

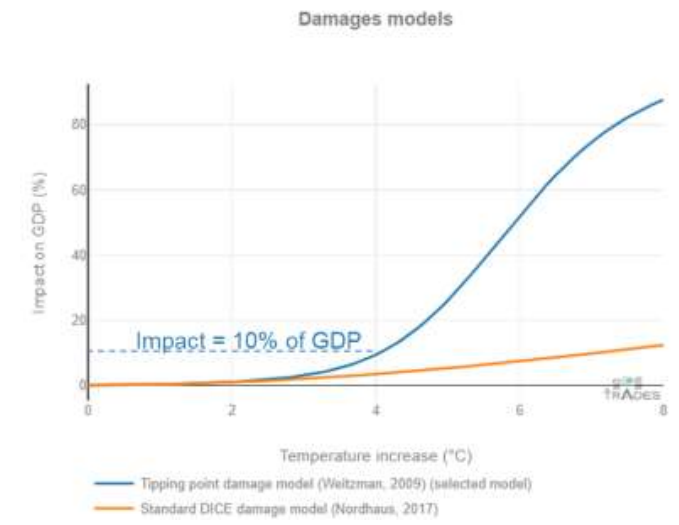
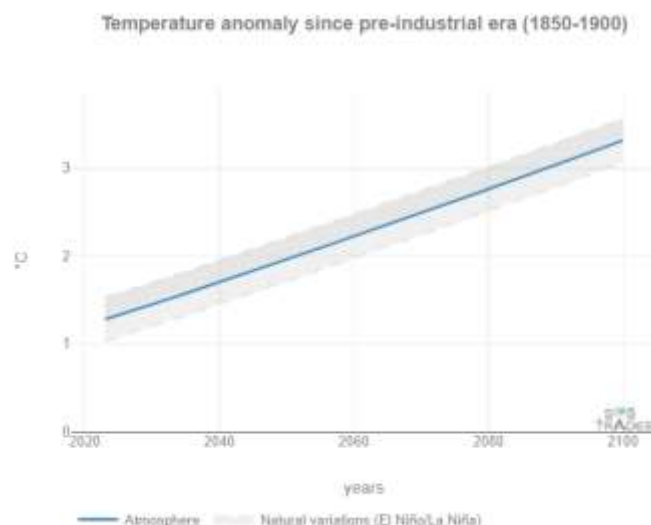
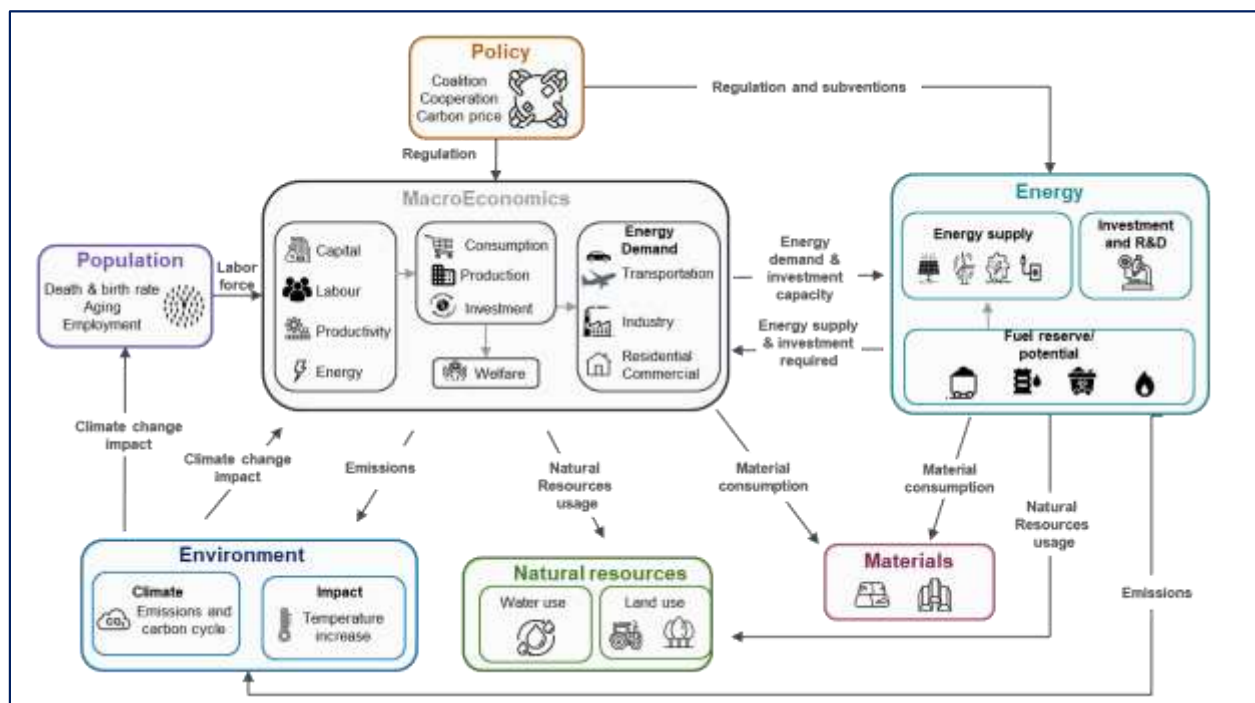
# Climate damage & tipping points : a key influence in transition

