Integrated modeling of SRM

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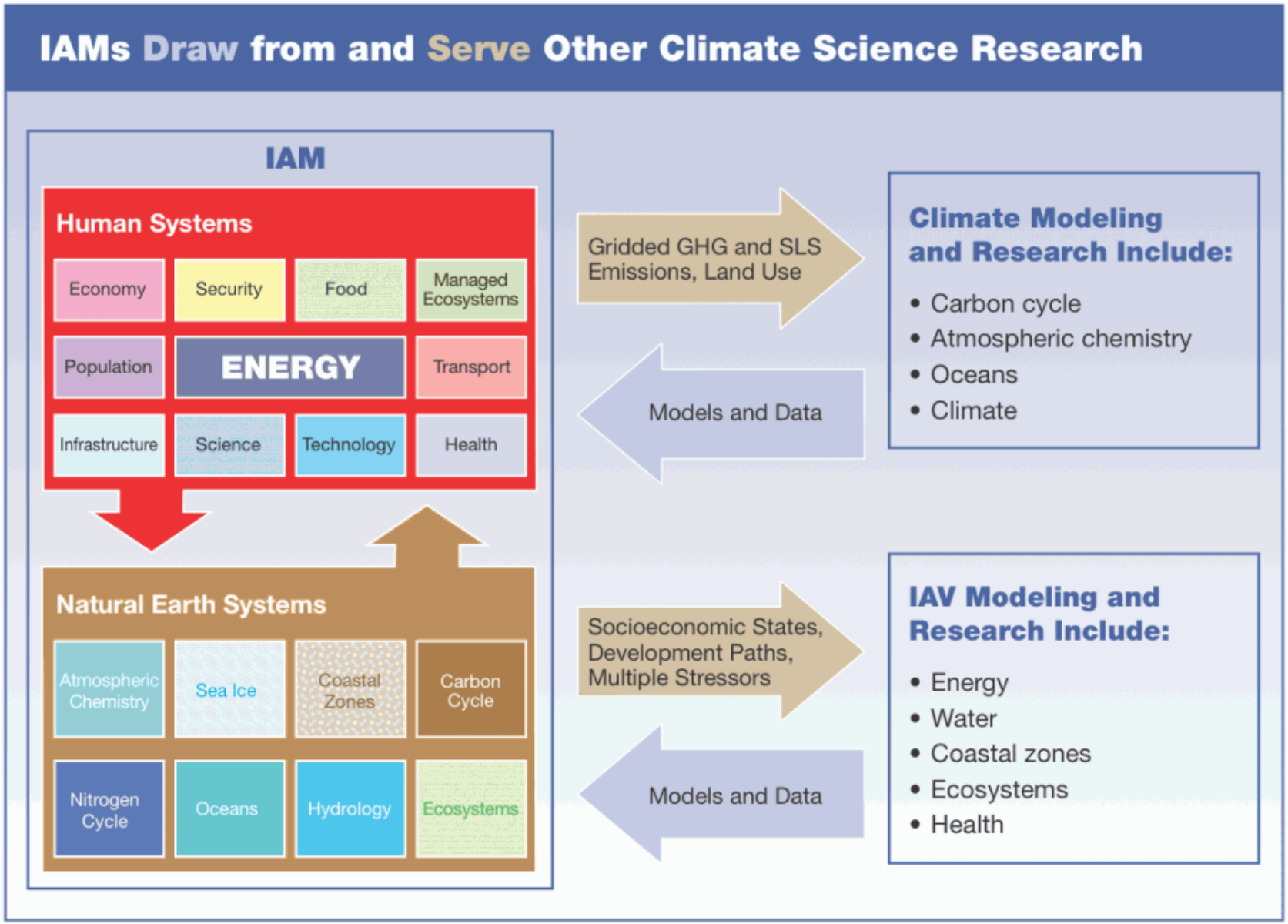
What are IAMs?



Classification (Weyant, 2017):

