

# Environmental complexity

## What role for IT?

Stéphane Grumbach

INRIA



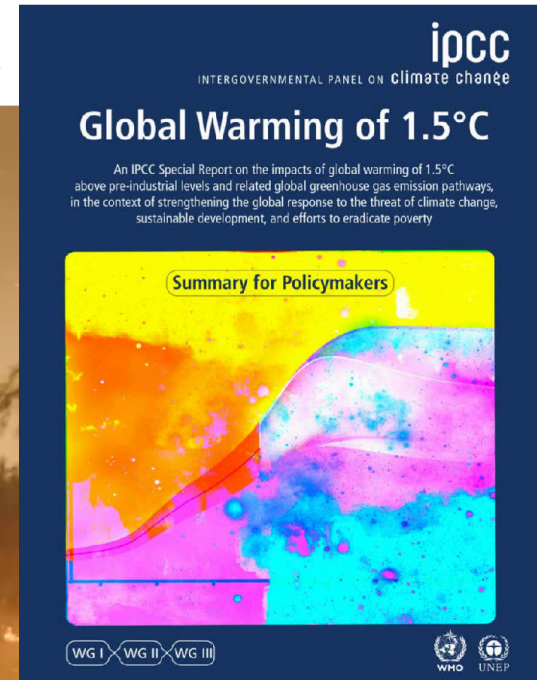


<https://www.erikjo.com/>

# We have 12 years to limit climate change catastrophe, warns UN

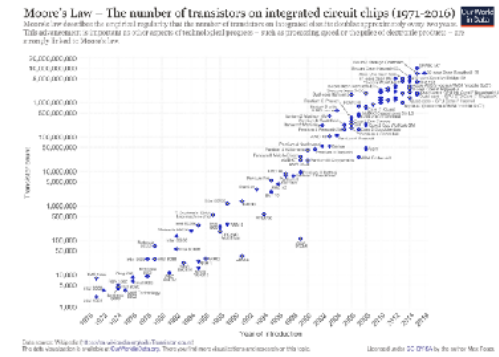
**Urgent changes needed to cut risk of extreme heat, drought, floods and poverty, says IPCC**

- **Overwhelmed by climate change? Here's what you can do**

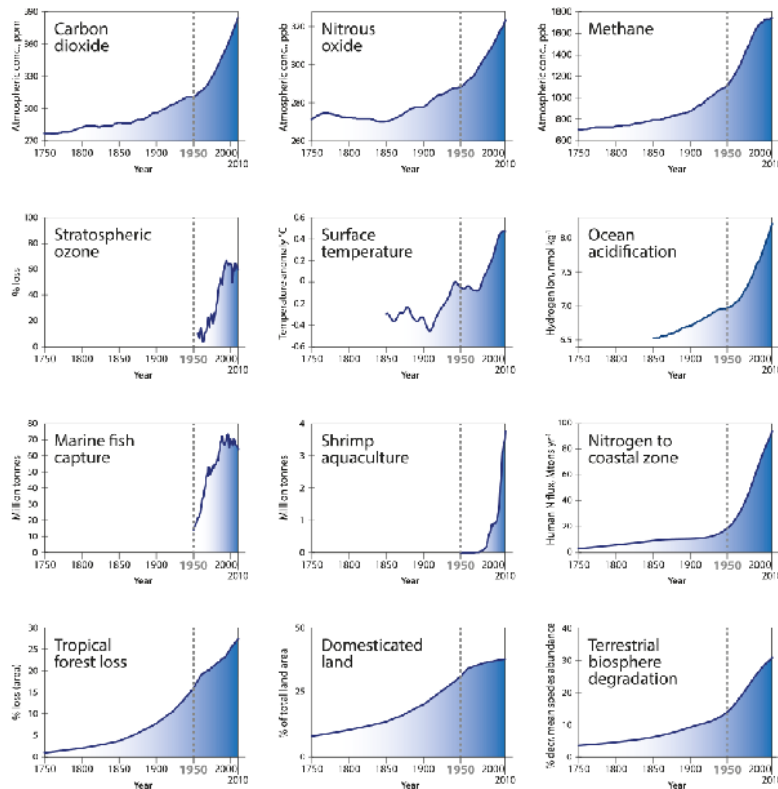


<https://www.theguardian.com/environment/2018/oct/08/global-warming-must-not-exceed-15c-warns-landmark-un-report>