IAMC Conference 2024 – Seoul Nov 4-6<sup>th</sup>  
Marie Morere - Matthieu Meaux - Thierry Chevalier

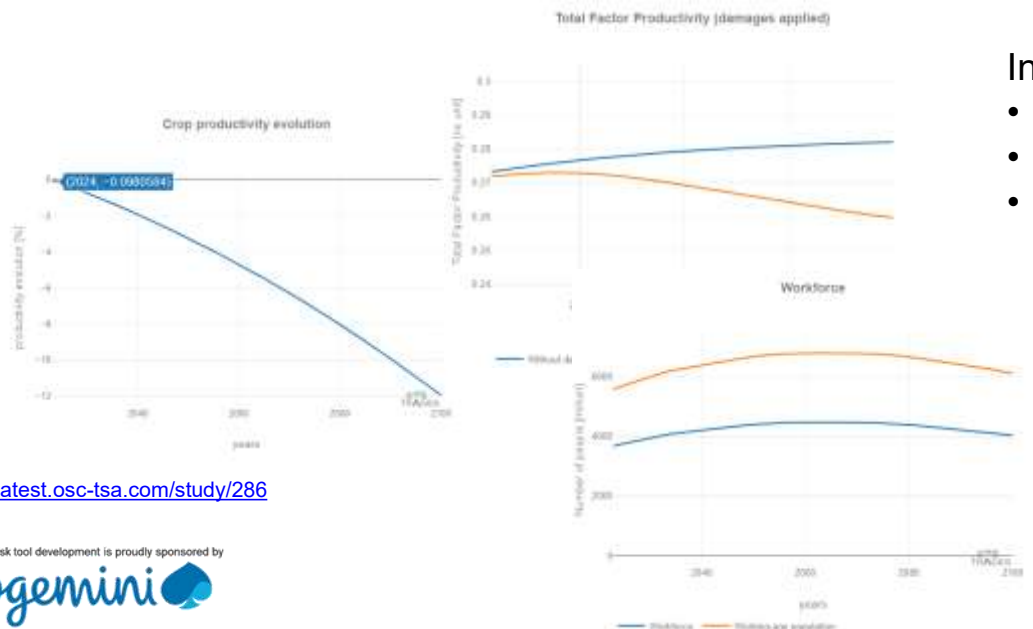
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# CLIMATE DAMAGE IS A KEY DRIVER IN ECONOMIC SCENARIOS