- Benefit-cost IAMs
- Detailed process IAMs

Source: http://www.iamconsortium.org/

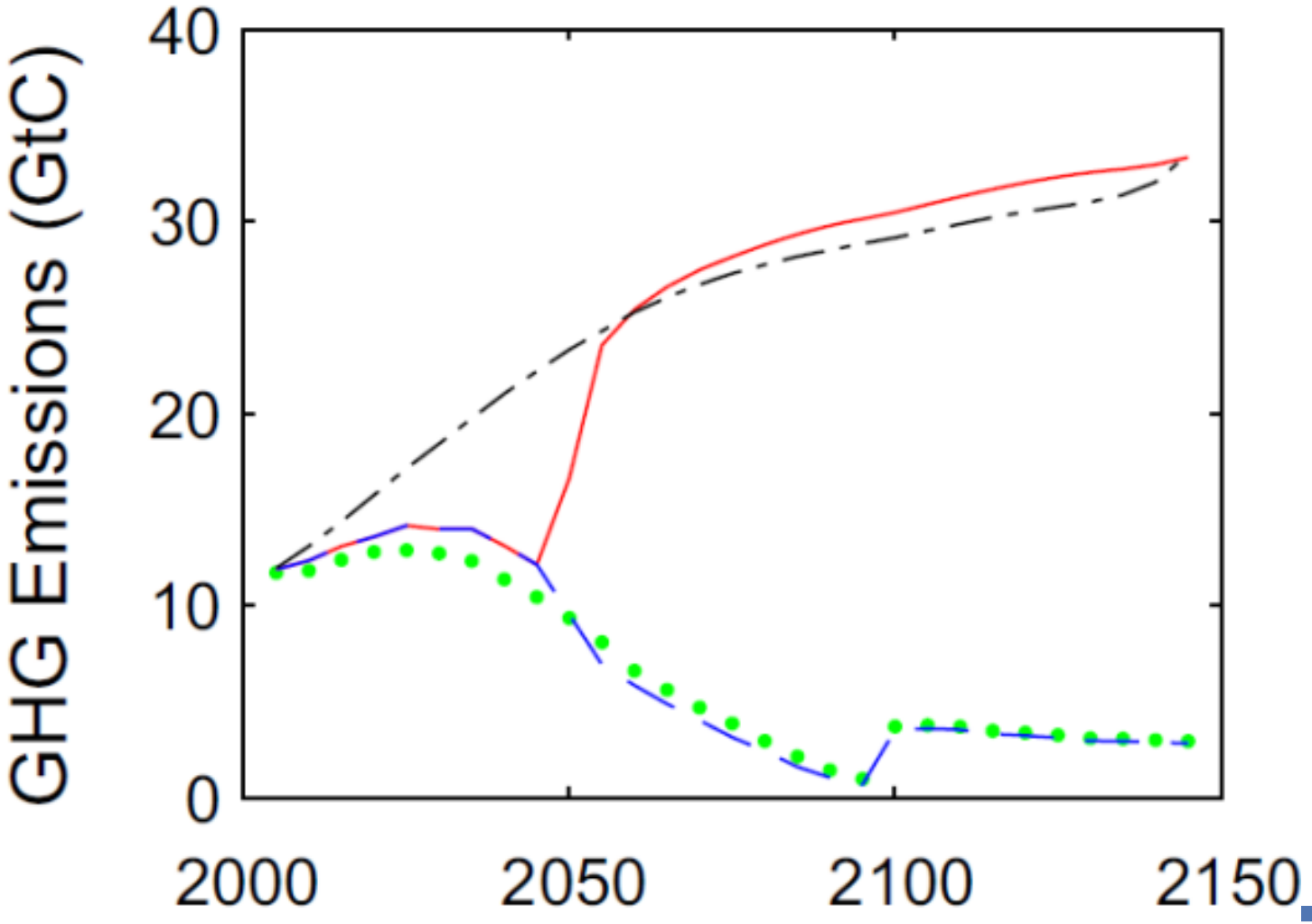
Literature overview

- Benefit-cost IAMs:
  - Mostly DICE-like (Goes et. al, Gramstad and Tjotta, Moreno Cruz and Keith, Belaia et. al, Helwegen et. al)
  - Highly sensitive to parametrization of costs and benefits
  - Degenerate application of CBA