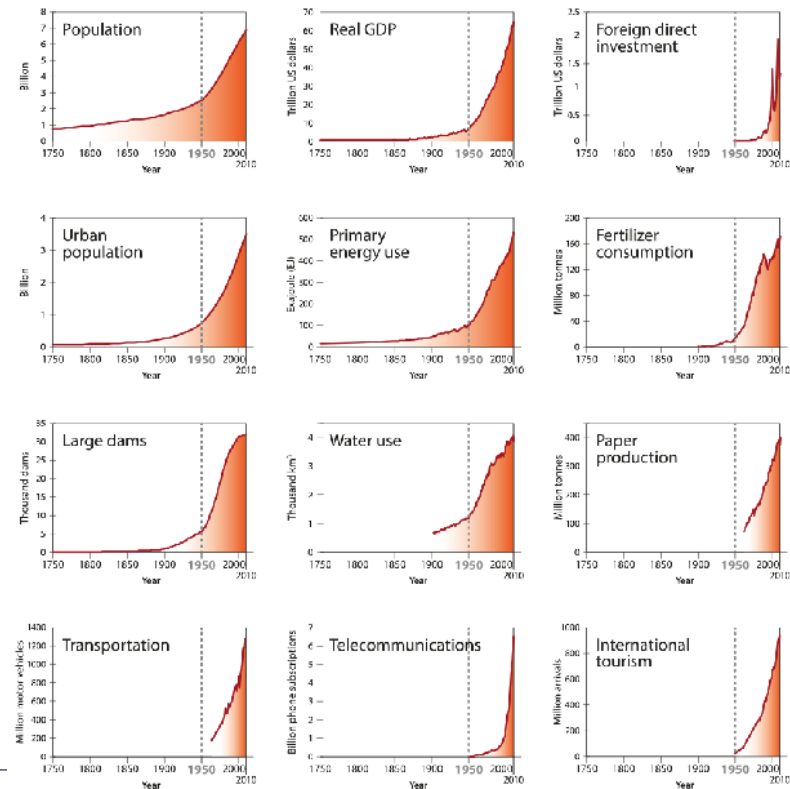
# Great Acceleration Earth, Society & IT



## Earth system trends



## Socio-economic trends



Steffen, Will; Crutzen, Paul J.; McNeill, John R. (2007). "The Anthropocene: Are Humans Now Overwhelming the Great Forces of Nature?". *Ambio*. 36 (8)