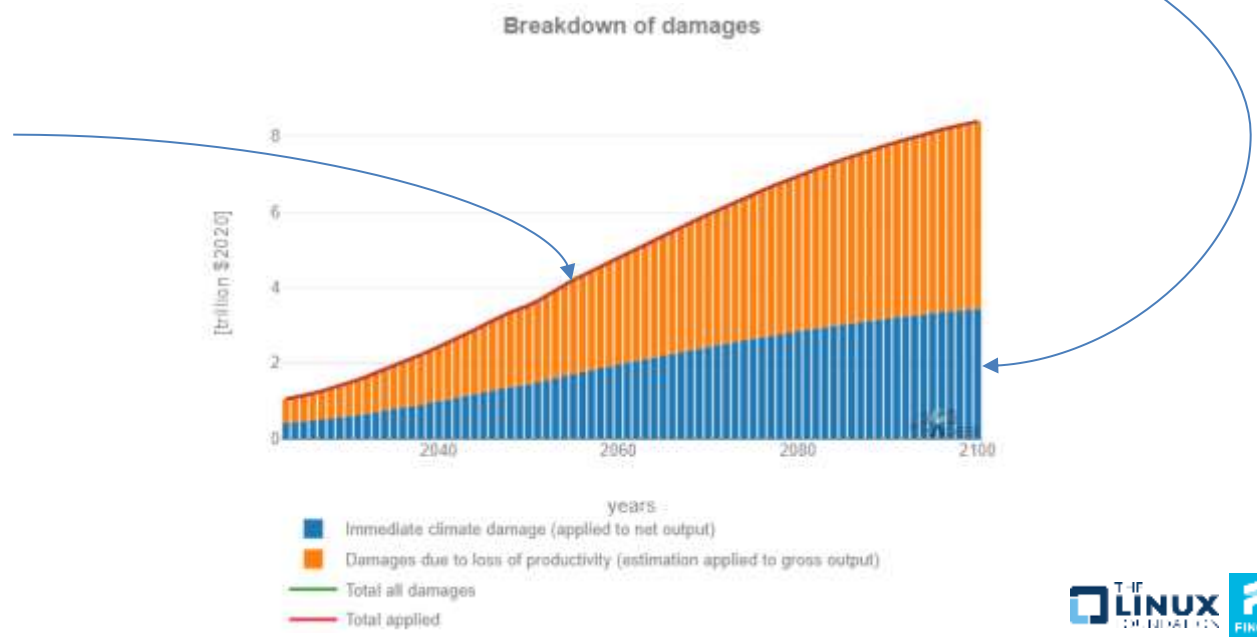


Direct damages on GDP



Indirect damages

- workforce
- productivity
- agriculture



<https://latest.osc-tsa.com/study/286>

# AND TIPPING POINTS A KEY DRIVER IN DAMAGE EVALUATION

Weitzman, M. L. (2009).

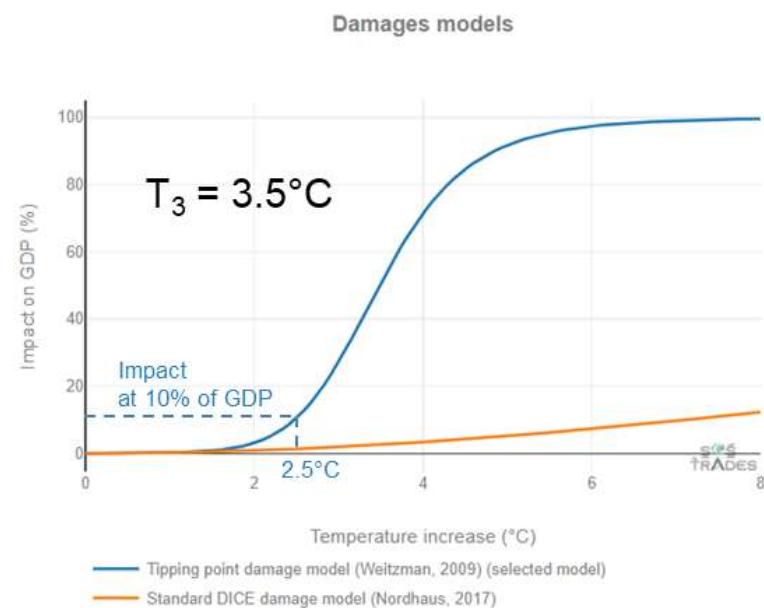
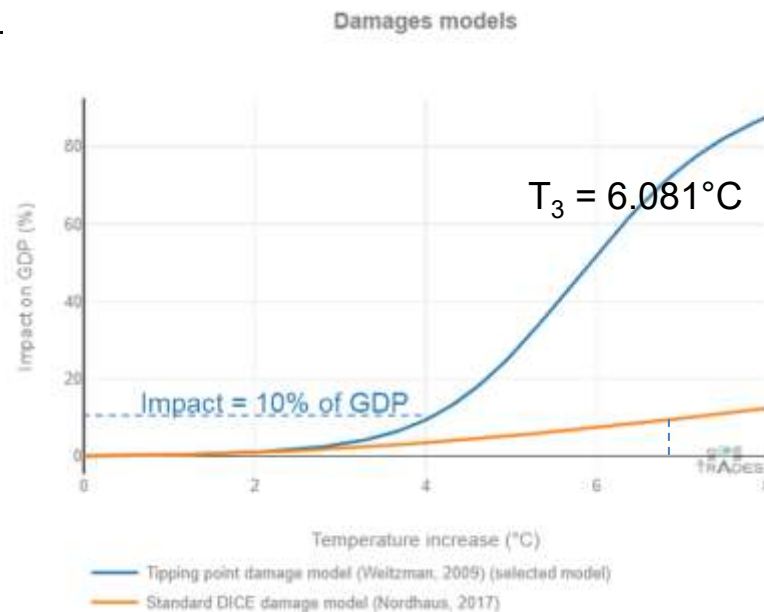
On modeling and interpreting the economics of catastrophic climate change.