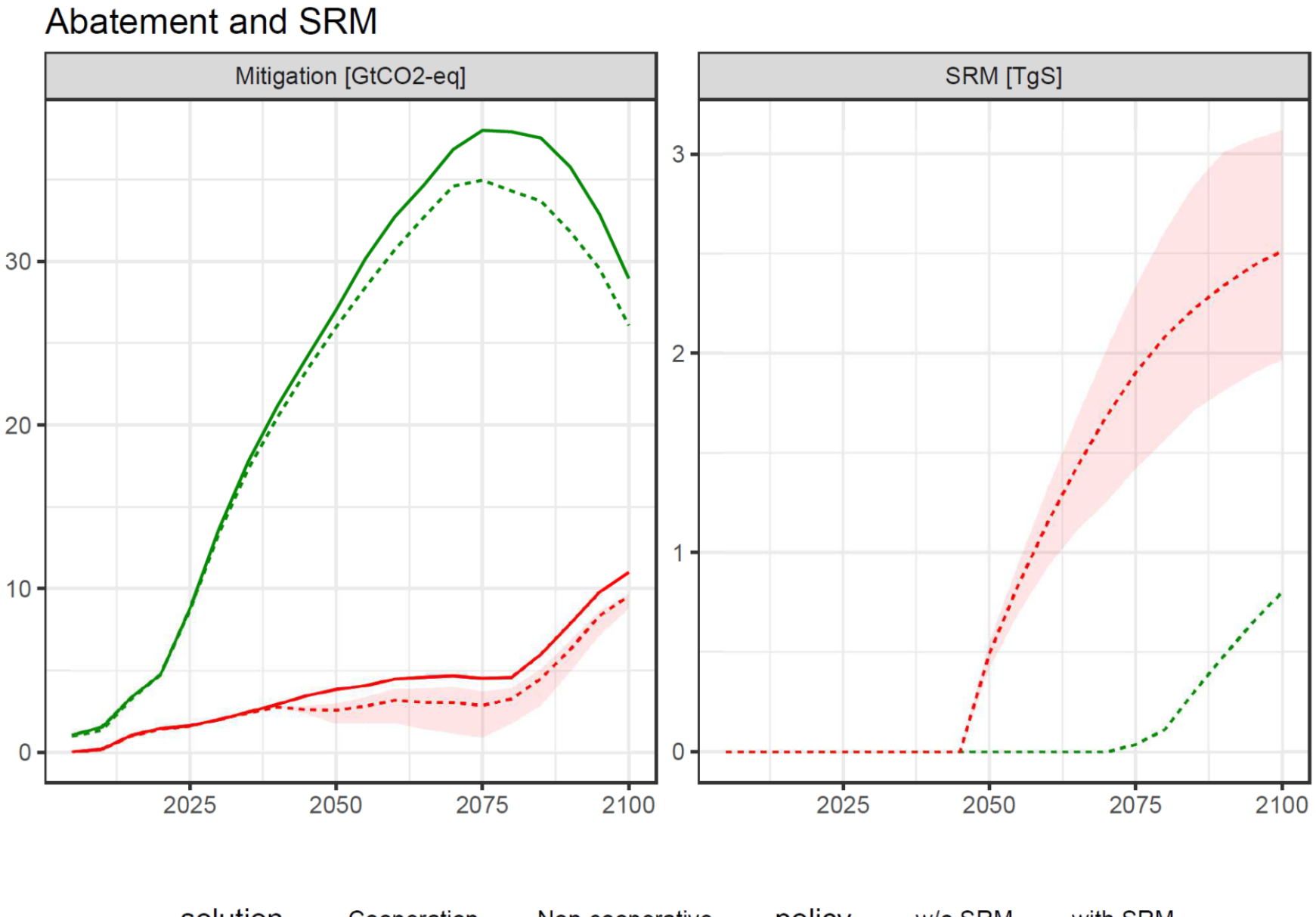
- Detailed process IAMs
  - Very few contributions (Arino et. al PNAS 2016, Emmerling and Tavoni, GEC & ERE)
  - Often accompanied by analytical/theoretical modeling
  - Often hybrid with CBA

Uncertainty

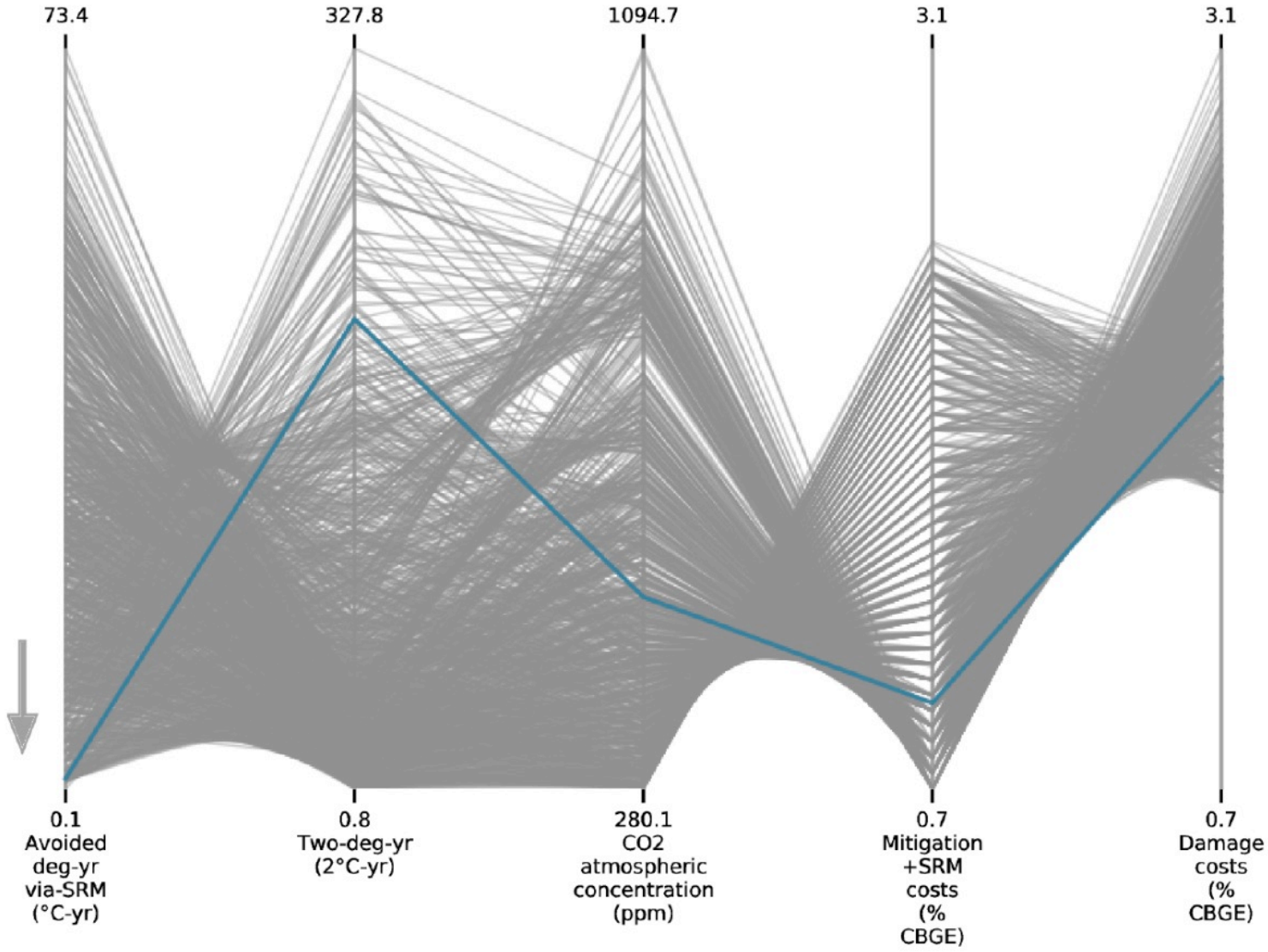
Proposition 1 *Under the assumptions 1 and 2, the optimal abatement in the first period decreases and is concave in the probability that climate engineering is effective, i.e.,* $A_1^{*\prime}(p) < 0$ *and* $A_1^{*\prime\prime}(p) < 0$.

