중립 생활실천서
- ('21.9) 도시 열섬
- ('21.10) IPCC AR6 WG1
- ('21.11) 기후변화 대응은 손해가 아니다
- ('21.12) 탄소중립 1주년
- ('22.1) 메탄
- ('22.2) 기후변화 불확실성



기후변화 설명서

홍제우 한국환경연구원 부연구위원

구독 +



Contents

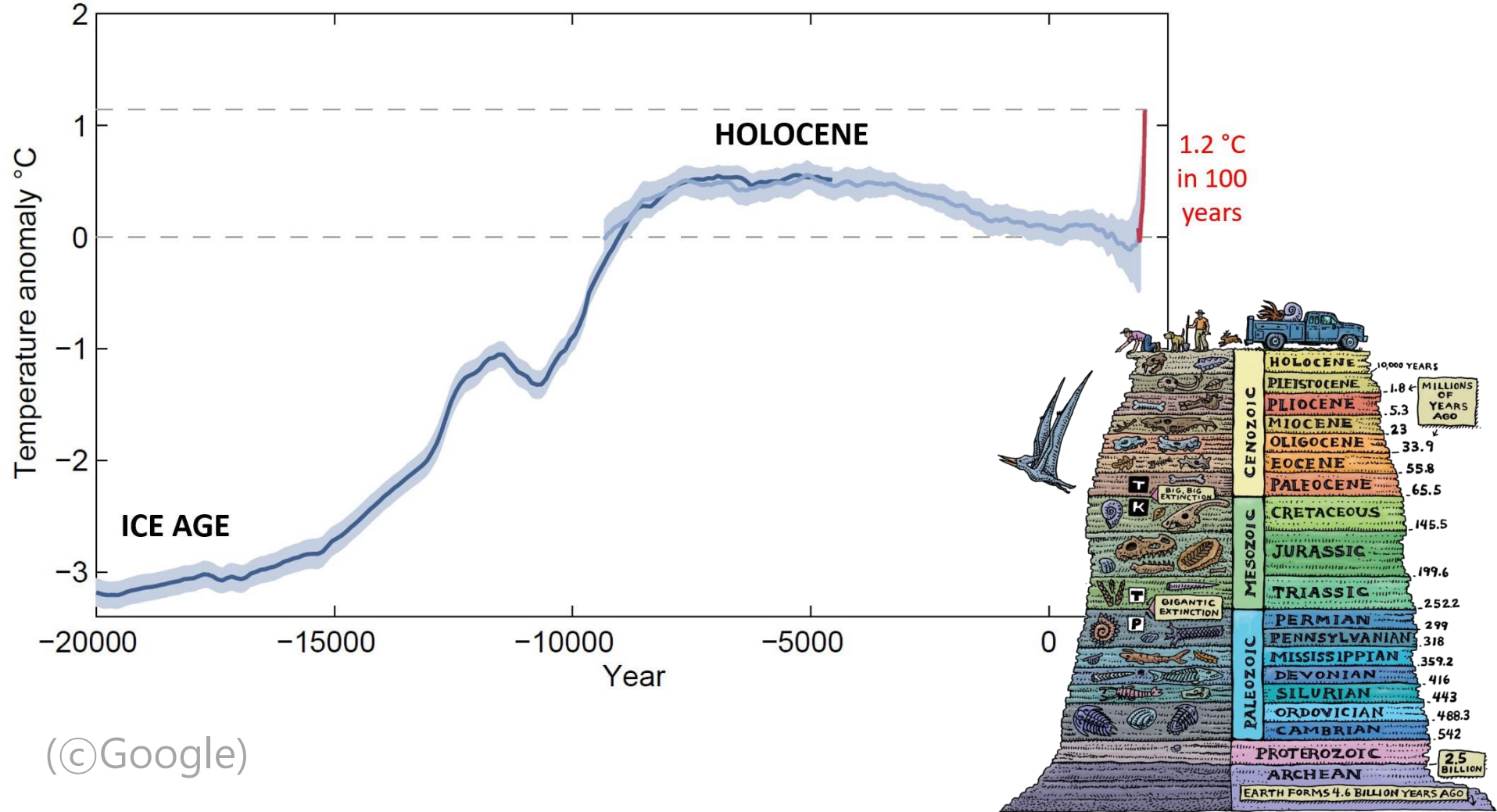
1. Overview of Climate Change
2. Key Concepts for Adaptation
3. Adaptation Policy in Korea
4. Declaration Ethical Principles in Climate Change
5. Discussion

1. Overview of Climate Change

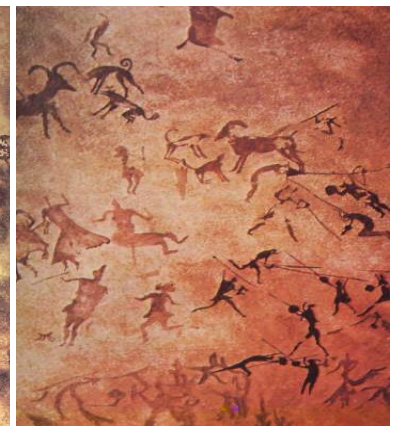


(©pixabay)

Anthropocene through the Adaptation

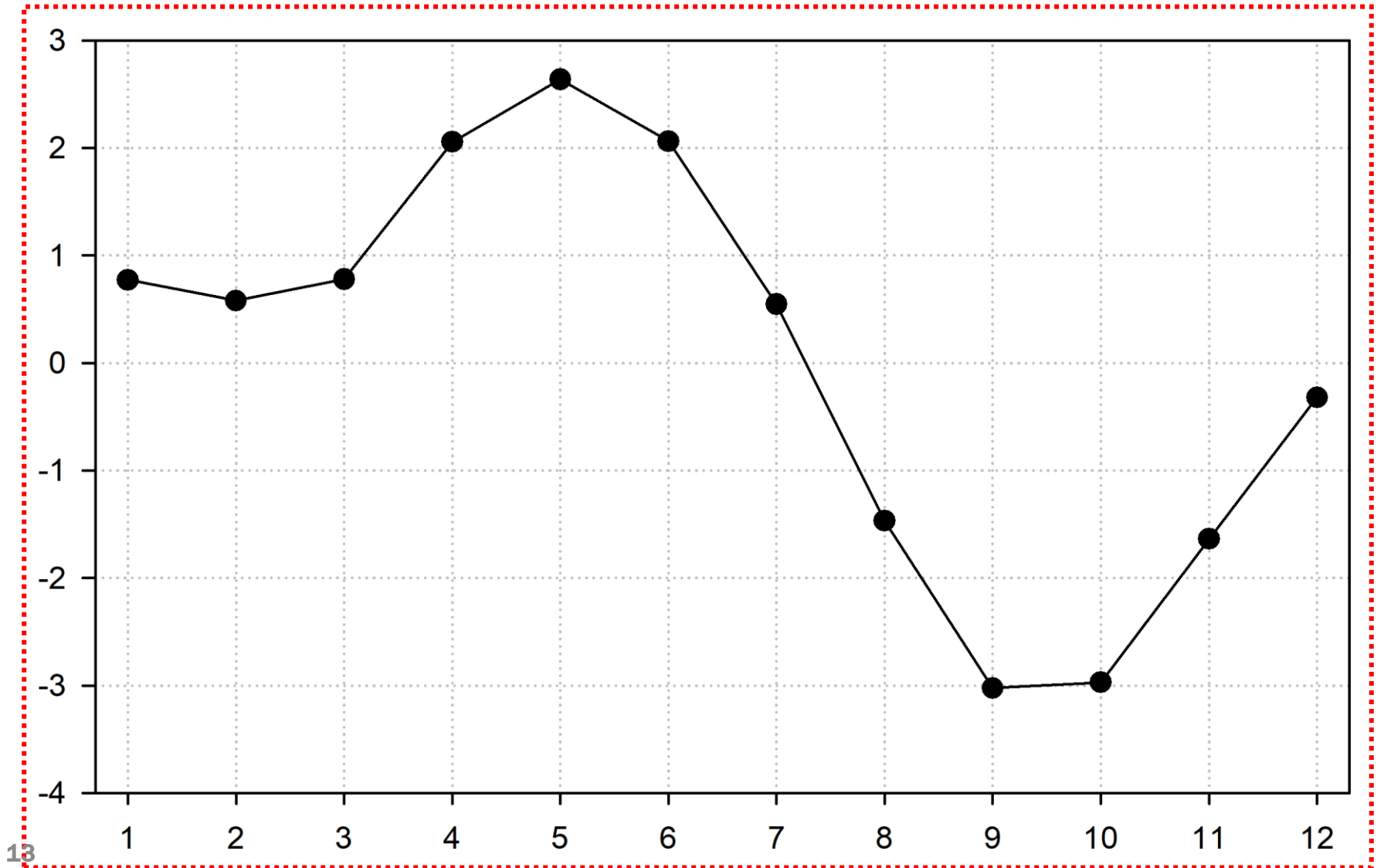


Green Sahara

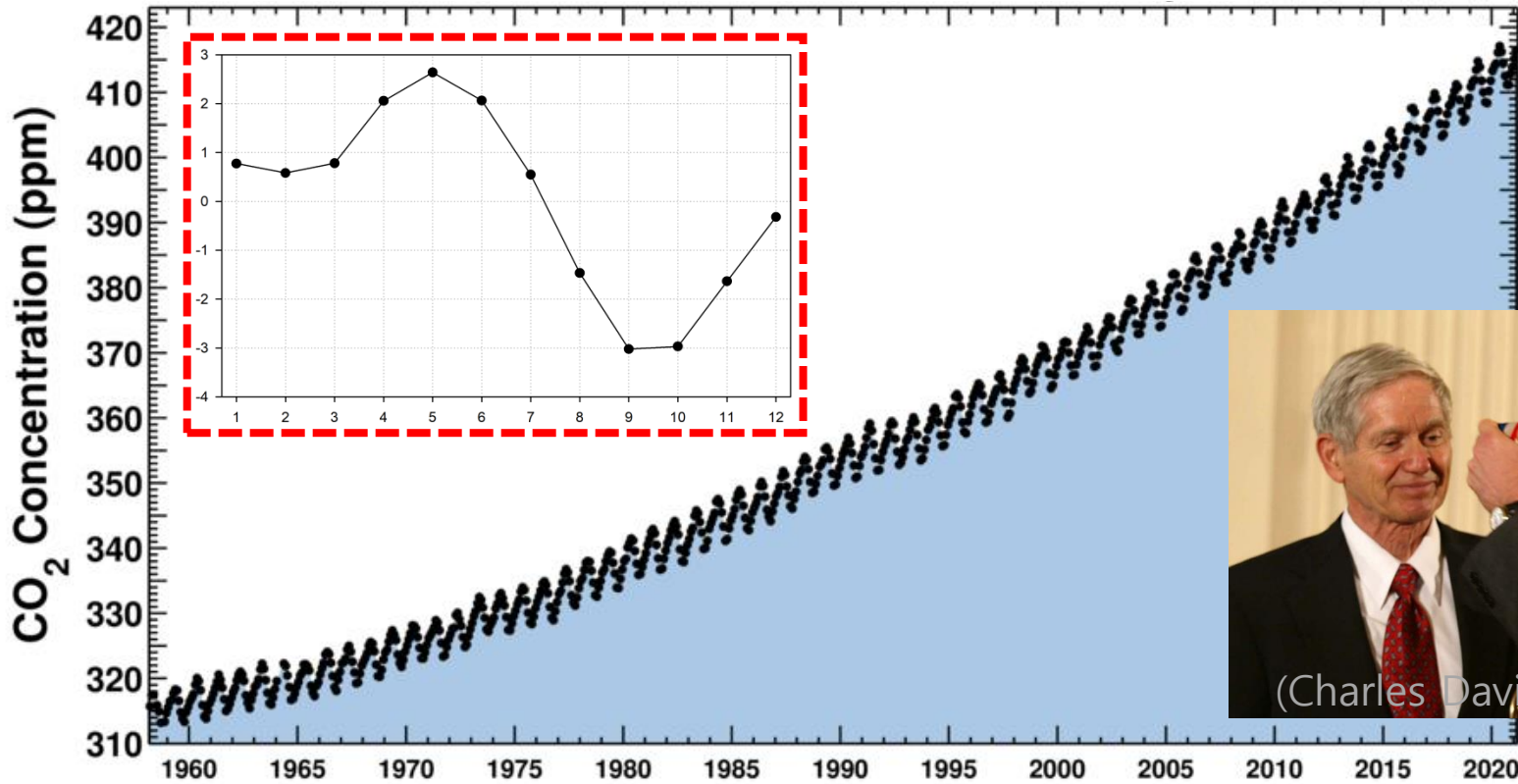


Henri Lhote
(1959, Tassili frescoes)

What it looks like?