The Review of Economics and Statistics, 91(1), 1-19

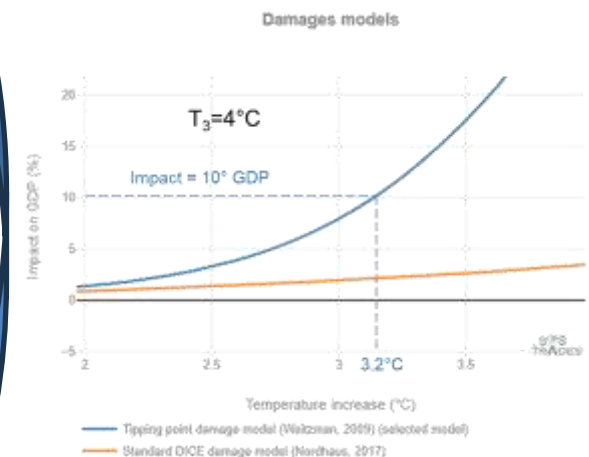
$$D_t = \left( \frac{T_{t,AT}}{20.46} \right)^2 + \left( \frac{T_{t,AT}}{T_3} \right)^{6.754}$$

$T_3 = 6.081^\circ\text{C}$  original value from a subjective probability estimate among 52 experts of triggering a « tipping point of major changes » in each of five possible categories:

- The Atlantic meridional overturning circulation (AMOC)
- The Greenland ice sheet meltdown
- West Antarctic Ice Sheet meltdown
- Amazon rainforest
- El Nino/southern Oscillation



There is no more consensus on the  $T_3=6.081^\circ\text{C}$  value cf [5], [6], [7]

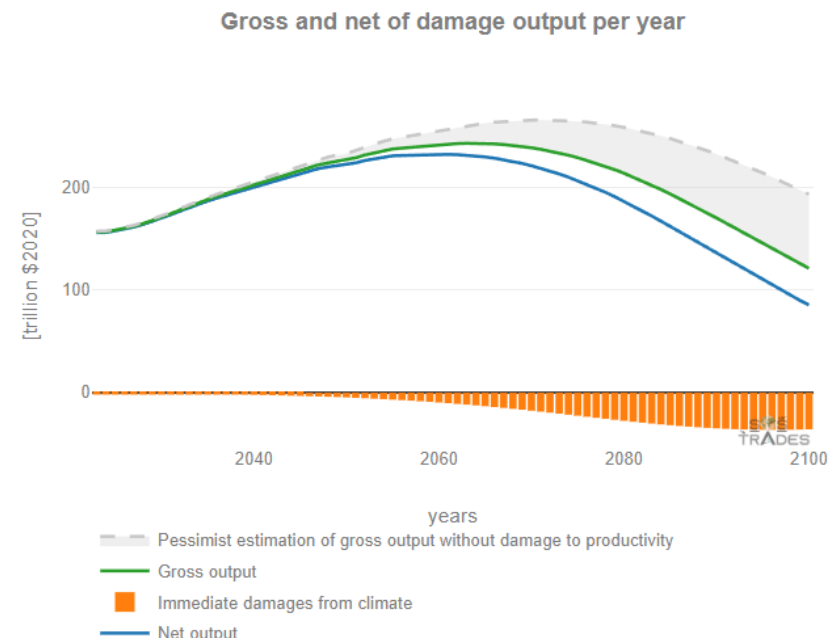
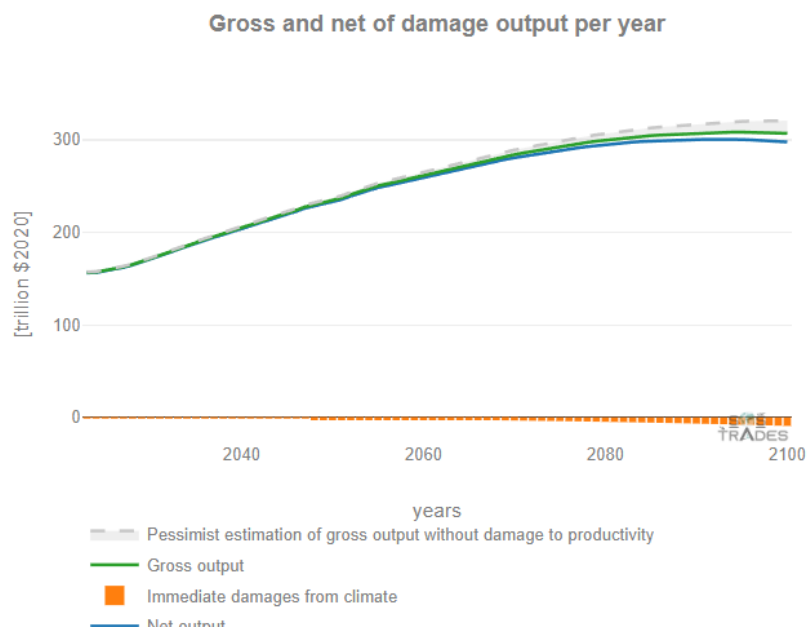