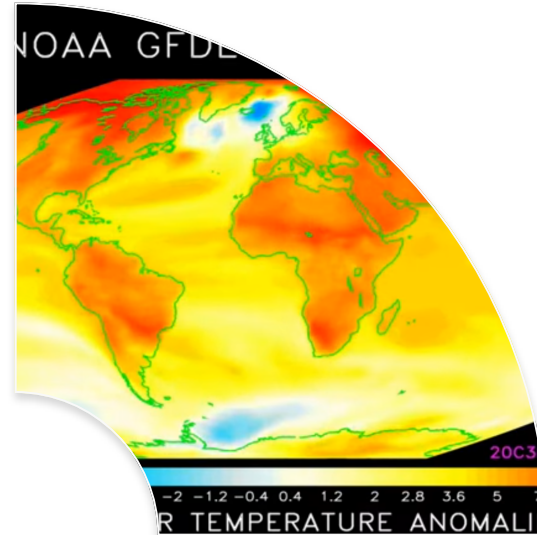


# Digital & Global Environnement

*Technological  
Solutions*

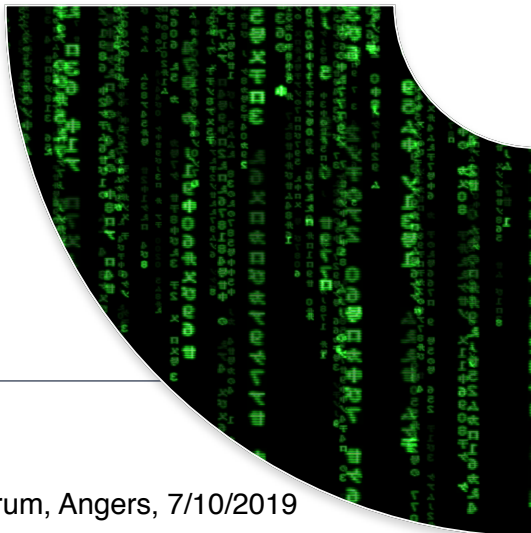


*Models &  
Predictions*

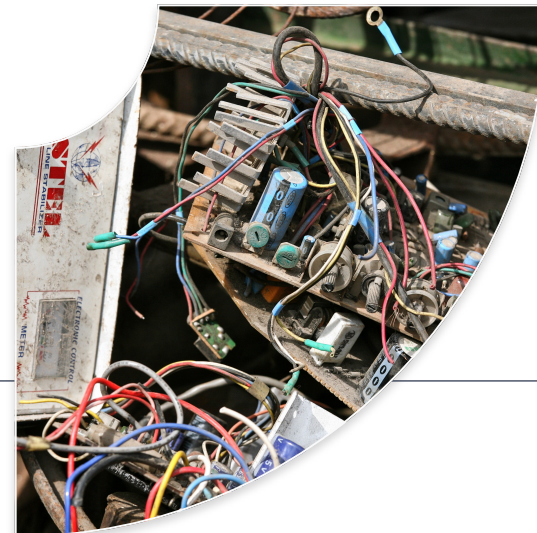


interactions

*Control  
Society*



*Negatives  
Externalities*



*Inria*

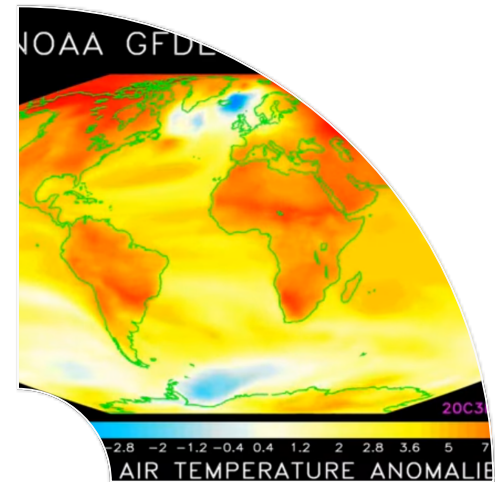
# I. Models & predictions

Data collection (Sensing)

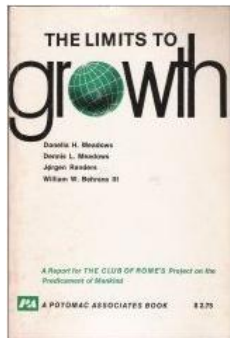
Complexes circulation models  
atmosphere, ocean, ground, vegetation, ...

Predictions increasingly reliable

Sharing of data & resources



Svante Arrhenius  
Nobel chemistry 1903  
CO<sub>2</sub> atmosphere =>  
Earth surface warming



RESTORING THE QUALITY  
OF  
OUR ENVIRONMENT



Report of The  
Environmental Pollution Panel  
President's Science Advisory Committee