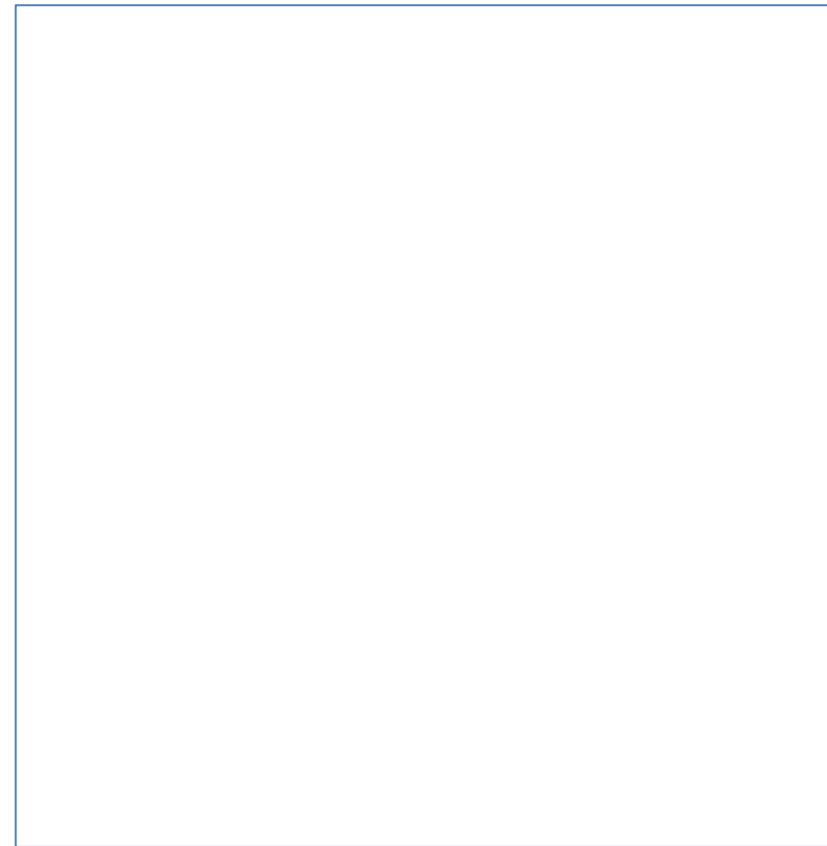
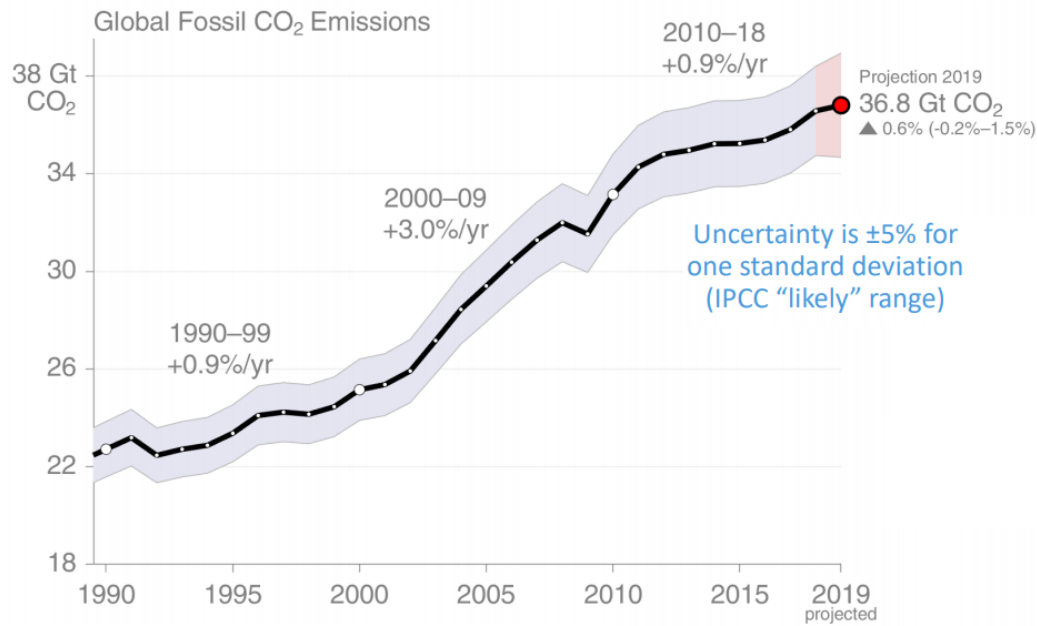
Keeling Curve



Why his CO₂ represents global trends?

Human-induced Climate Change

- By the people...

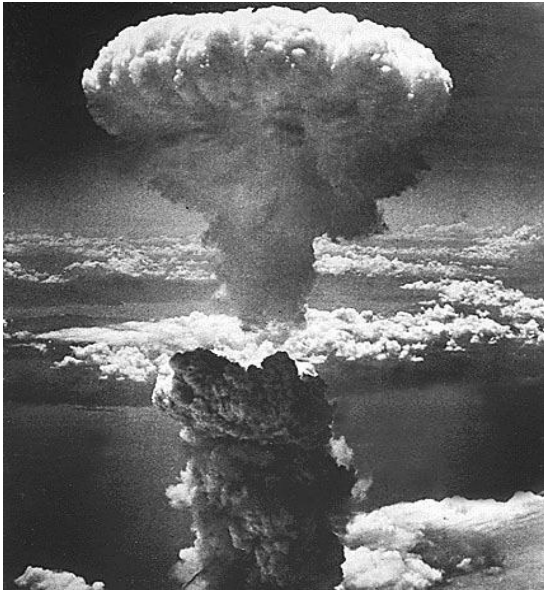


(Global Carbon Project)

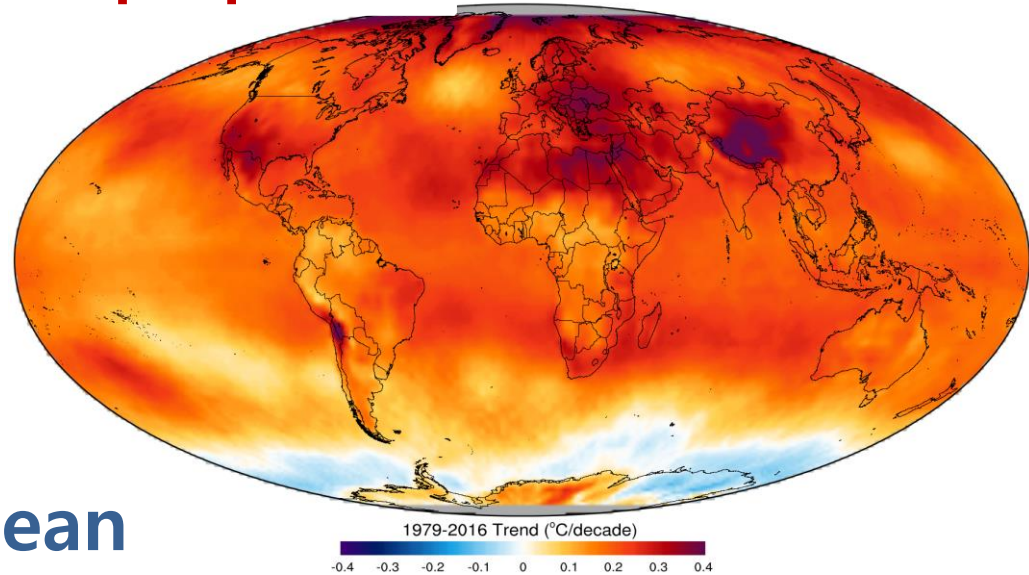
Greenhouse Effect

= 4 atom-bombs a second

= 345,500 atom-bombs a day



troposphere

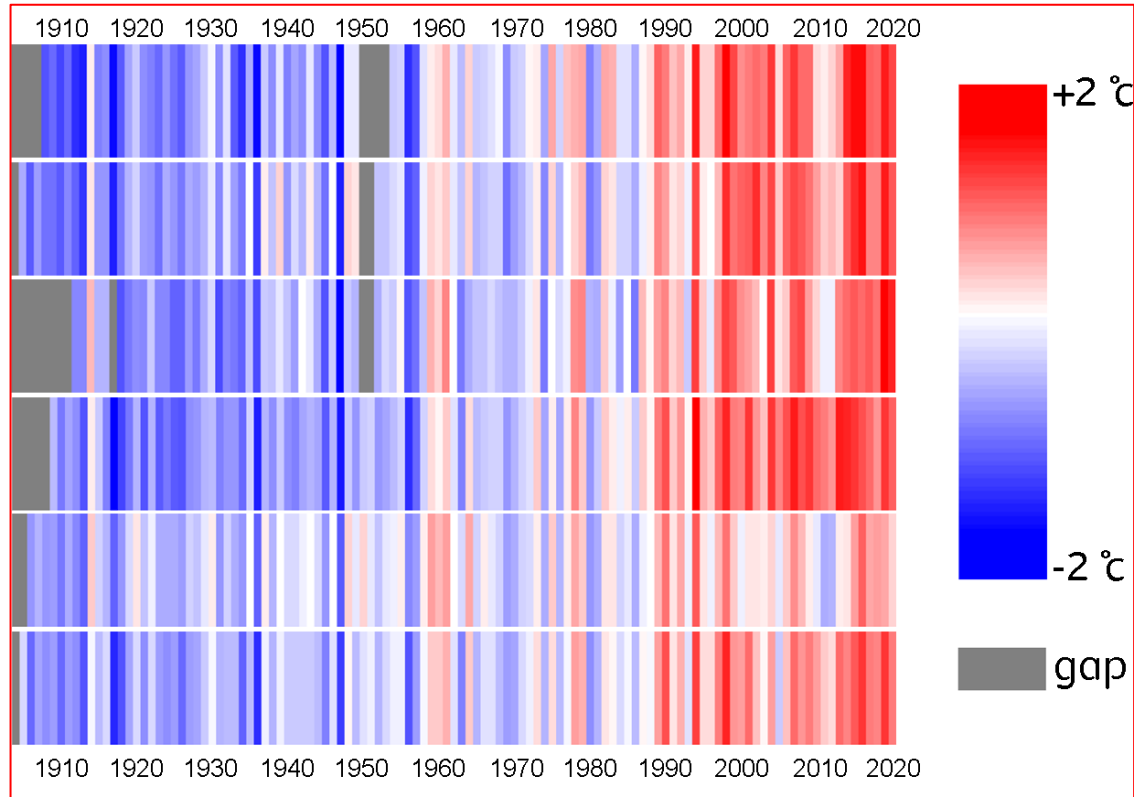


90% of heat to the Ocean

Only ~2% to the Atmosphere



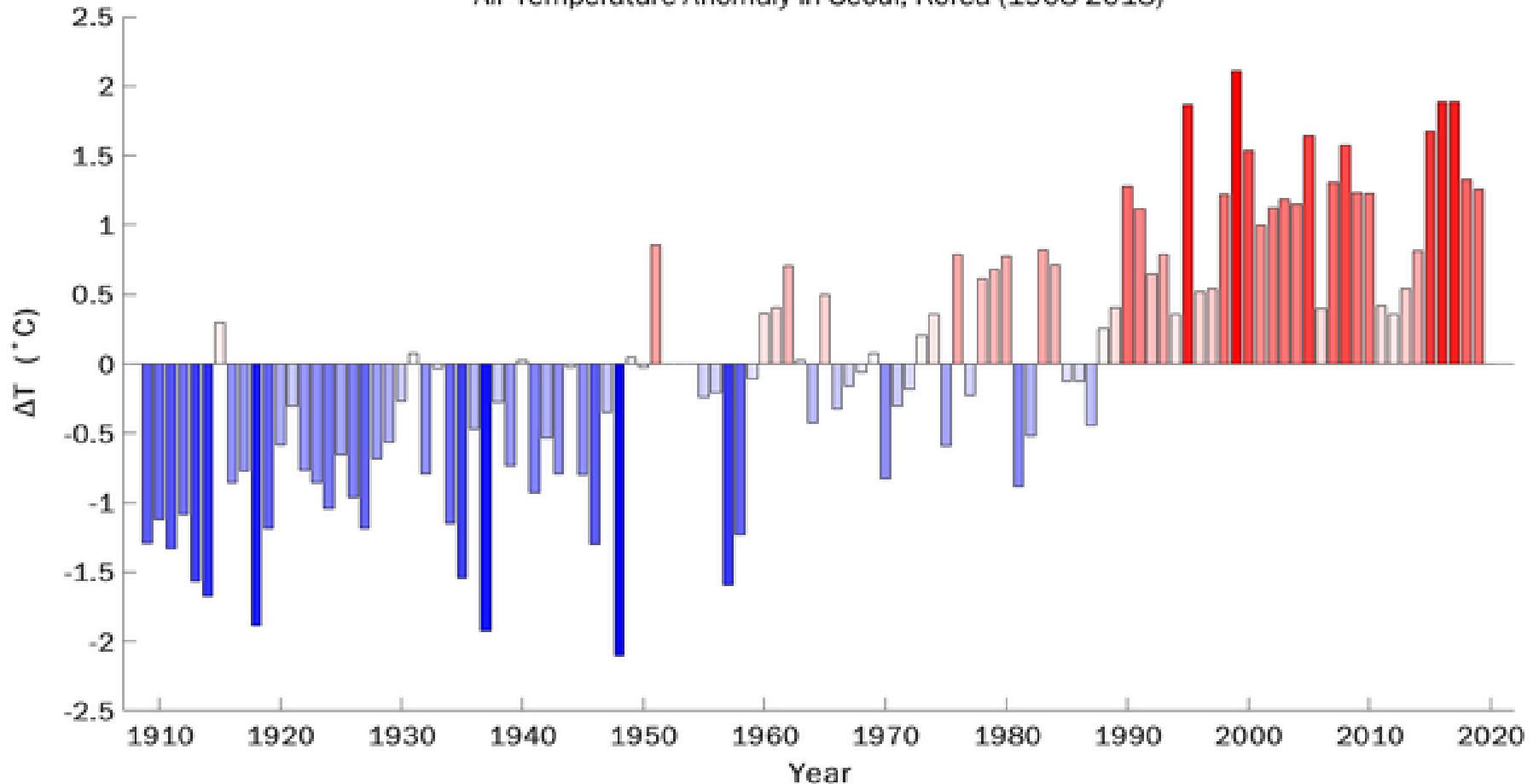
Slow-onset Process



Long-term trends in Korea

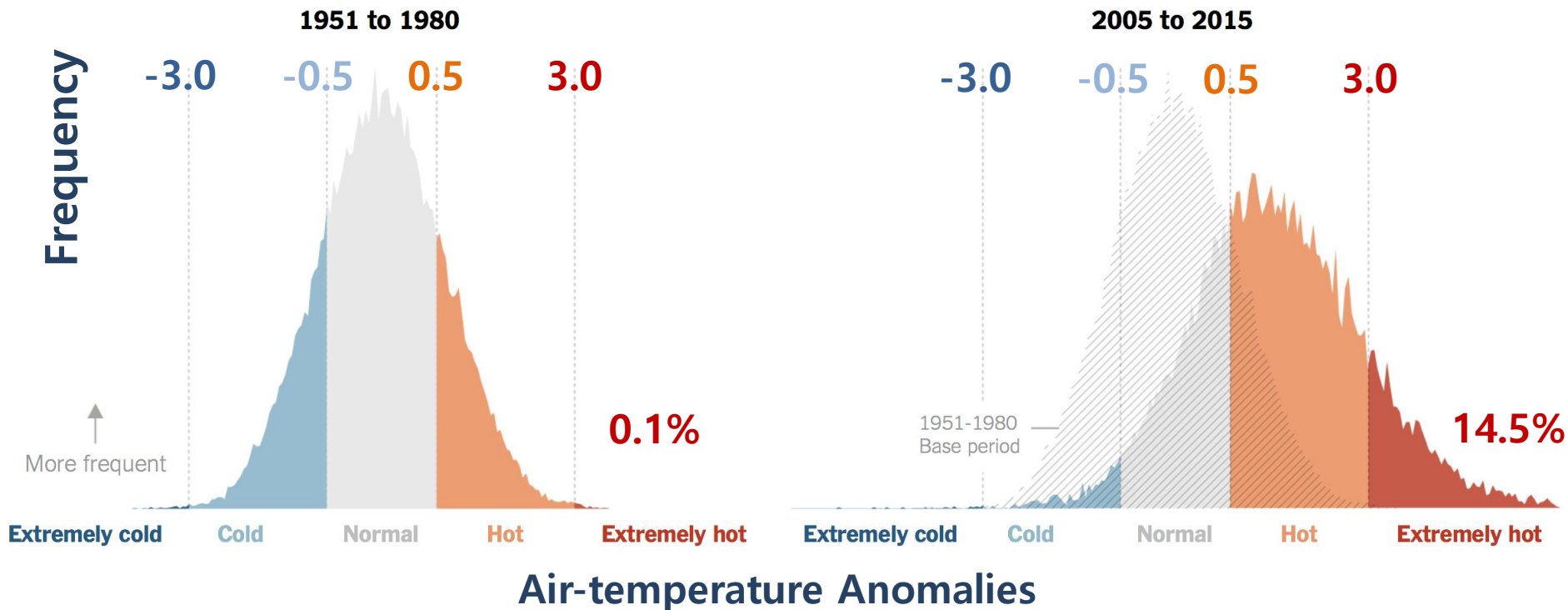
Seoul, Korea

Air-Temperature Anomaly in Seoul, Korea (1908-2018)