<https://latest.osc-tsa.com/study/286>



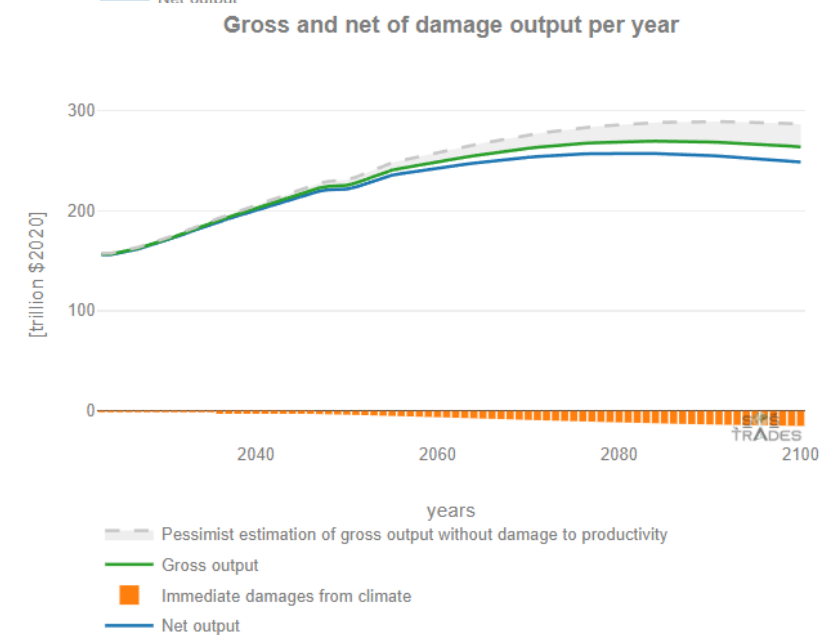
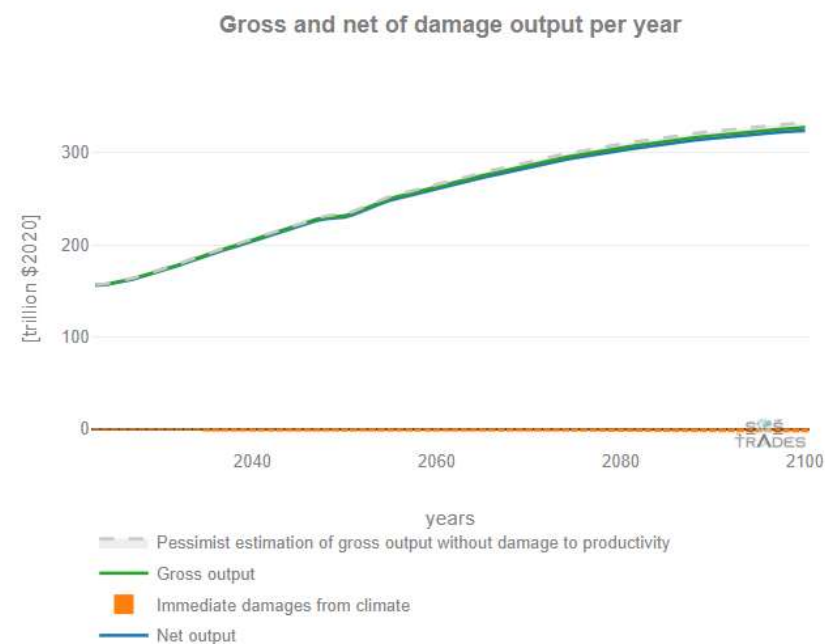
# SO WHAT WOULD BE ECONOMIC SENSITIVITY TO TIPPING T° VALUE ?