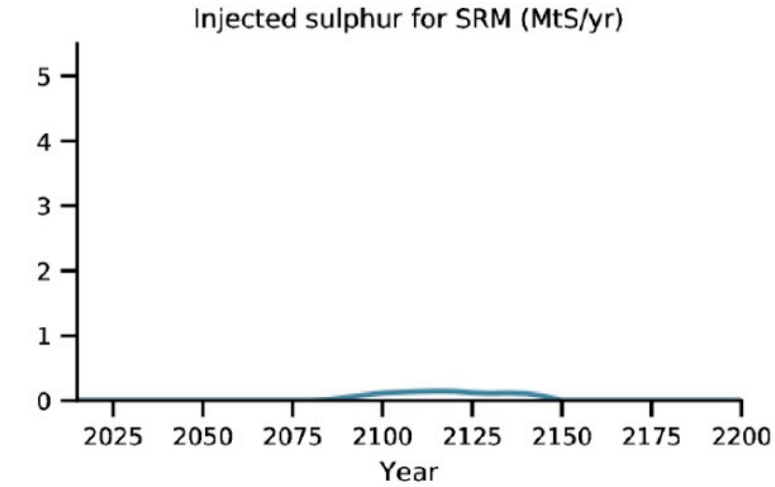


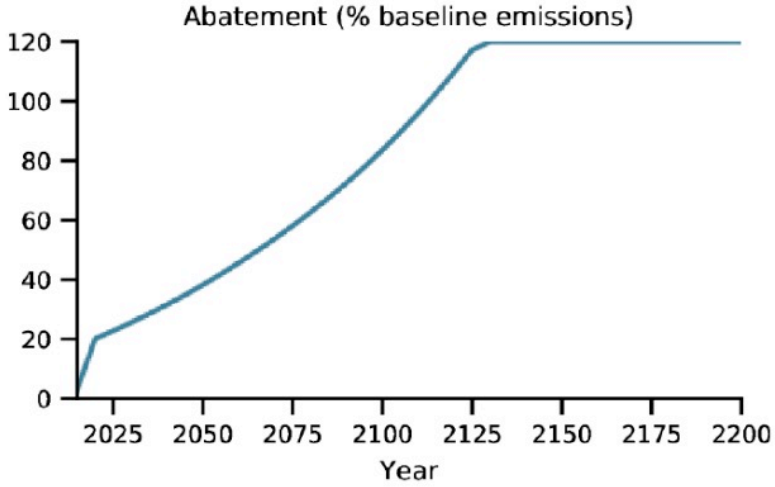
Governance


Abatement and SRM
Mitigation [GtCO2-eq]
SRM [TgS]
30
20
10
0
3
2
1
0
2025
2050
2075
2100
solution
Cooperation
Non-cooperative
policy
w/o SRM
with SRM