Low-likelihood, High-impact Outcomes

NH in summer (JJA)

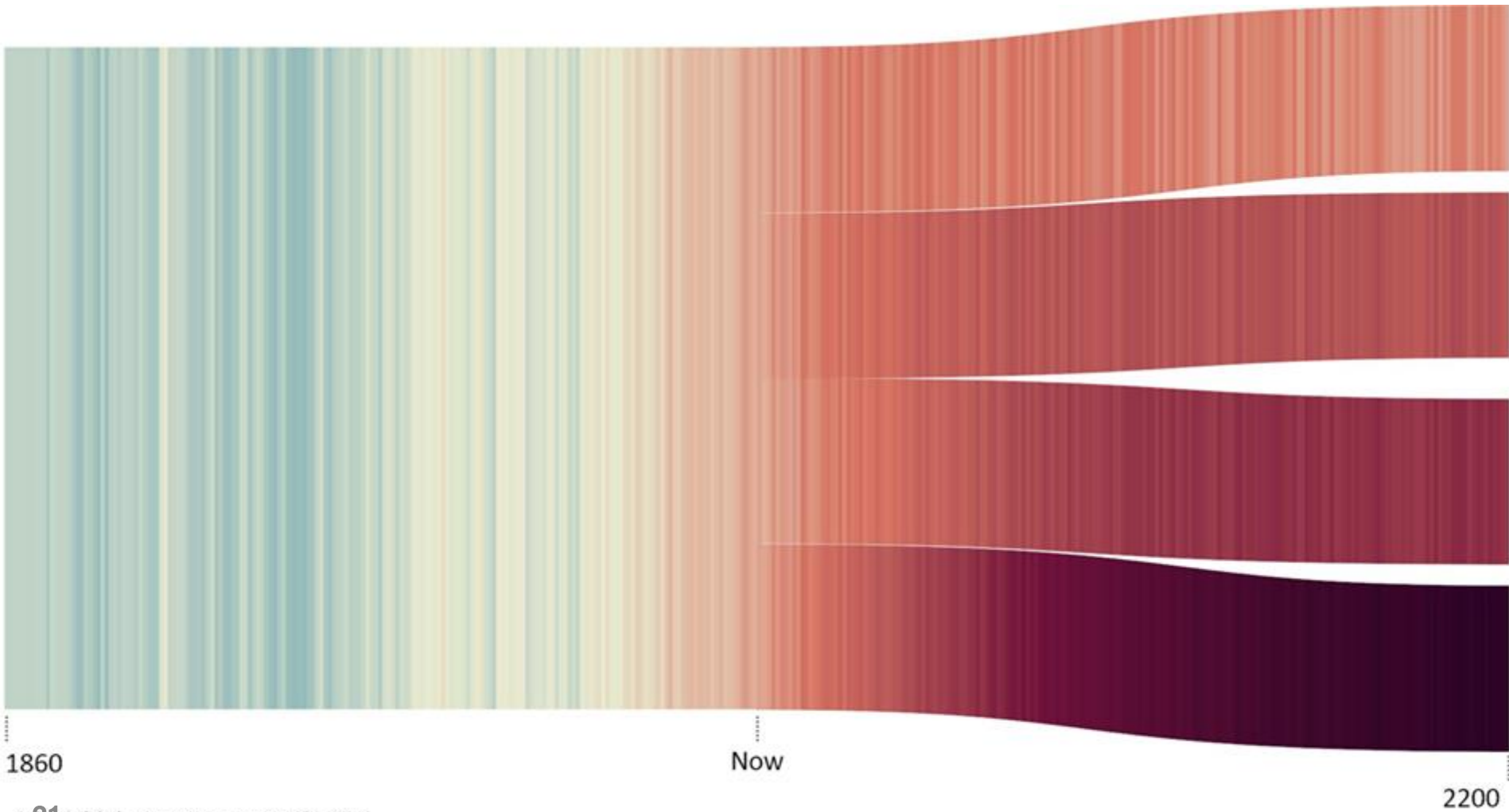


(Columbia University Earth Institute)

조천호 교수님 발표 중

Our Future ?

조천호 교수님 발표 중

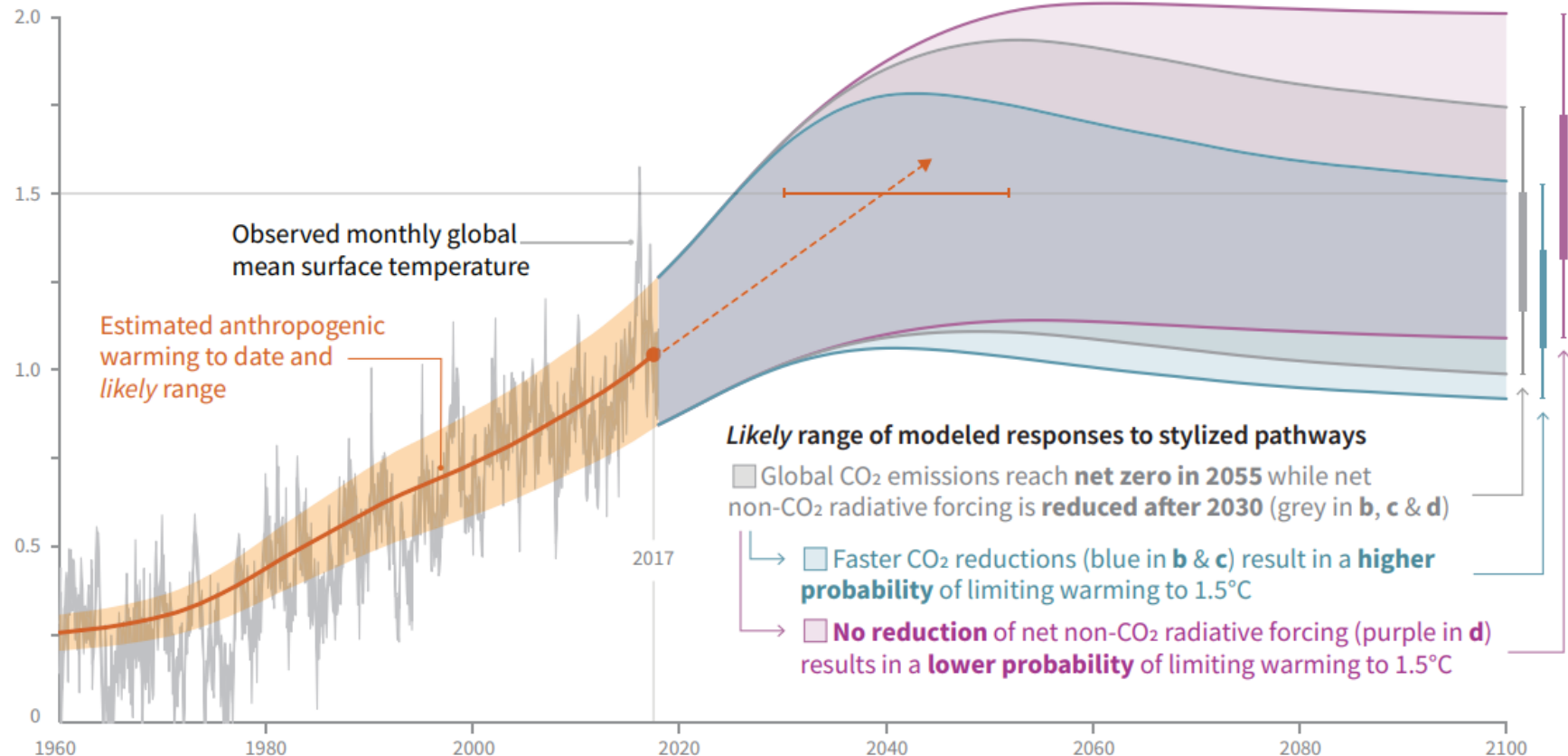


2050 Carbon Neutral

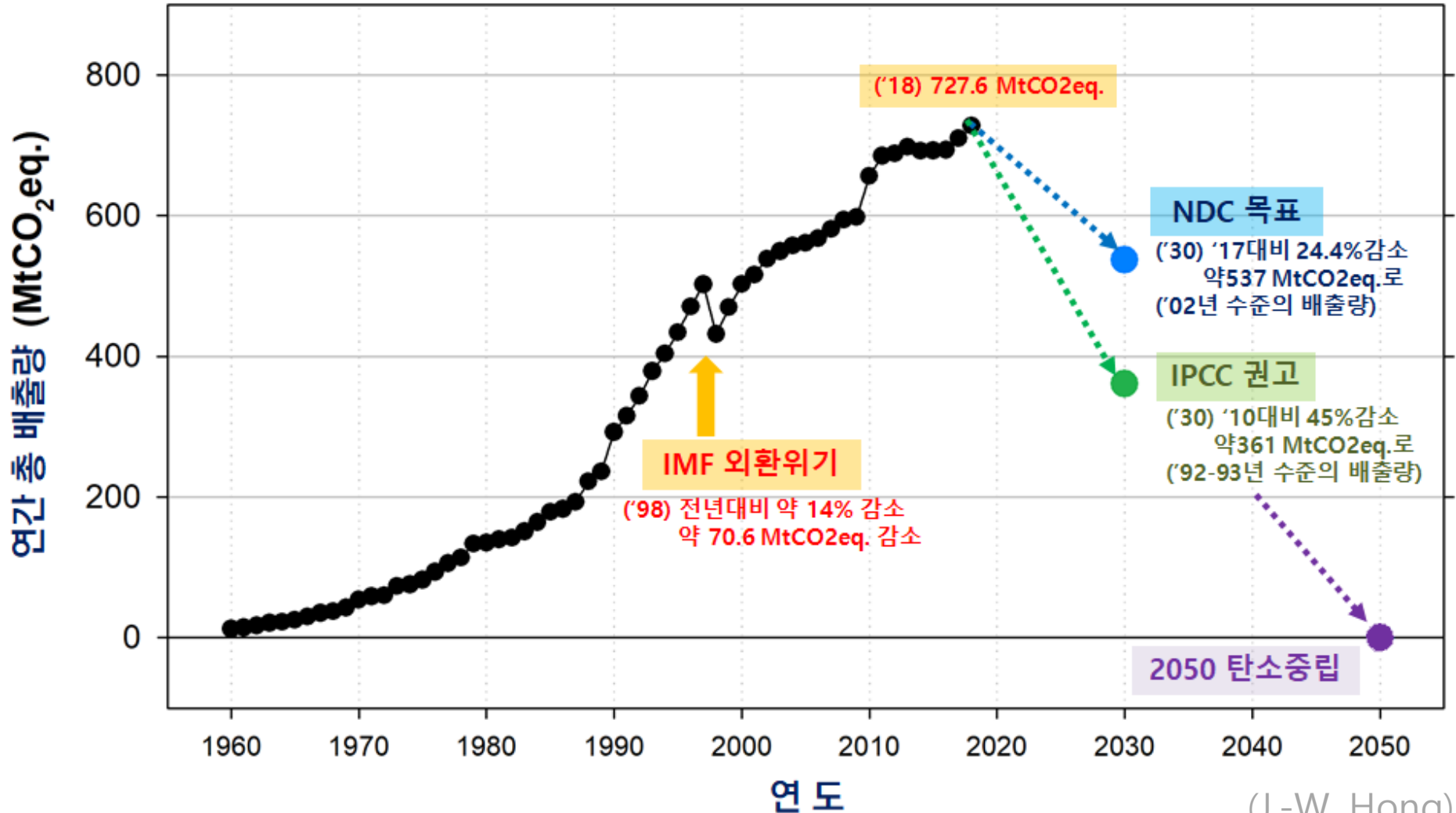
- We should include non-CO₂.