Fossil 40%



cf [8]

NZE

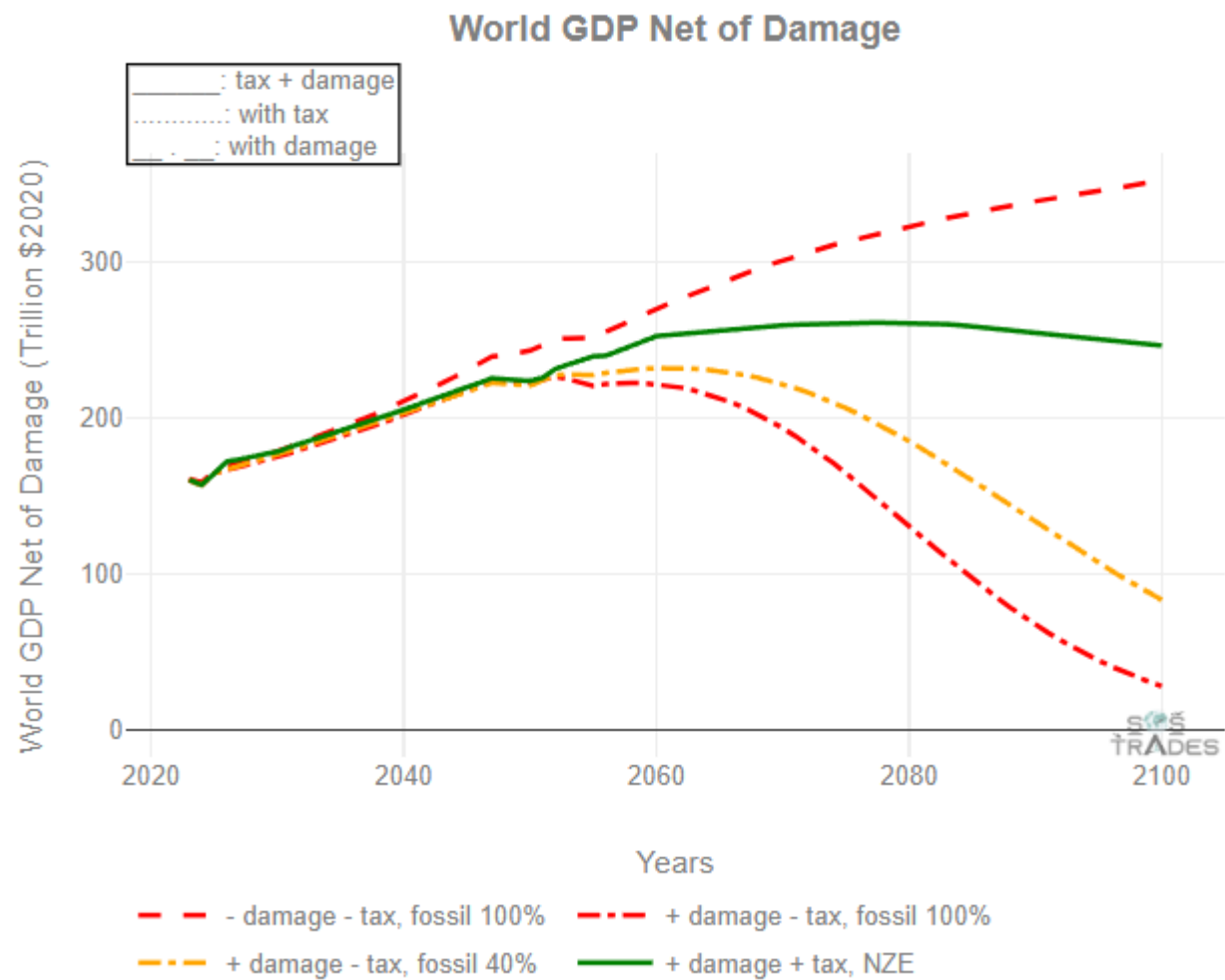