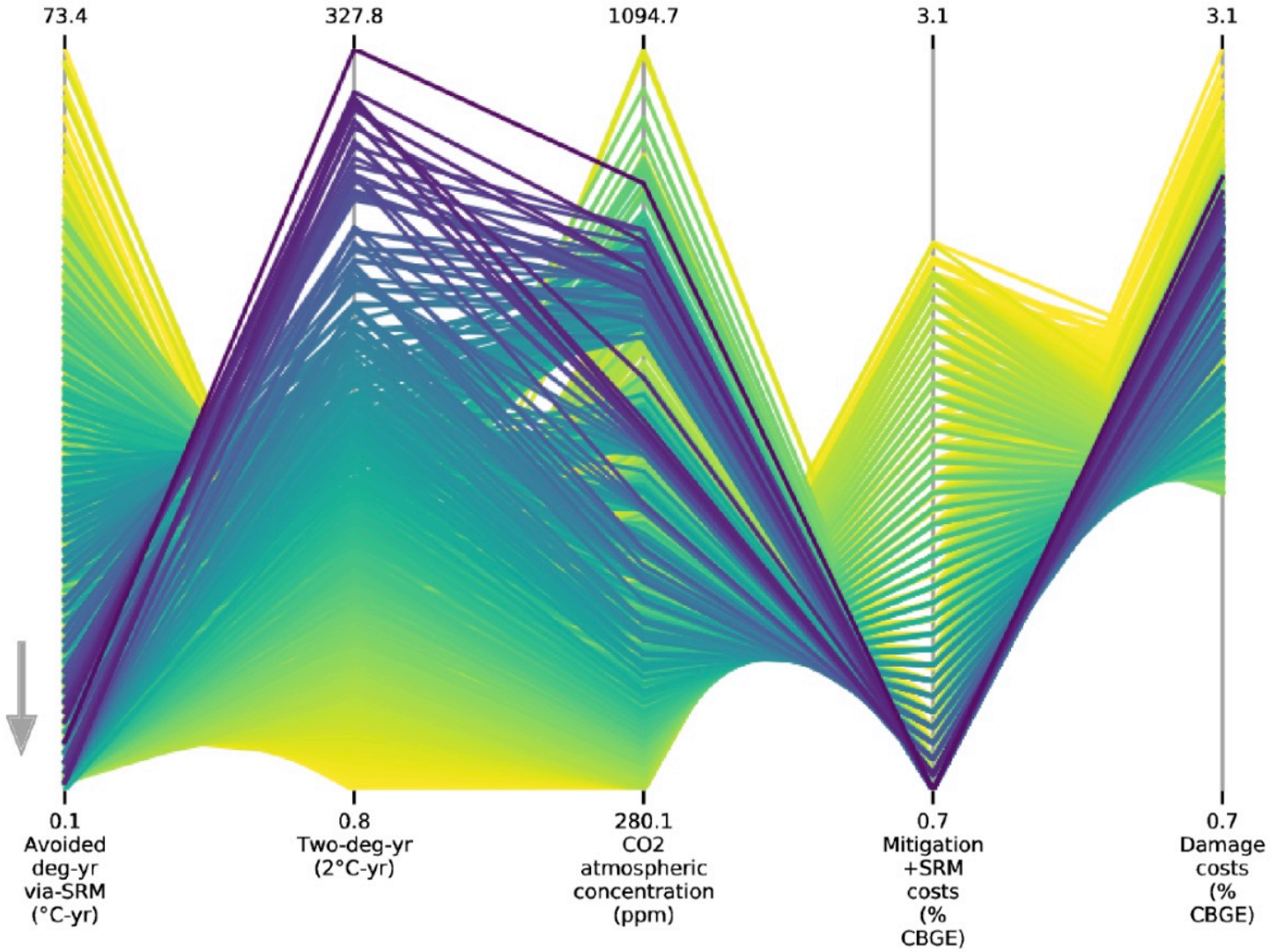
Beyond single objective optimization

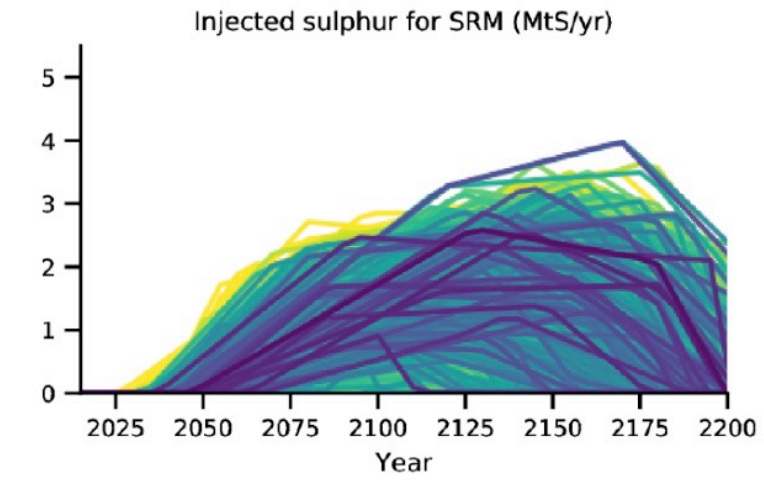


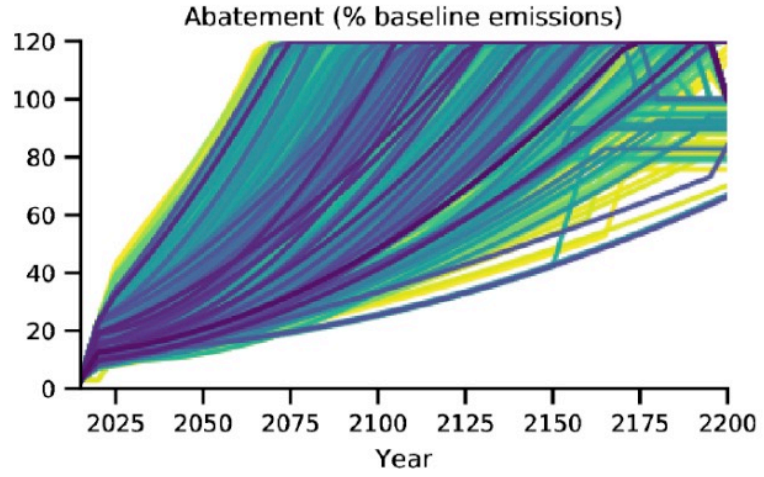




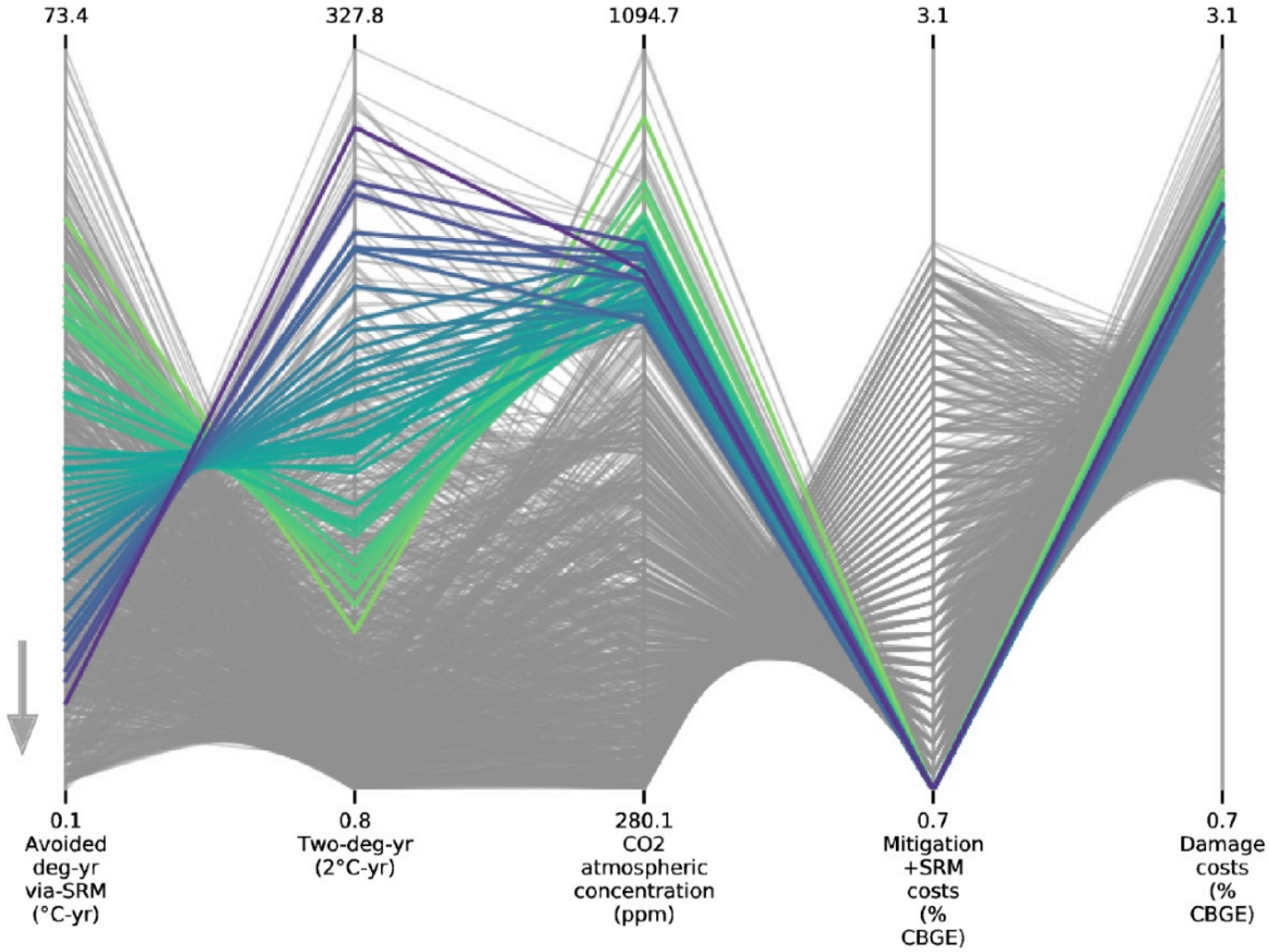
Beyond single objective optimization

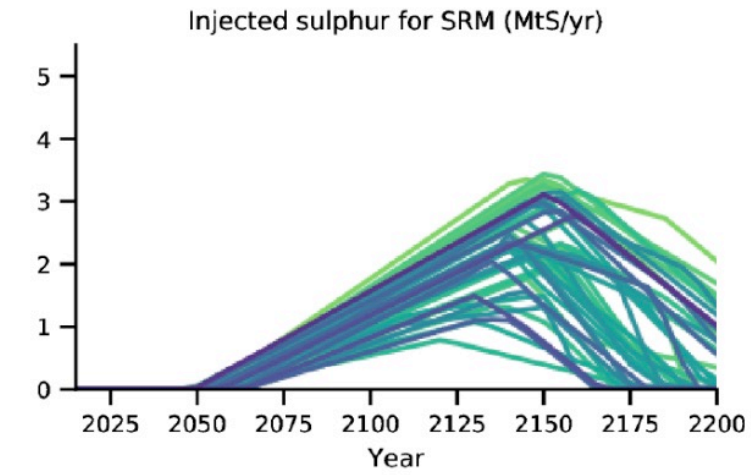


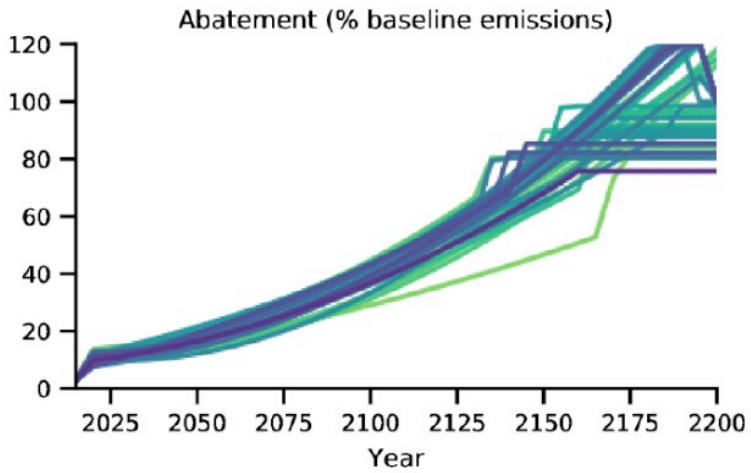