(IPCC SR15, 2018)

Global warming relative to 1850-1900 (°C)

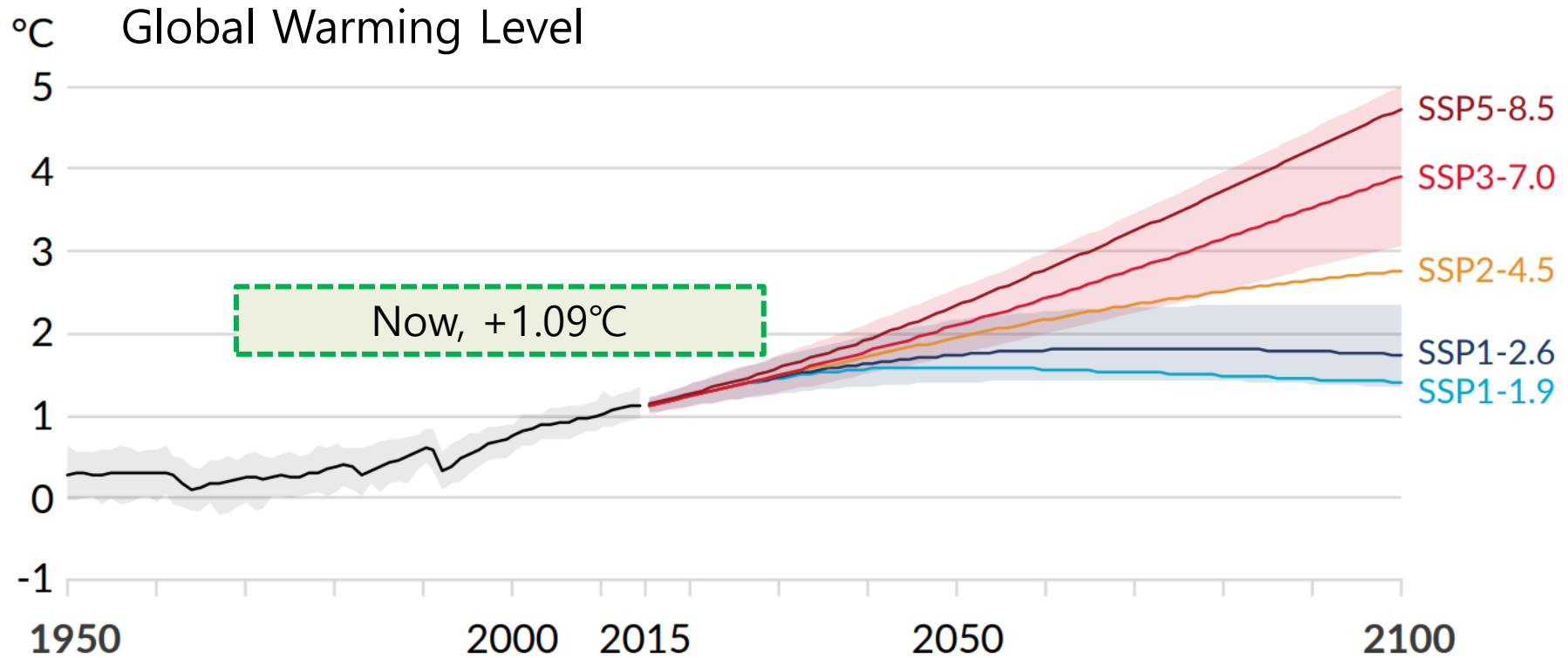


Mitigation ...



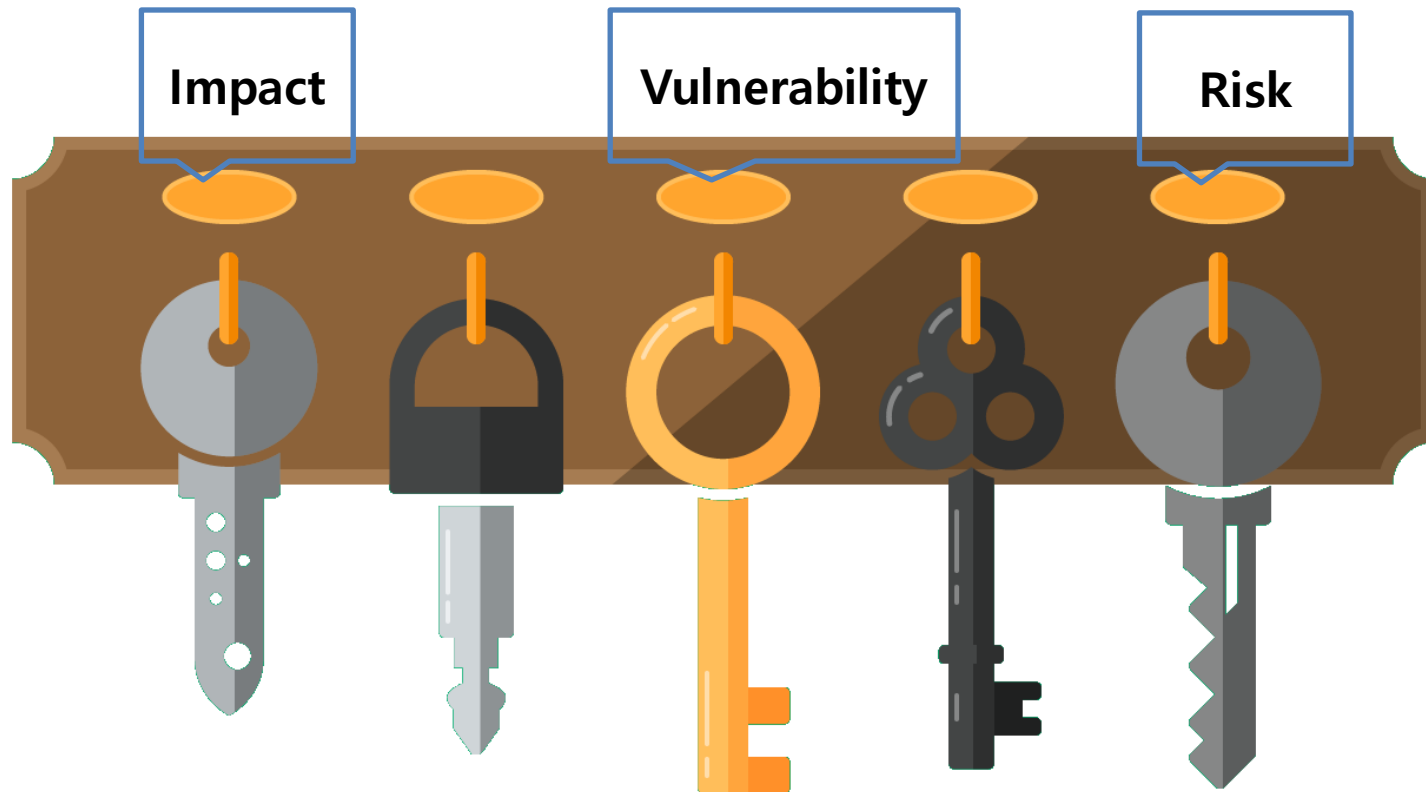
We need Adaptation !

- We will touch 1.5°C soon (2021-2040).



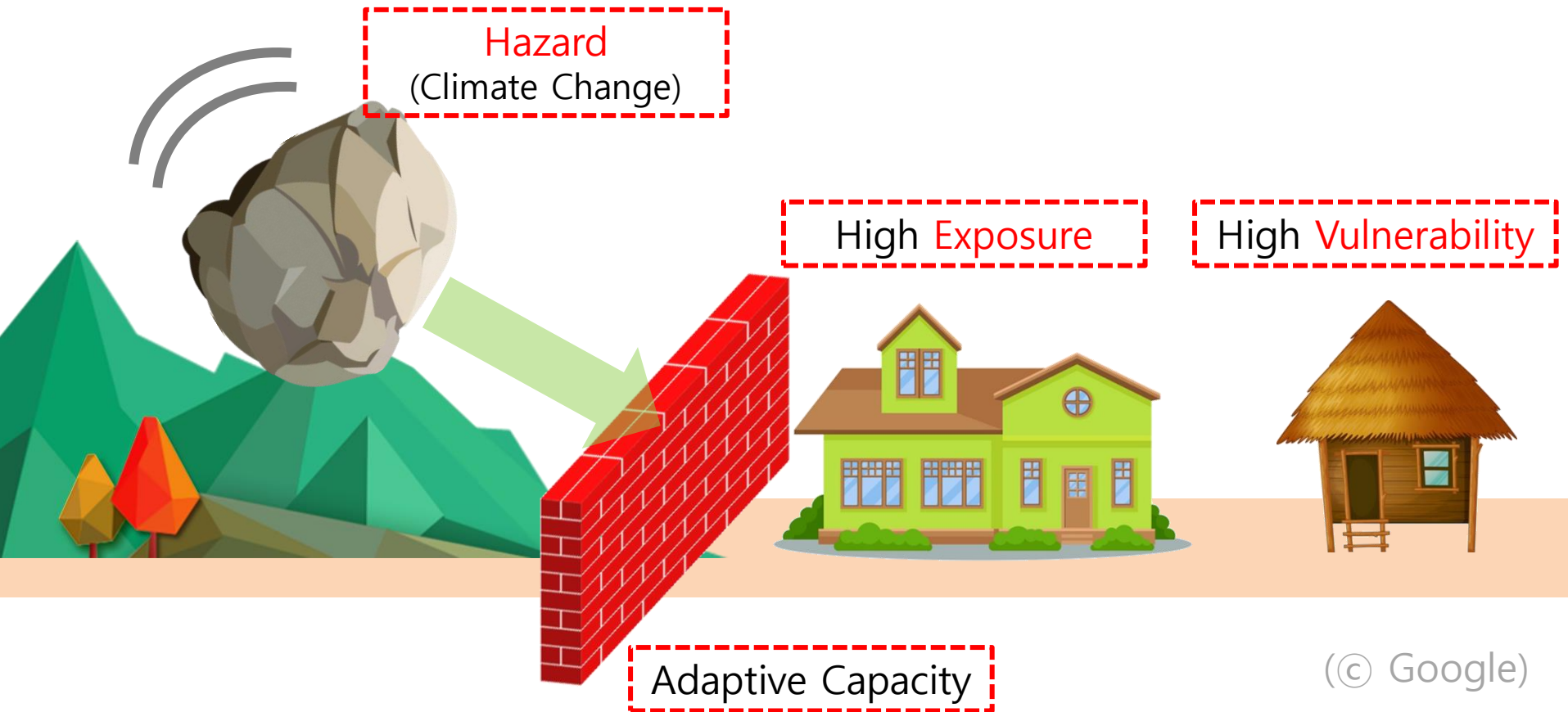
(IPCC AR6 WG1, 2021)

2. Key Concepts for Adaptation



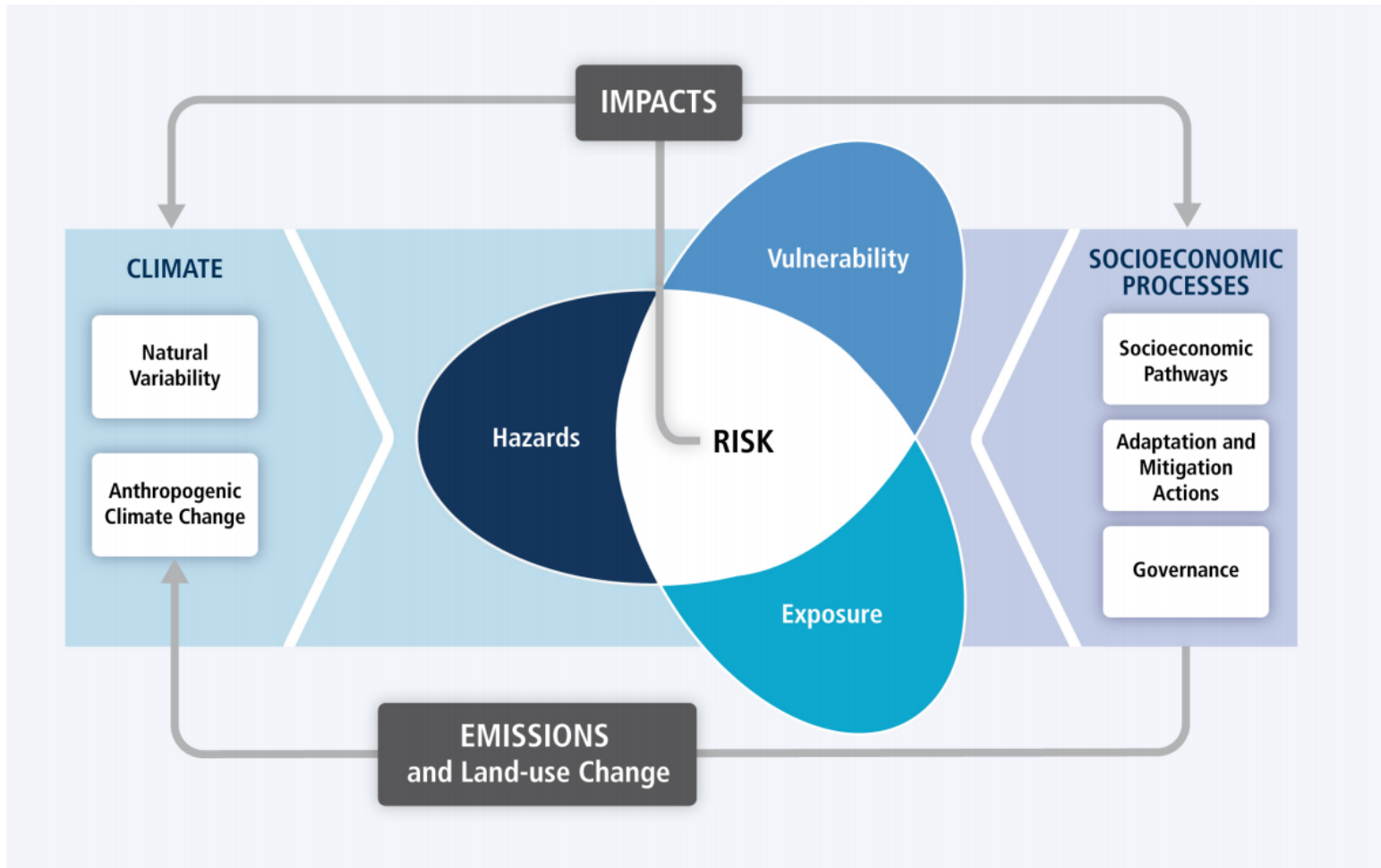
(© Google)

Build Adaptation Capacity



(© Google)

Climate Risk



(IPCC AR5 WG2, 2014)