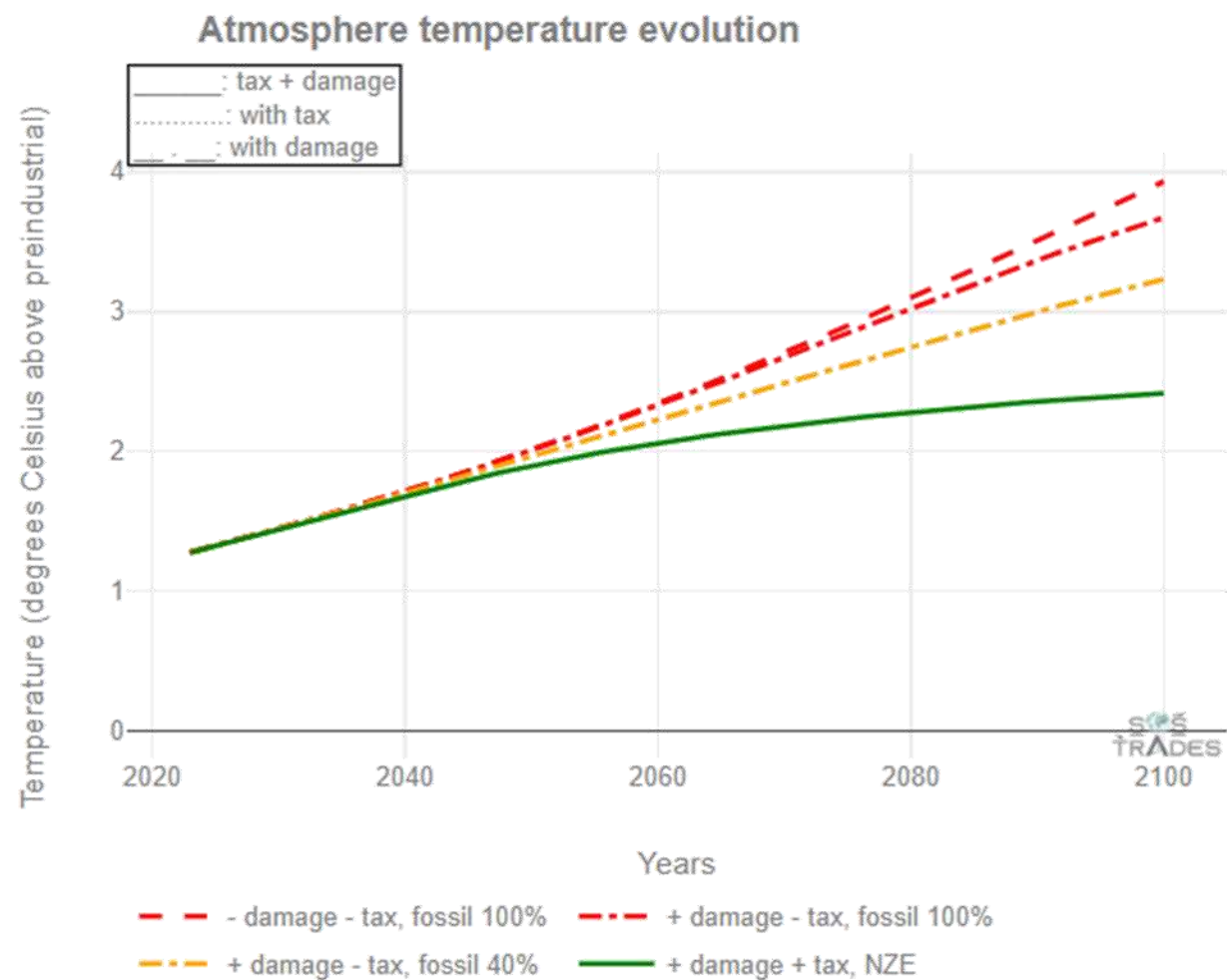