THE WHITE HOUSE  
NOVEMBER 1965

## 1970 Radical awareness



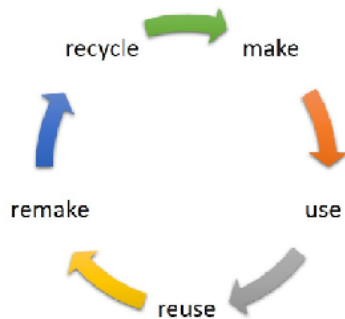
## II. Technological Solutions

Frugal use of resources

- sharing, circular models, ...
- optimization, **homeostasis**

“smart grid” energy intermediation

- zillions of consumers
- zillions of unreliable producers



### **New supply / demand arbitrage**

consumption adaptable to production  
priority to critical infrastructures

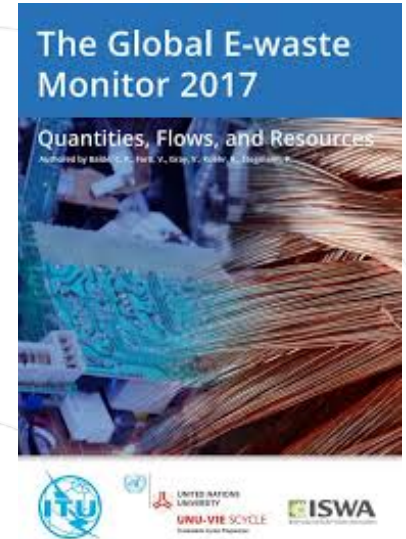
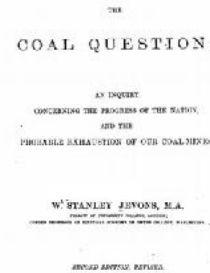
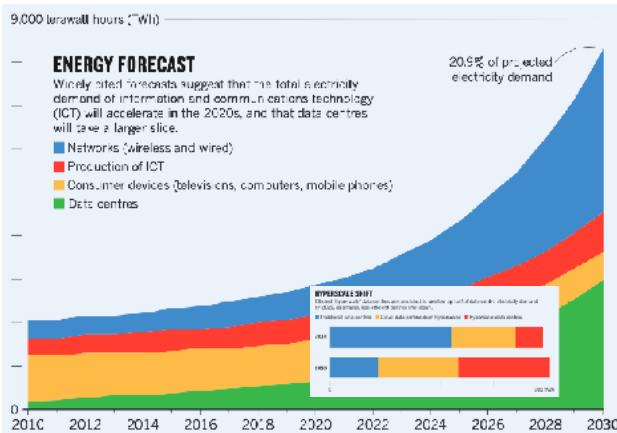


# III. Negative Externalities

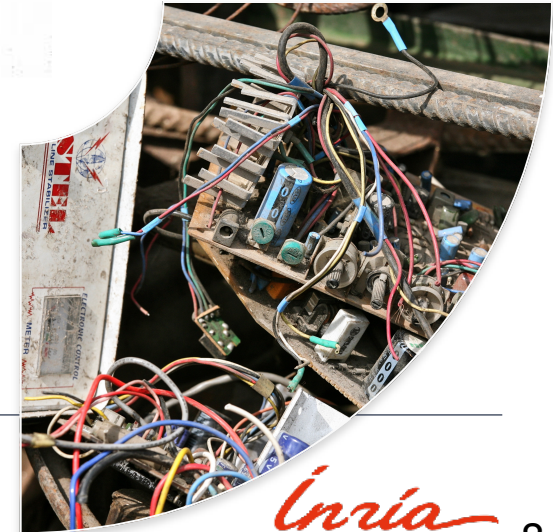
Energy consumption  
from 10% to 20% electricity

Environmental pollution  
e-waste: 6kg/person (2016)

Social disruption  
new de facto norms



Jevons Paradox



Inria



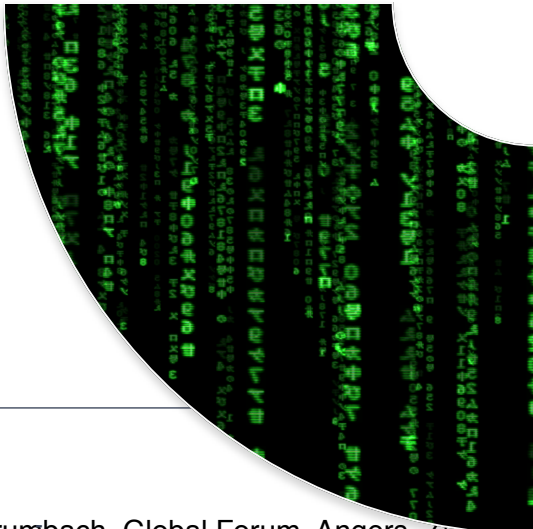
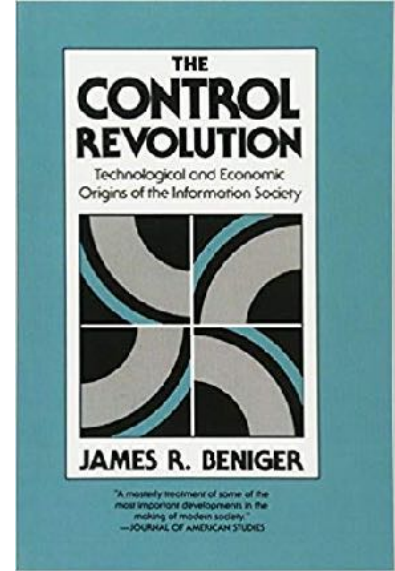
# IV. Control Society


Digital :

= economy based on control  
maximal exploitation of information

Evolution of the global environment :

= new complexity  
intrication human activities / ecosystems





Let us  
be careful  
in the way  
we intent to build  
a harmonious future