Gap makes Adverse Impacts

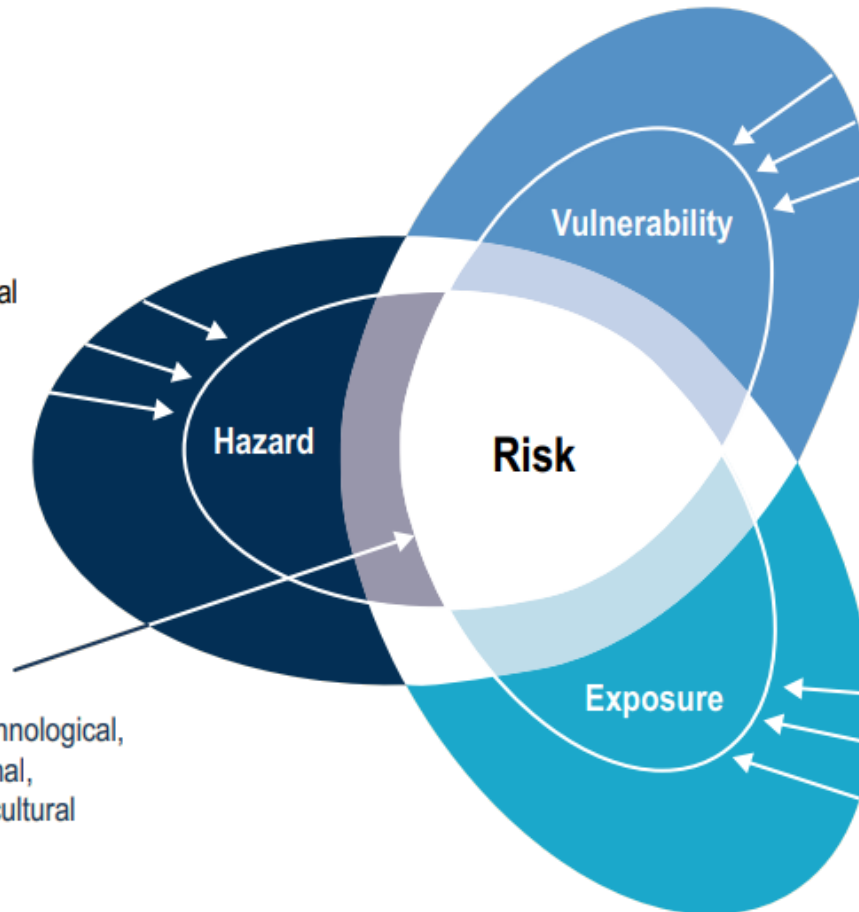
Actions to reduce Hazards

Examples include:

- Ecosystem-based measures to reduce coastal flooding
- Mangroves to alleviate coastal storm energy
- Water reservoirs to buffer low-flows and water scarcity

Limits to Adaptation

- E.g. physical, ecological, technological, economic, political, institutional, psychological, and/or socio-cultural



Actions to reduce Vulnerability

Examples include:

- Social protection
- Livelihood diversification
- Insurance solutions
- Hazard-proof housing and infrastructure

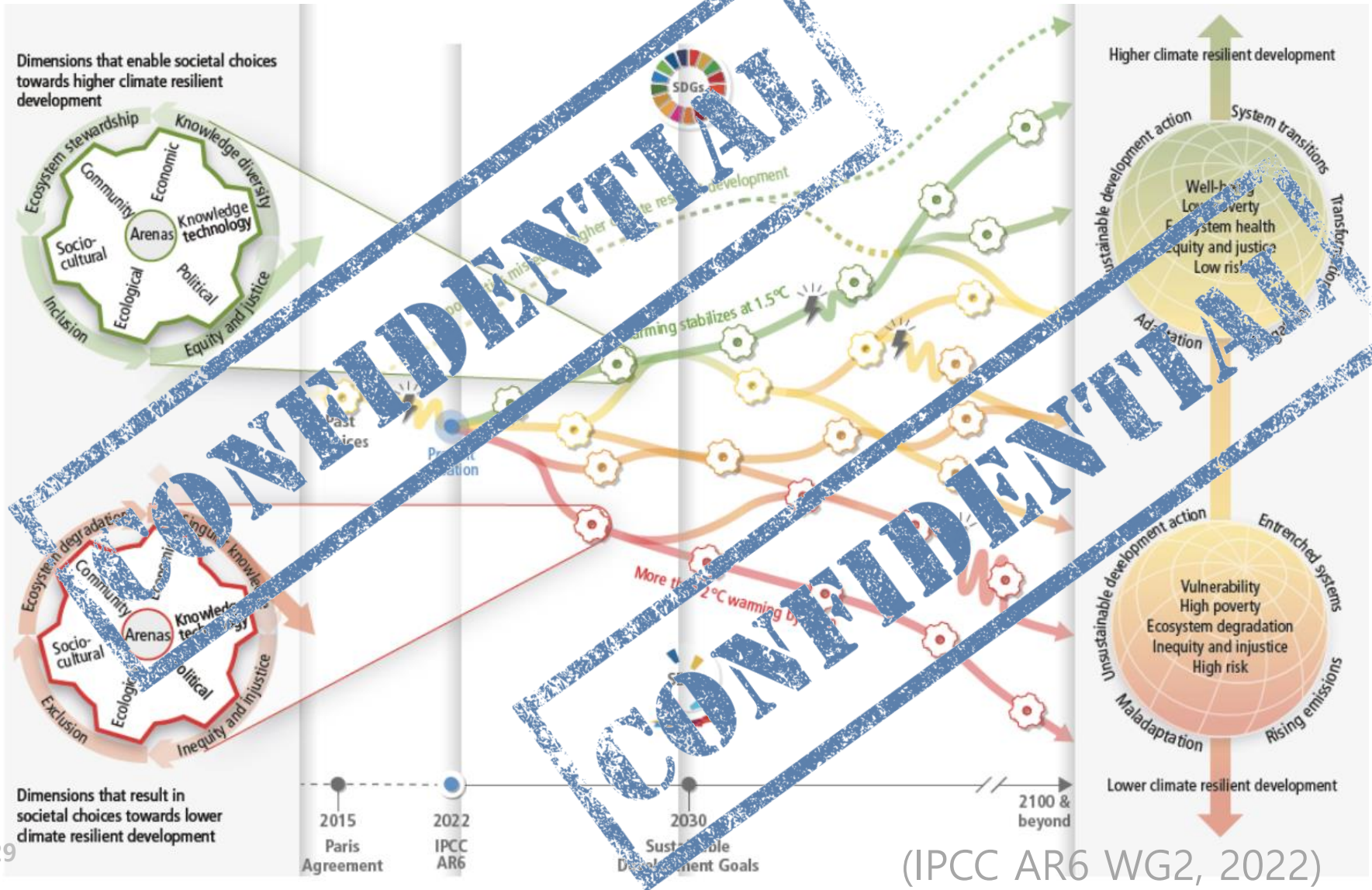
Actions to reduce Exposure

Examples include:

- Coastal retreat and resettlement
- Risk sensitive land use planning
- Early warning systems and evacuations

(IPCC AR6 SROCC, 2019)

Pathways to Climate Resilient Development

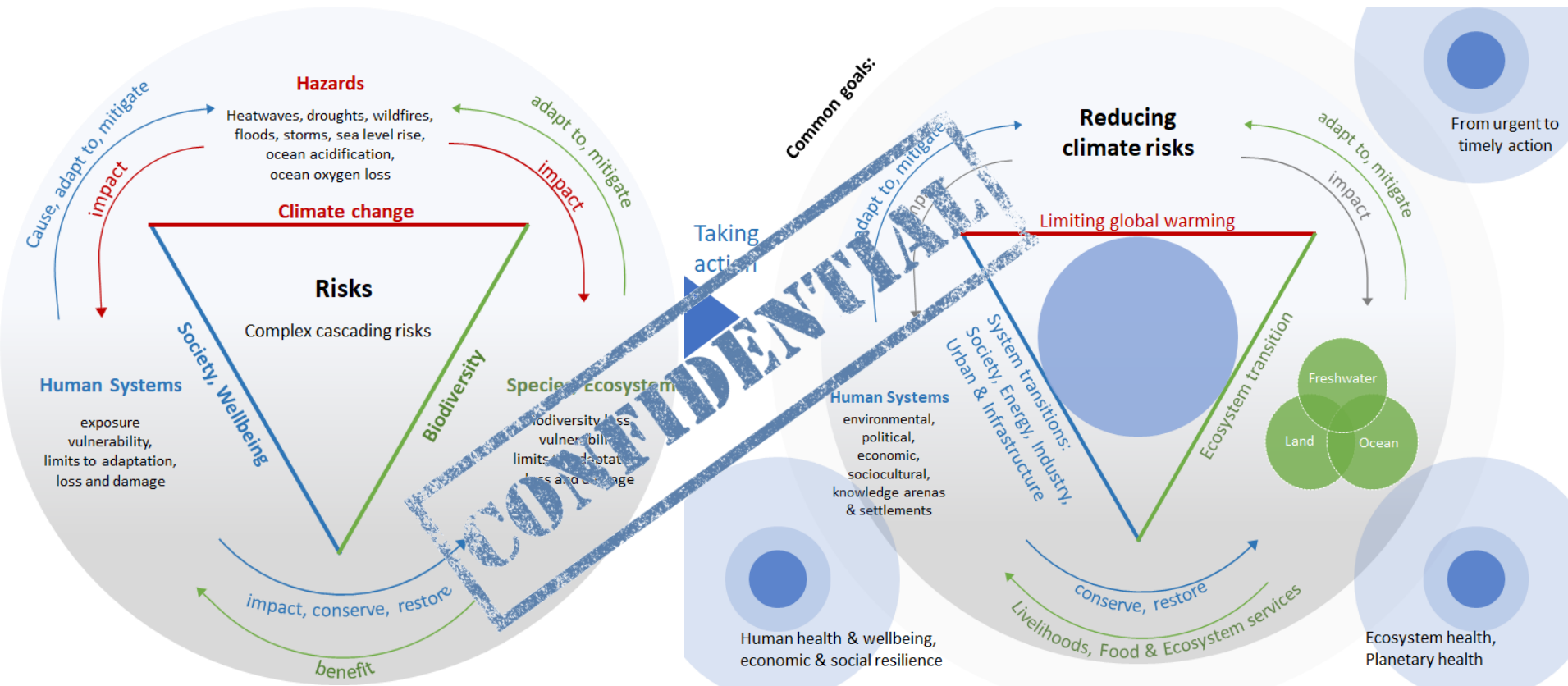


Mind the Gap !