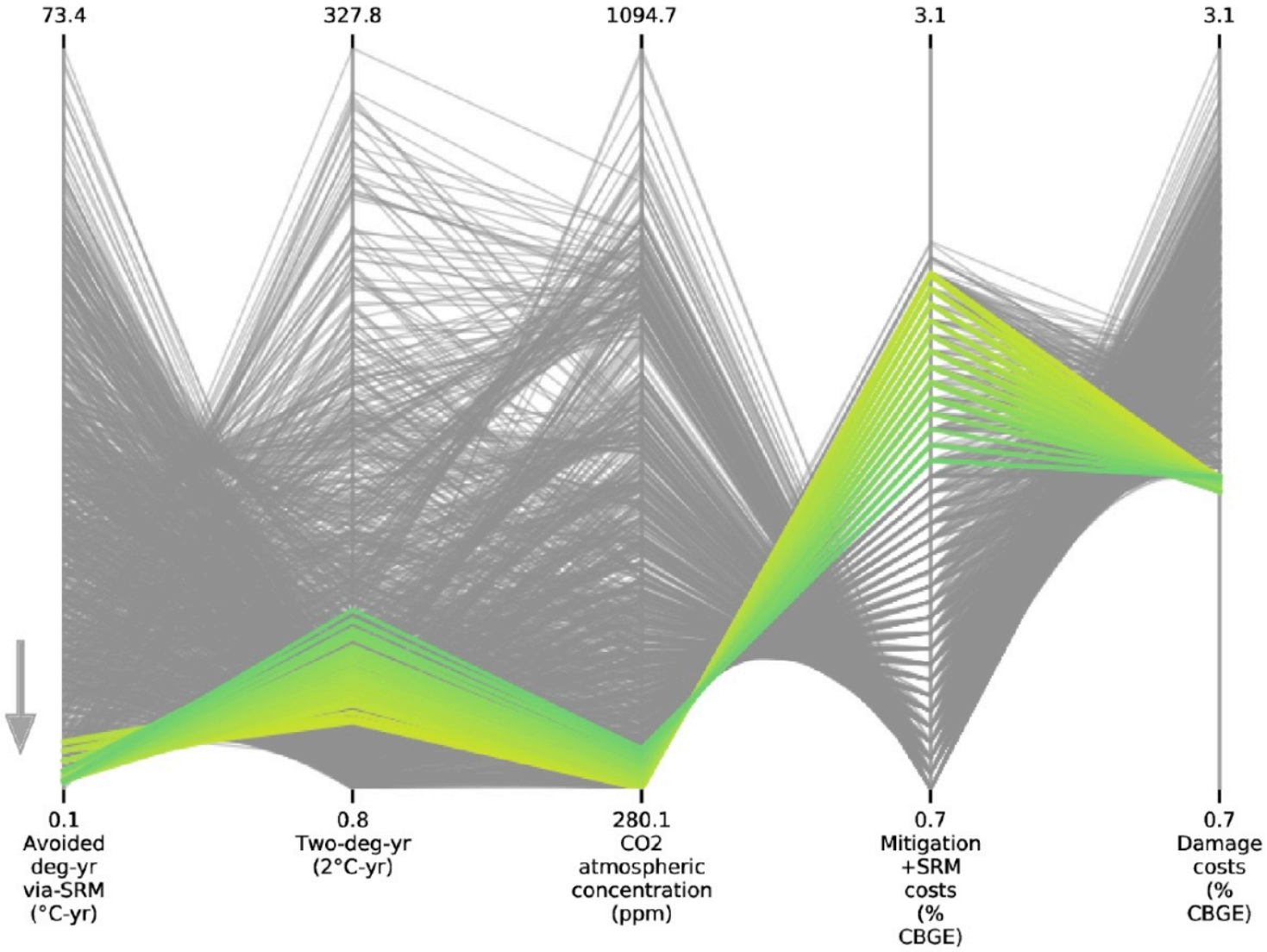
Minimizing mitigation + SRM costs

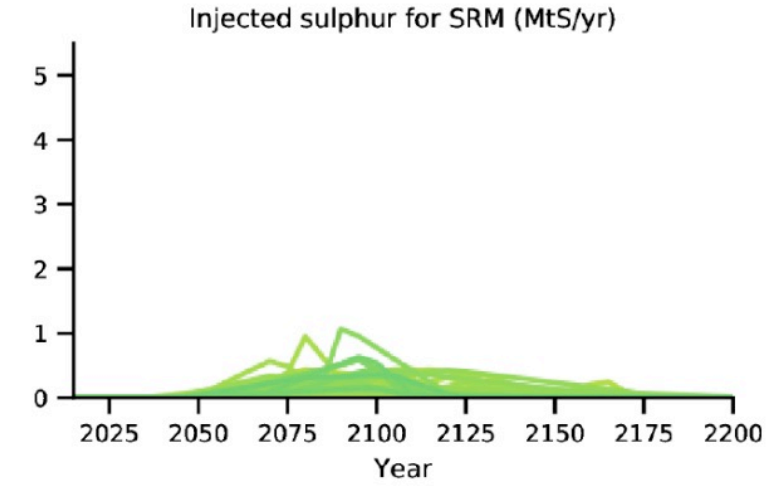


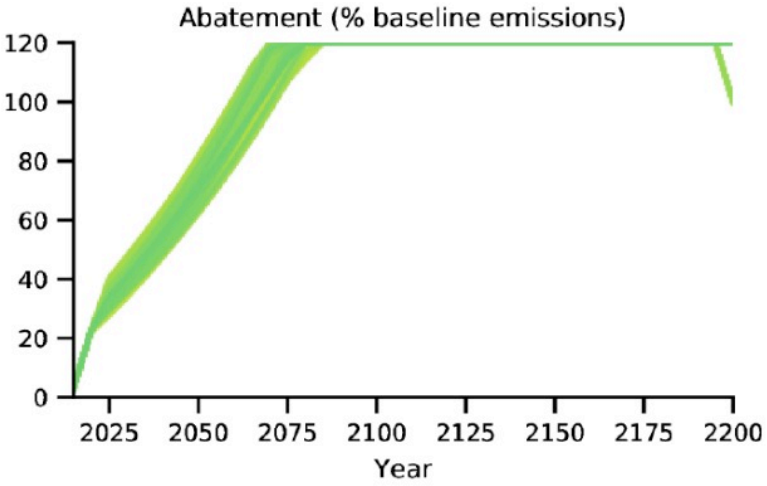




Minimizing damage costs







Open issues which need to be resolved (and won't be easy)

Data:

- Climate change economic impacts
  - Recent empirical literature (Burke, Hsiang et. al): high economic impacts and inequality -> large scope for SRM (Harden al 2019)
  - But also high uncertainty, especially at the country level (Ricke, Caldeira, Drouet and Tavoni)
  - Based on Temp: precipitation, CO2
- SRM economic impacts
  - Empirical literature (Proctor for volcanoes, fires?)
  - Air quality
  - Governance (including lab experiments, forthcoming)

Frameworks:

- Exploratory analysis will grow, more complex methods (multi-objective, deep uncertainty, etc.), coupling with reduced complexity GCM
- Hard to see it soon in a major detailed process IAM ensamble

Grazie

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