Tipping point at 6.081 °C

Tipping point at 3,5°C



# DIFFERENT CARBON INTENSITY SCENARIOS WITH A 3.5°C TIPPING POINT



<https://latest.osc-tsa.com/study/256>

# CONCLUSION & NEXT STEPS

## Conclusion on the tipping point effects

- Even if obvious: the tipping point temperature is a key parameter that can completely change the scenario generation results. It is one of the key driver of damages in WITNESS.

- WITNESS using Weitzman Formula

- GDP (Y) is directly impact by the damage function:

$$Y = A \cdot (\alpha \cdot Ku^\gamma + (1 - \alpha) \cdot L^\gamma)^{\frac{1}{\gamma}} \quad \text{with} \quad Ku = Kne \cdot \frac{En}{E\_max\_k}$$

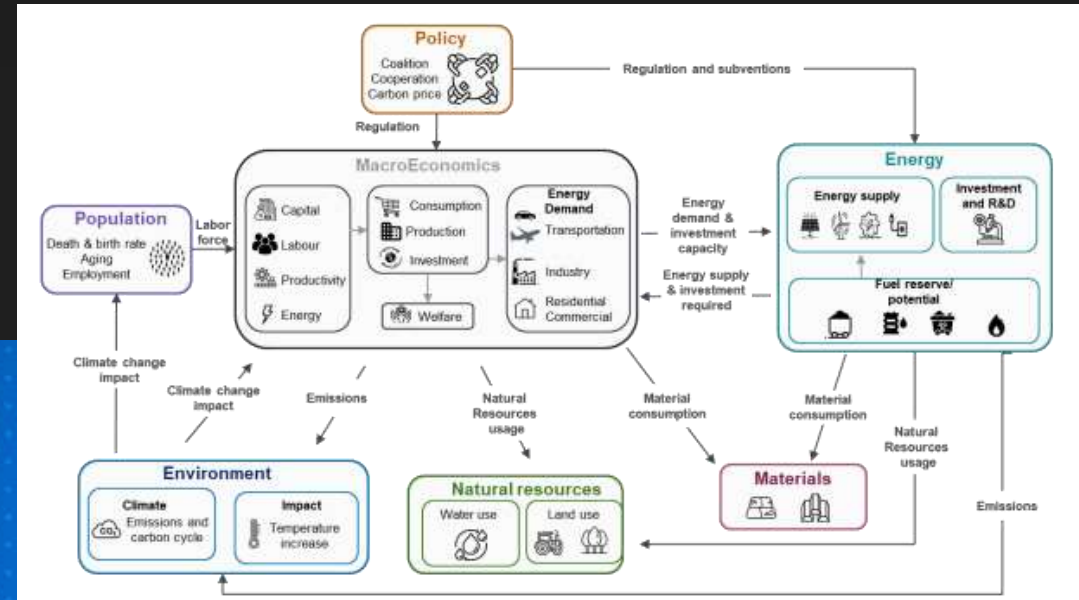
and  $Q_t = (1 - \Omega_t)Y_t$  where  $\Omega$  is the damage fraction of output (see [damage model documentation](#))

- Global damage GDP model potentially generate partial double accounting effect with other indirect damages already taken into account
  - on Population (due to climate impact on population, hence on labor force available)
  - on Macro-Economics (due to high temperature productivity loss)
  - on Agriculture (due to Crops productivity loss)

## Future research : new damage function(s)

- Direct damage on GDP does not allow to take full advantage of WITNESS advanced coupling
- It would be ideal to have a damage function that affects directly the capital (K) along with the existing damage on Labor (L) and agriculture
  - Inspired from physical risks damage functions ?
  - Which level of world distribution is required ?

# Thank You



Interested in contributing?

<https://www.witness4climate.org/>

WITNESS website  
Links to OS-C, github, live platform...



Interested in learning more ?

[https://www.iamcdocumentation.eu/index.php/Reference\\_card\\_-\\_WITNESS](https://www.iamcdocumentation.eu/index.php/Reference_card_-_WITNESS)

WITNESS  
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