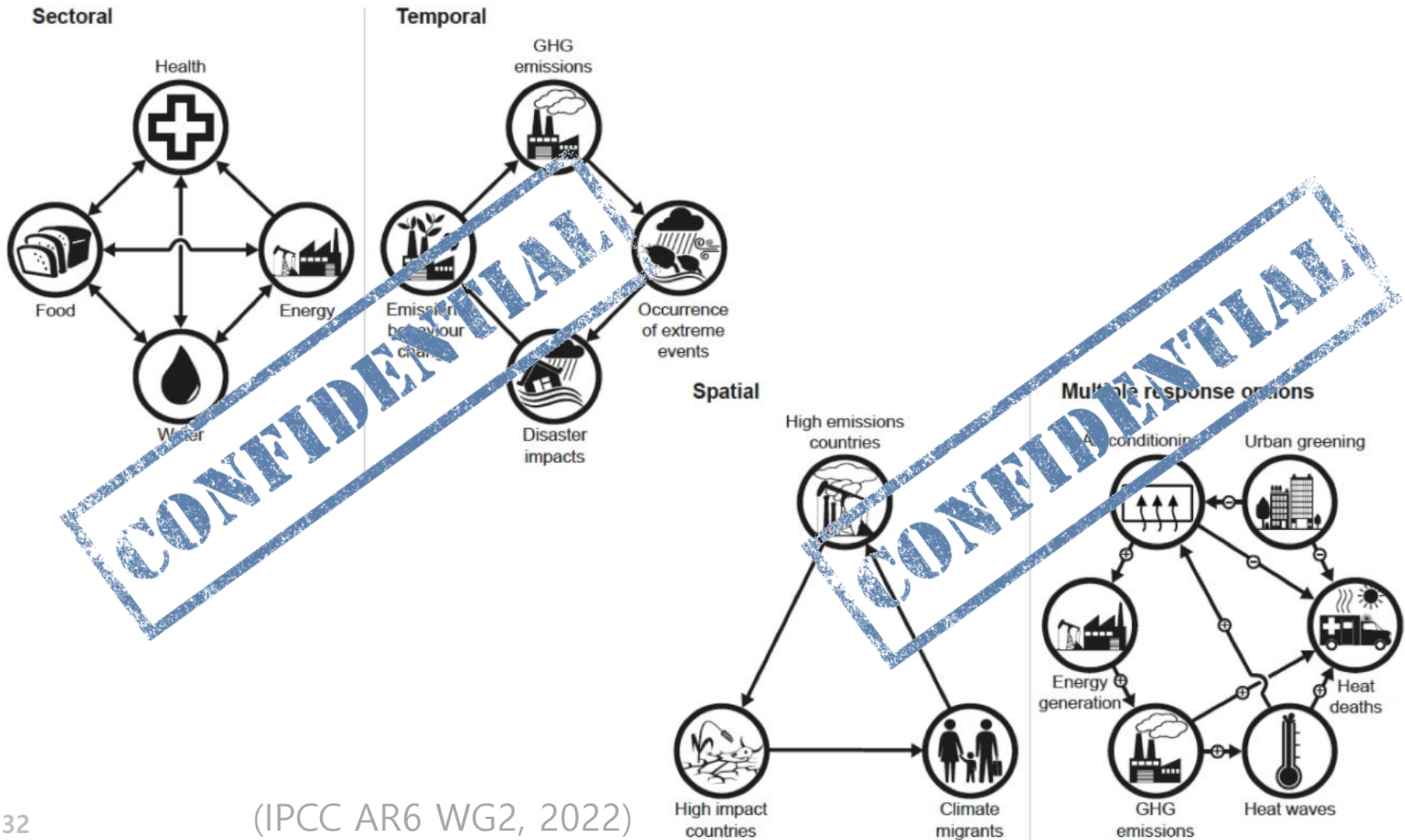


MIND THE GAP

Climate Risks

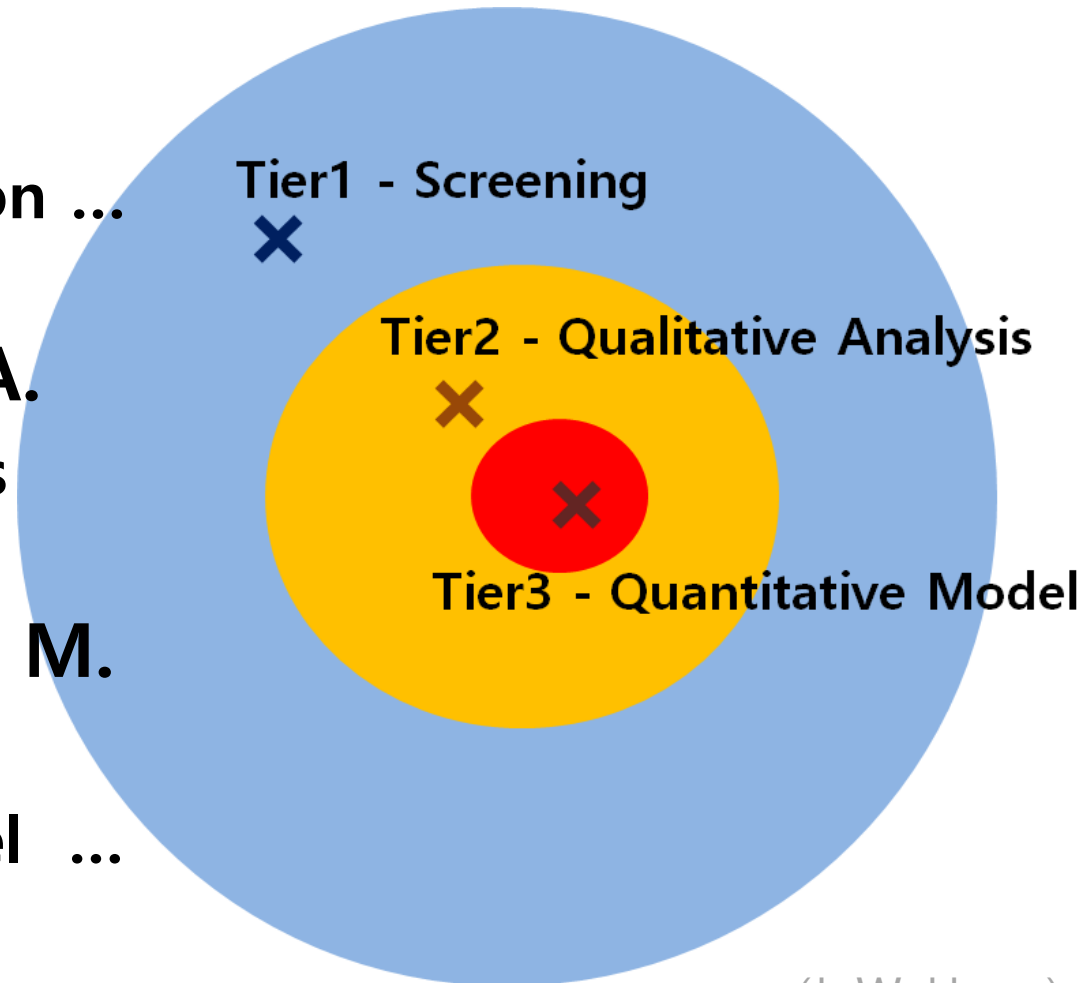


Complex, Compound, Cascading



Risk Assessment

- **Tier1 – Screening**
 - records, data, opinion ...
- **Tier2 – Qualitative A.**
 - index-based analysis
- **Tier3 – Quantitative M.**
 - empirical model
 - process based model ...



(J.-W. Hong)

Risk Management Framework

- **① Identification**
 - list-up
- **② Selection**
 - choice and concentration
- **③ Planning**
 - NAP, LGAP ...
- **④ MRE (M&E)**
 - perform, monitoring, evaluation, reporting

3. Adaptation Policy in Korea



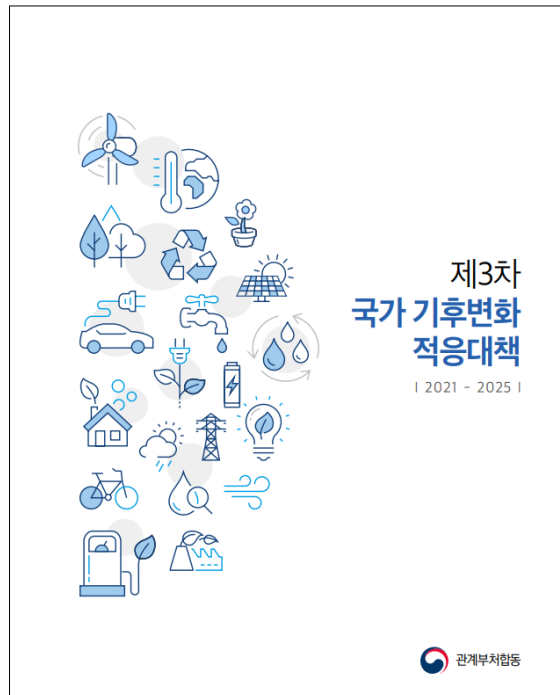
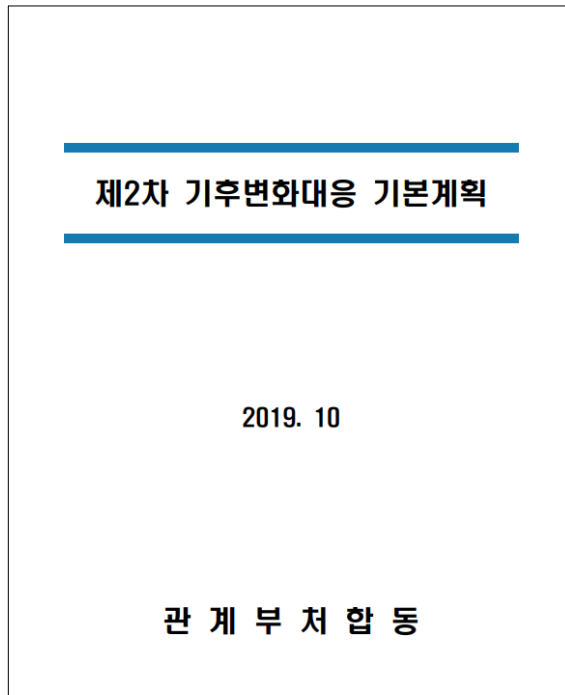
Institution

- **Carbon Neutral Green Growth Basic Law**
 - enact: 2021.09.
 - enforce: 2022.03.



Institution (2)

- Master Plan for Climate Action (20-yr)
- NAP, LGAP (5-yr)
- Climate Change Impact Assessment



Climate Scenarios

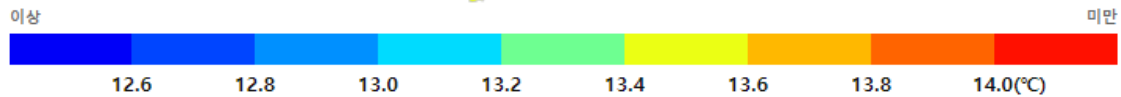
Starting Point !!

평균기온, RCP8.5, 충청북도, 2021~2100년(연)

행정구역을 더블클릭하면 해당 지자체로 이동

기상청 기후정보포털
 ENGLISH | 사이트맵
 기후정책법령
 기후변화감시
 기후변화시나리오
 기후예측정보
 열린마당
 SEARCH
 - 기후정보포털 소개
 (07062) 서울특별시 동작구 여의대방로 16길 61 기상청 기후변화감시과
 대표번호: 022181-0452
 시나리오 문의: 022181-0406
 E-mail: dcmd@korea.kr
 COPYRIGHT © 2017 KMA. ALL RIGHTS RESERVED.

back



사항 더보기 >

- 이 있는 카드뉴스 동영상 4탄] 21... 11-26
- 뉴스 시리즈 23탄] 기후변화, 산불... 11-11
- 이 있는 카드뉴스 동영상 1탄] 이... 11-05
-] 2020년 기후정보포털 사용자 만... 11-02
-] 기후변화 시나리오 자료 제공 오... 10-22

사전

기후용어사전

후변화감시 용어 해설집 바로 가기

기상청 기후변화과학 시리즈 20

!생활

2020 편 -

Assessment Report

Assessment
Report

발간등록번호
11-1360620-000132-01



책임운영기관
국립기상과학원
National Institute of
Meteorological Sciences

Perspective
Report

발간등록번호

"IPCC 6차 평가 보고서 대응"

전지구 기후변화
전망보고서

- SSP1-2.6 / SSP5-8.5에 따른 기후변화 전망 -



책임운영기관
국립기상과학원

Assessment Report(2)

- 120 authors, ~1,900 papers

WG I



WG II



Tools for Risk Assessment

Give me a place(Model) to stand on,
and I can move(Save) the Earth.
- Archimedes?? (Scientist)

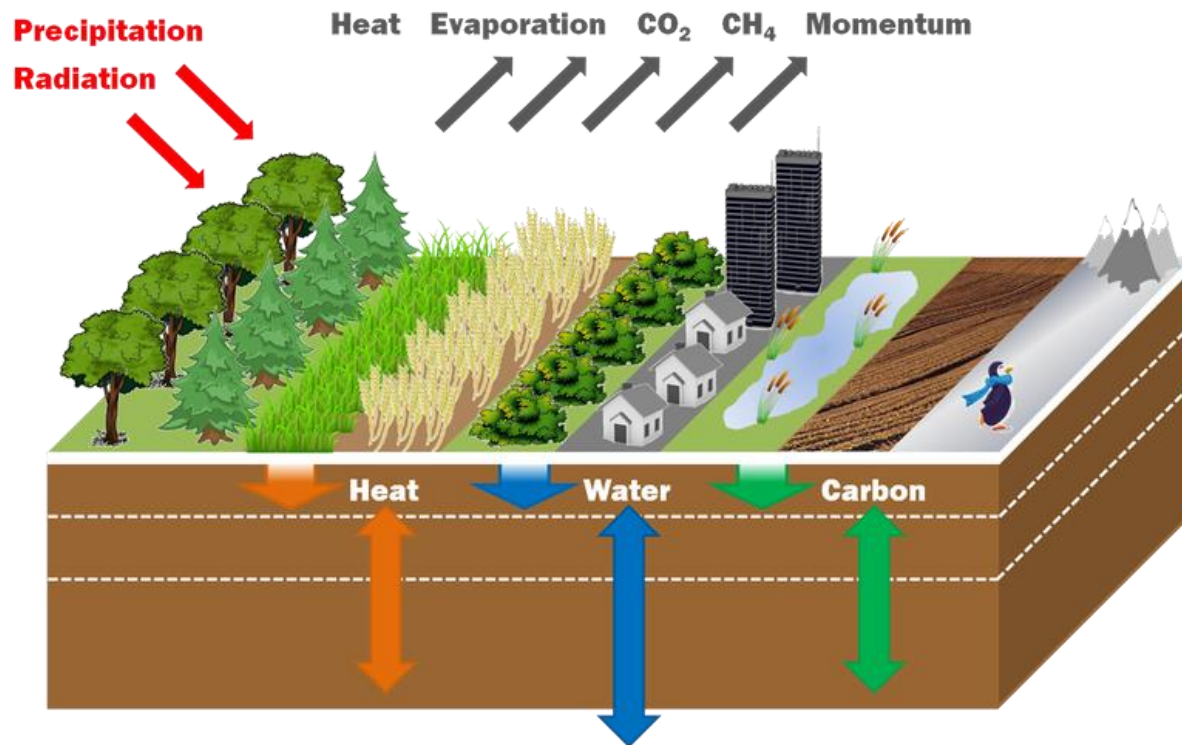


(© Google)

"No one but **the modeler** believes in his results; everyone **except the observer** believes in his data!"
- So&So after Albert Einstein

Land Surface Model (LSM)

- to simulate the exchange of water, energy, carbon over the surface-atmosphere interface
- light (<100 Mb) & simple (low computing source)



VESTAP

- Vulnerability Assessment Tool to Build Climate Change Adaptation Plan
- 6 sectors(e.g., health), 57 climate risks (e.g., health V due to heatwaves)

The screenshot displays the VESTAP web application interface. At the top, there is a navigation bar with the VESTAP logo, the title '기후변화취약성 평가지원 도구 시스템', and a user profile for 'administrator' with a login timestamp. The main content area is divided into several sections:

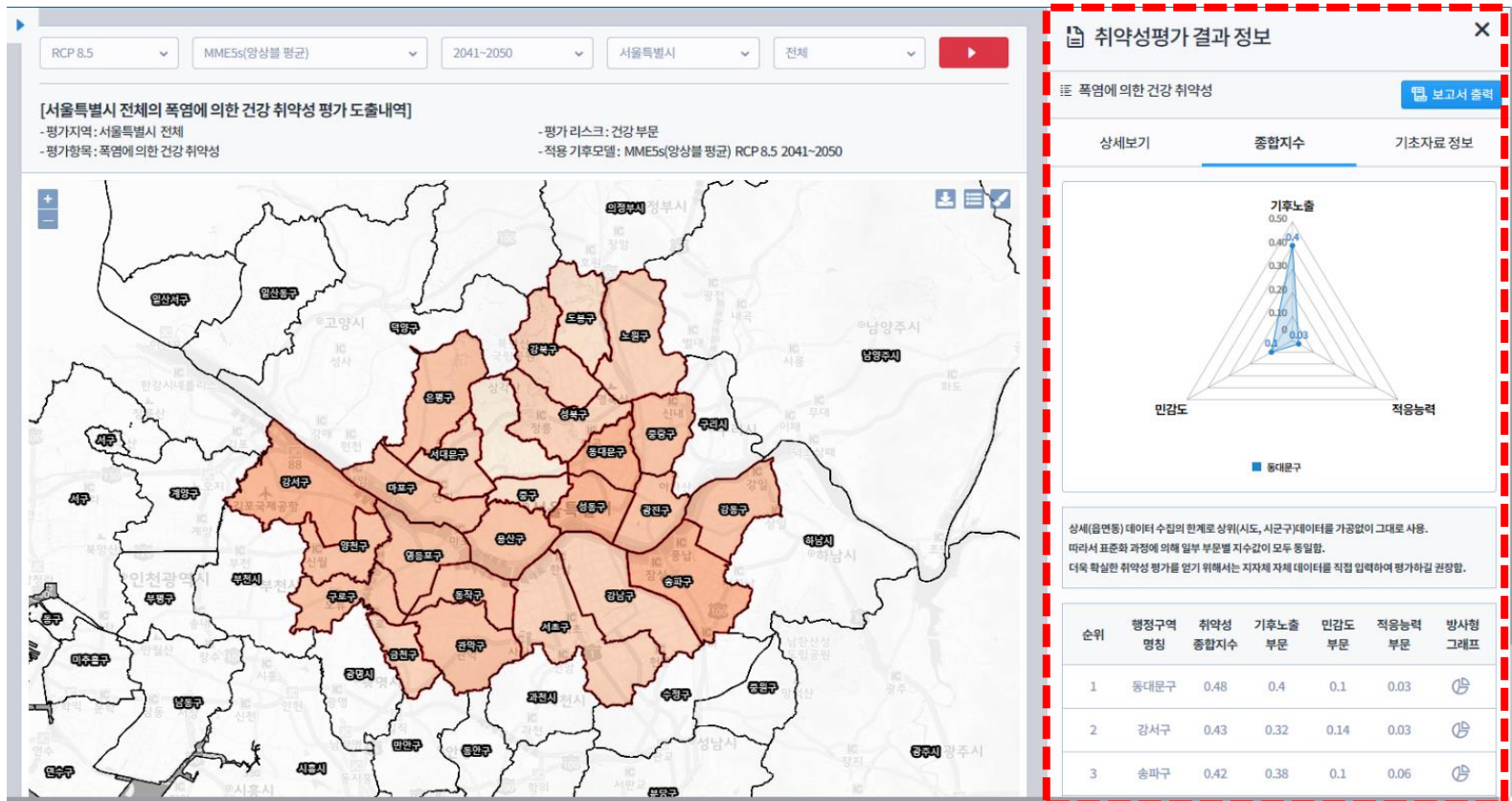
- Left Sidebar:** Contains navigation links for HOME, 기후변화취약성, 사용자정의 취약성, DB정보, 열린마당, ADMIN, 지자체별 인벤토리, 전국단위 취약성평가, 전국 사용자정의 취약성, 열린마당 관리, 통계보기, and 회원관리.
- Top Navigation:** Includes '부문' (Sector) with icons for Health, National Security, and Agriculture; '소개' (Introduction); and '항목' (Item).
- Main Content:** A map of Seoul showing vulnerability assessment results for various districts. The map is color-coded, with darker orange indicating higher vulnerability. A legend on the right side of the map shows a color scale from light to dark orange.
- Right Panel:** Titled '취약성평가 결과정보' (Vulnerability Assessment Results Information). It includes a '취약성평가 결과정보' tab, a '상세보기' (Detailed View) button, and a '종합지수' (Composite Index) section. This section features a radar chart showing the performance of '동대문구' (Dongdaemun-gu) across five metrics: 기후노출 (Climate Exposure), 민감도 (Sensitivity), 적응능력 (Adaptation Capacity), and two others. Below the chart is a table of results.

순위	행정구역 명칭	취약성 종합지수	기후노출 부문	민감도 부문	적응능력 부문	방사형 그래프
1	동대문구	0.48	0.4	0.1	0.03	
2	강서구	0.43	0.32	0.14	0.03	
3	송파구	0.42	0.38	0.1	0.06	

(VESTAP, KEI KACCC)

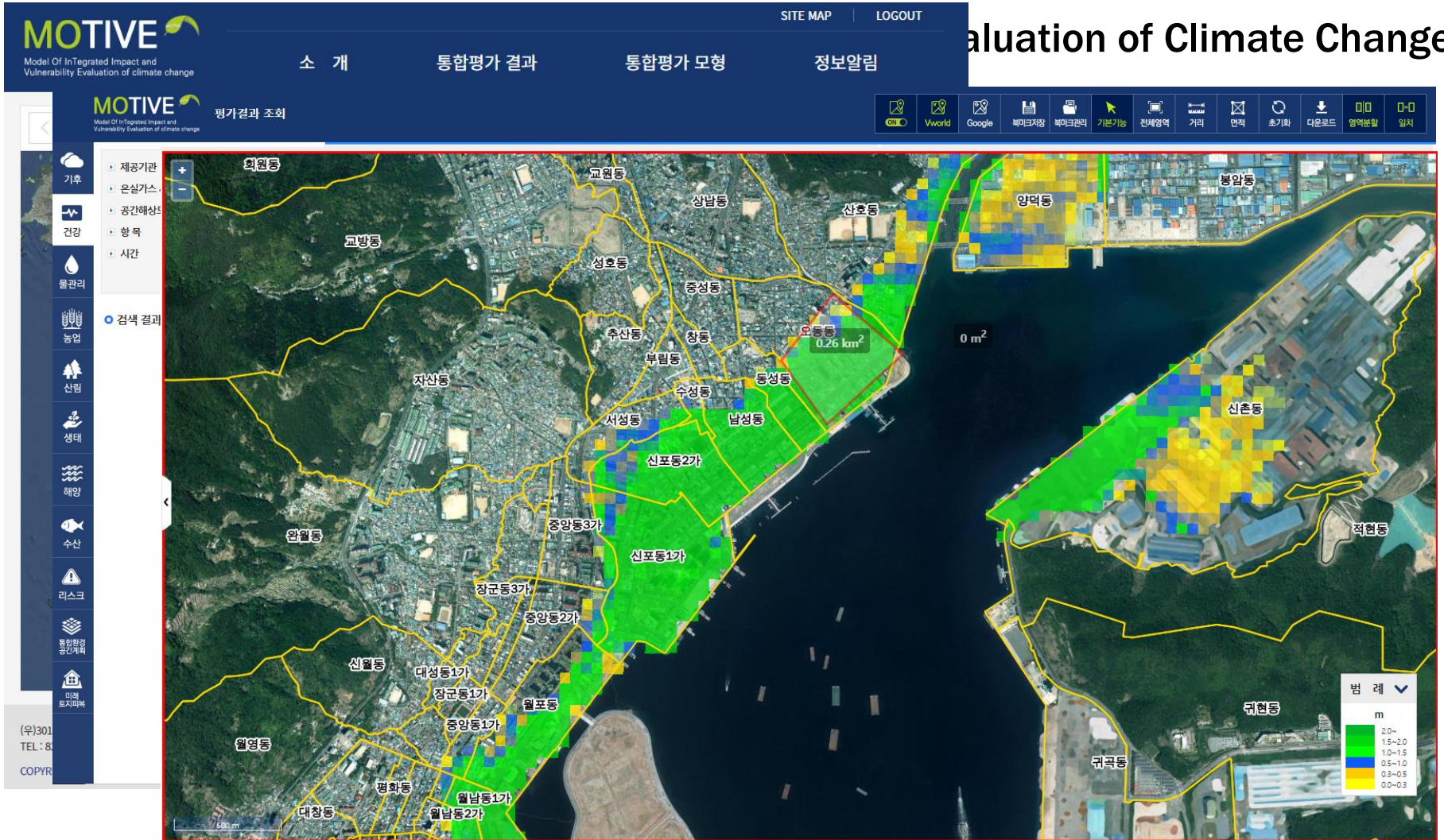
VESTAP

- **Vulnerability** = $\alpha \times \text{Exposure} + \beta \times \text{Sensitivity} - \gamma \times \text{Adaptive Capacity}$
- **V** is calculated based on the concepts in 「IPCC AR4」.
- **E, S, AC** are averaged value of normalized(0~1) 4~10 indices.



MOTIVE

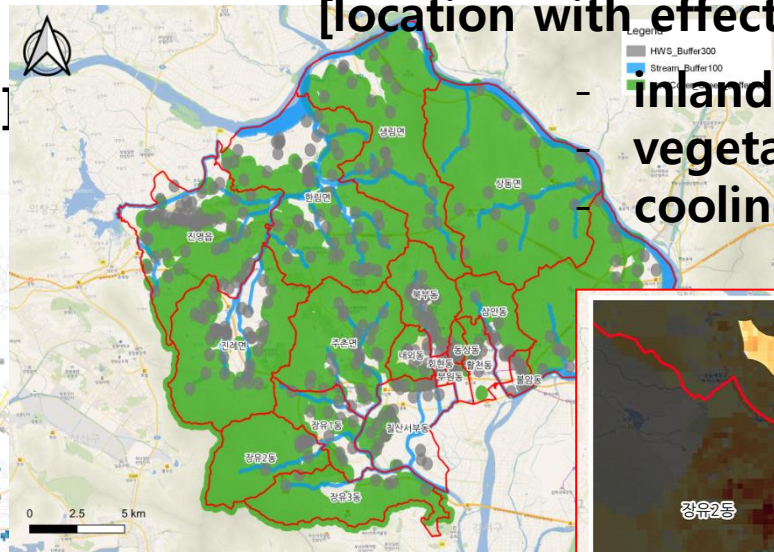
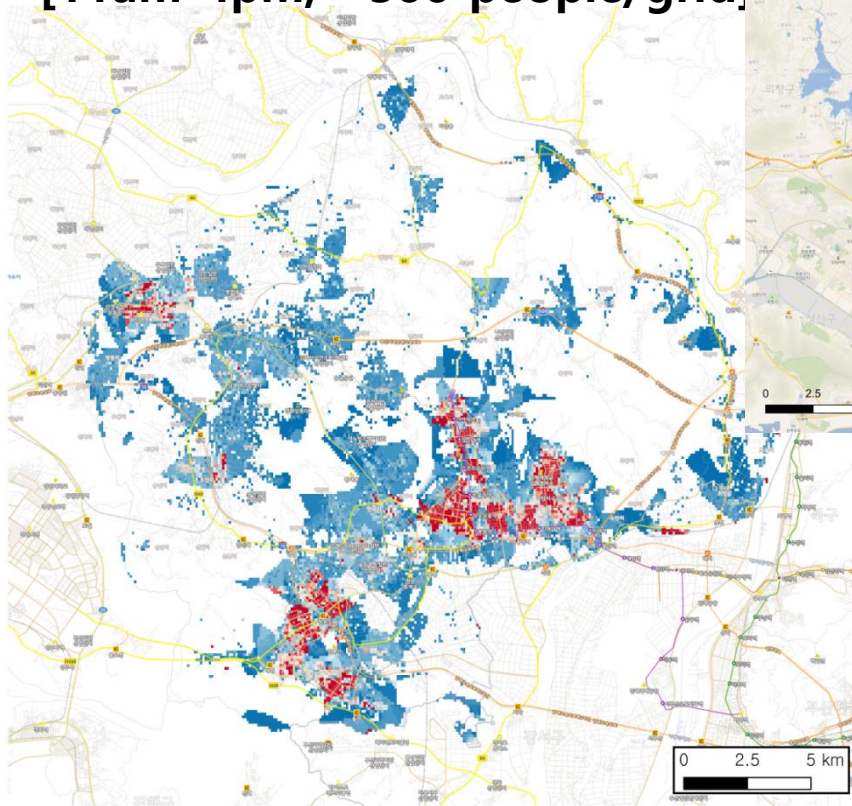
Evaluation of Climate Change



Hotspot Research

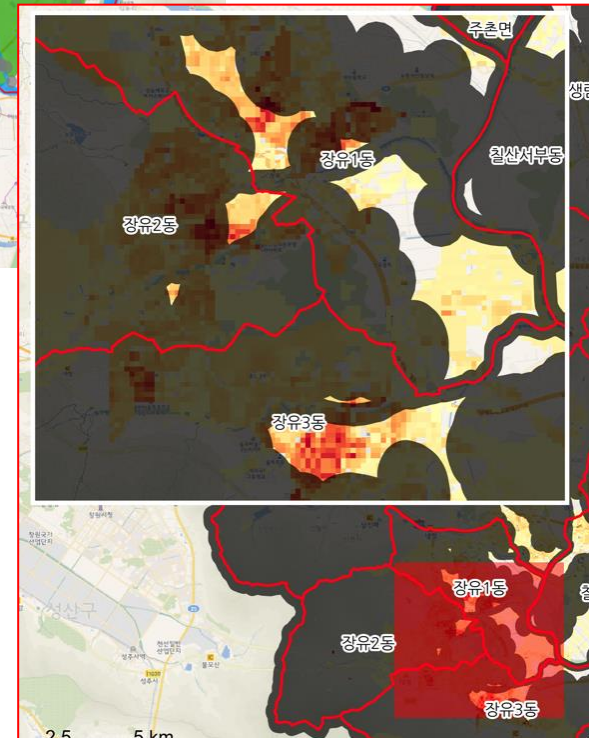
- floating population (50m, 1hr)

for JJA 2020,
[11am-4pm; ~300 people/grid]



[location with effective range]

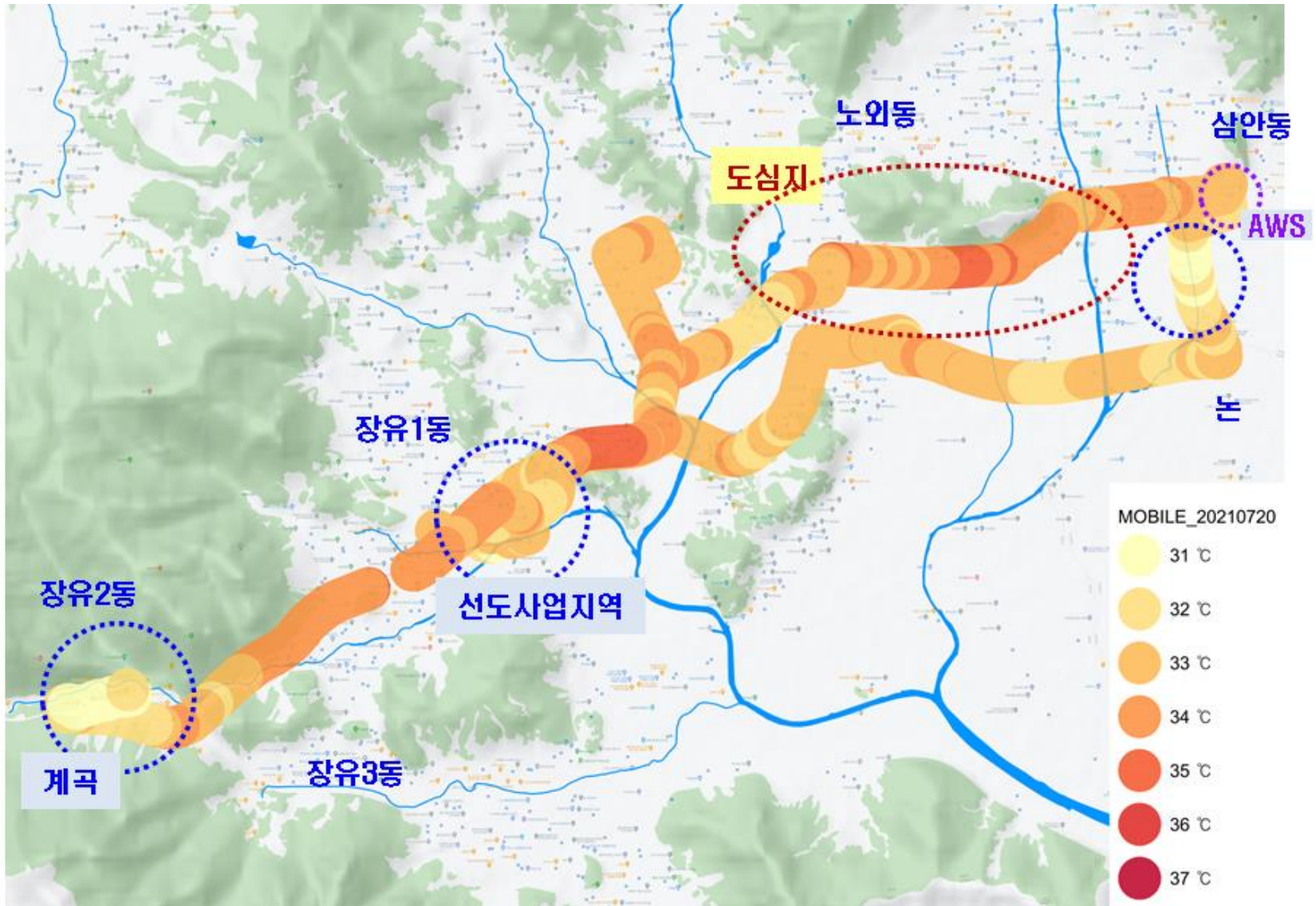
- inland water
- vegetated area
- cooling center



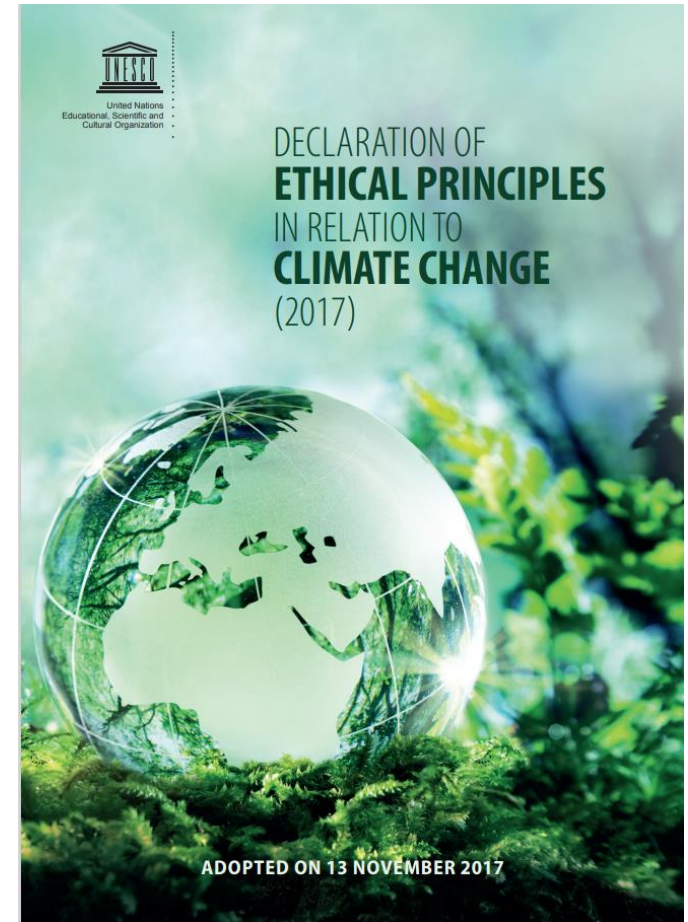
Mobile monitoring



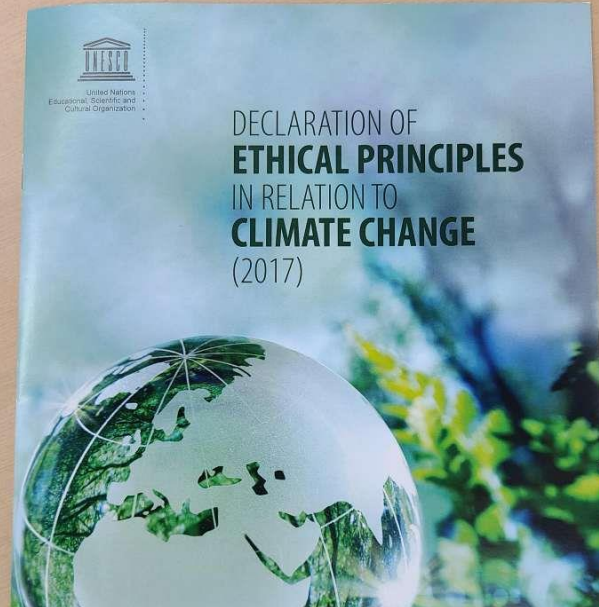
Mobile monitoring



4. Declaration of Ethical Principles in Relation to Climate Change



Declaration of Ethic Principles



- Prevention of harm
: **위해금지**
- Precautionary approach
: **사전주의 원칙**
- Equity and justice
: **형평성과 정의**
- Sustainable development
: **지속가능발전**
- Solidarity
: **연대**
- Scientific knowledge and integrity in decision-making
: **과학지식과 의사결정의 진실성**

Precautionary Approach

- Assumed the risk of climate-change...
- Based on risk management process



(Rumsfeld)

KNOWN KNOWNS

I know...

KNOWN UNKNOWNNS

I know I don't know...

UNKNOWN KNOWNS

I don't know, but
somebody does...
and they ain't tellin'

UNKNOWN UNKNOWNNS

Who would have thunk?

Equity and Justice

- Poor and rich,
- Large- and mid- companies, Stranded assets,
- Seoul and the provinces, Metropolitan- and Local,
- Maternal-child health,
- Younger- and Older generation,



대통령 직속 탄소중립위원회 민간 위원직

사퇴 선언문

청소년기후행동은 대통령 직속 탄소중립위원회의 논의 구조를 거부하며, 공식적으로 동료 활동가의 탄소중립위원회 민간위원직 사퇴를 선언합니다.

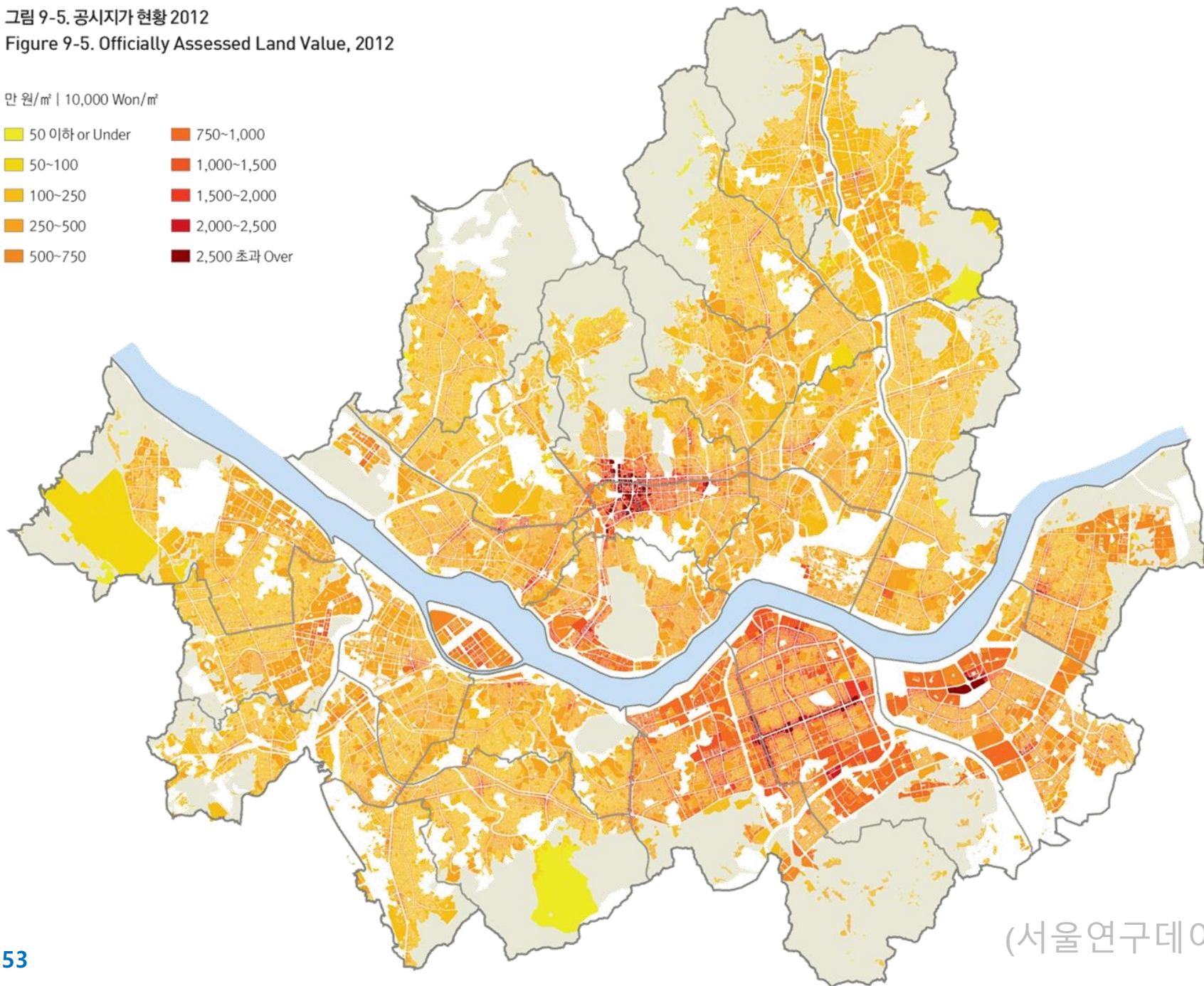


청소년기후행동
YOUTH & CLIMATE ACTION

그림 9-5. 공시지가 현황 2012

Figure 9-5. Officially Assessed Land Value, 2012

만 원/㎡ | 10,000 Won/㎡

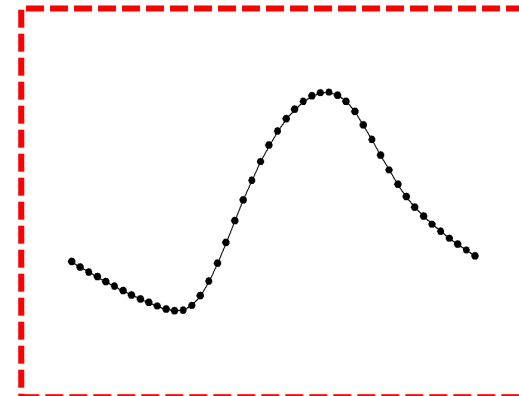
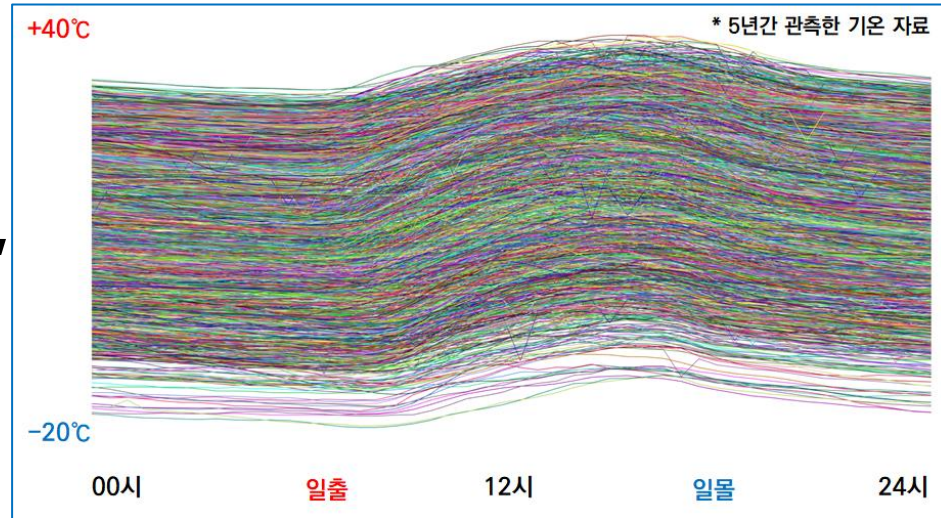
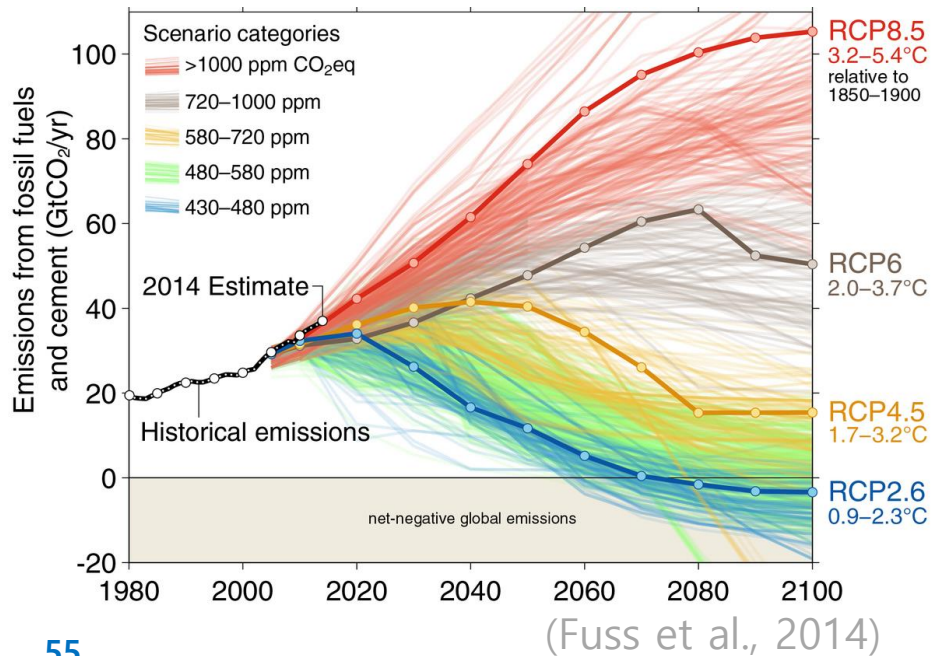


(서울연구데이터)



Scientific Knowledge and Integrity in Decision-Making

- **Scientism,**
- **Uncertainty,**
: mean, median, error bar,



5. Discussion



Discussion

- **Overview of Climate Change**
- **Key Concepts for Adaptation**
- **Adaptation Policy in Korea**
- **Declaration Ethical Principles in Climate Change**

Thank you for your attention!!

Think Globally, Act Locally !
Think Locally, Act Globally !

HONG Je-Woo,

Research Fellow | Ph.D in Atmospheric Science

jwhong@kei.re.kr

+82-10-3123-6183

