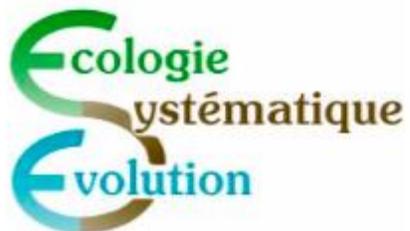




# Les tortues marines contre la transition énergétique ?

Marc Girondot



Laboratoire Ecologie, Systématique et Evolution  
ESE – UMR8079



# Transition énergétique

Le terme « transition énergétique » désigne un changement dans le mode de production de l'énergie.

C'est ce qui s'est passé quand on a effectué une transition entre la force humaine et la machine à vapeur lors de la révolution industrielle.



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# Transition énergétique

Le terme « transition énergétique » désigne un changement dans le mode de production de l'énergie.

A l'heure actuelle, ce terme est utilisé dans une acception plus étroite:

- Production d'énergie décarbonée



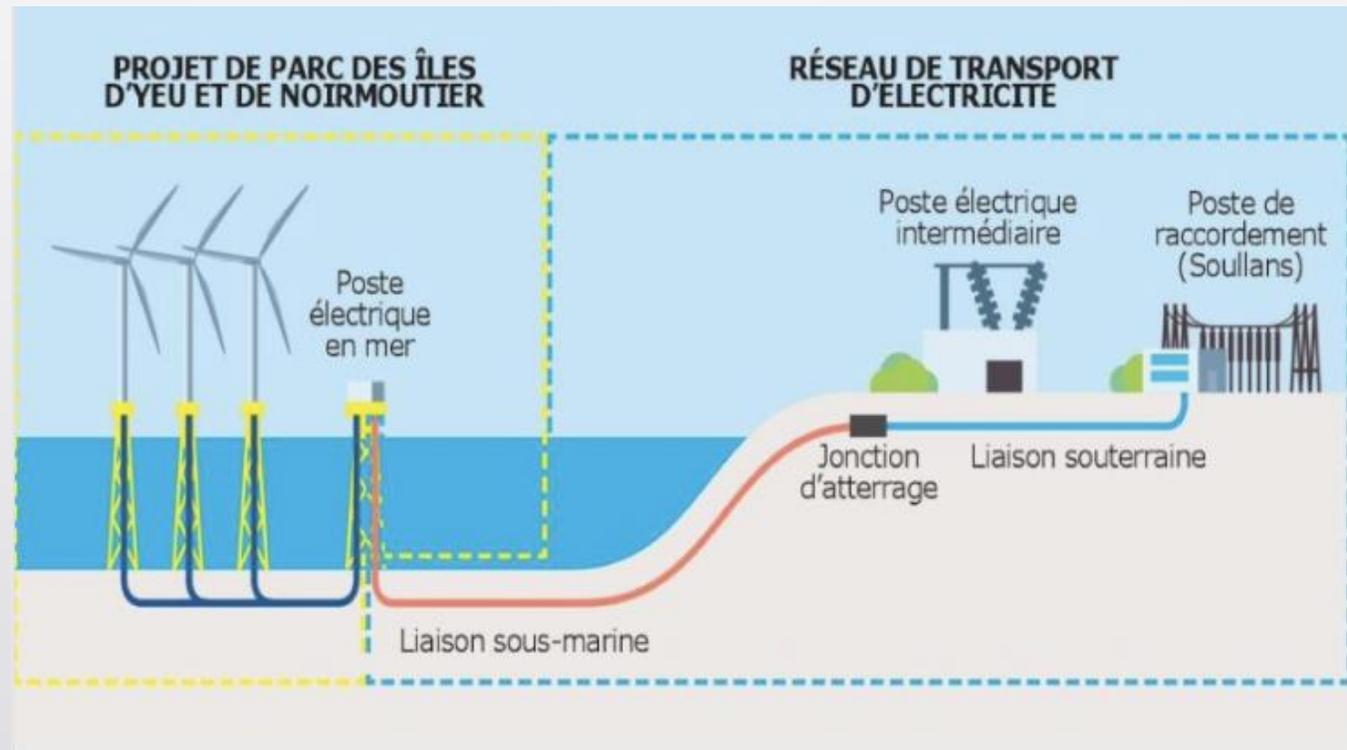
# Développement de l'éolien en mer



Les éoliennes en mer sont-elles une menace pour les tortues marines ?



# L'éolienne en mer dans son écosystème industriel





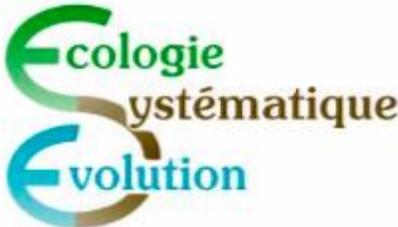
# Les menaces

- Collision par les systèmes d'ancrage +
- Collision par le trafic maritime à proximité +++
- Pollution par peinture antifouling ++
- Pollution électro-magnétique ++++
- Modification des courants +
- Disponibilité alimentaire -



# Les tortues marines face aux pollutions chimiques

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# Quels polluants ?

- Éléments traces (incluant les « métaux lourds »)
- Substances chimiques fabriquées par l'homme



# Règlement Reach

## *Registration, Evaluation, Authorization and restriction of Chemicals*

- REACH est un règlement de l'Union européenne adopté pour mieux protéger la santé humaine et l'environnement contre les risques liés aux substances chimiques, tout en favorisant la compétitivité de l'industrie chimique de l'UE.
- 20 000 substances chimiques ont été déclarées jusqu'en 2018.



# Tortues marine et polluants

- La quasi-totalité des travaux concerne le dosage de divers polluants chimiques chez des tortues marines avec effet de:
  - L'espèce, le lieu de capture, le sexe, l'organe, l'année, le statut reproductif.
- Cela permet de produire un niveau de référence mais... et alors; on en fait quoi ?



# Relation entre la mort d'un animal et la concentration d'un polluant

- Les animaux (*Lepidochelys olivacea* au Mexique) morts ont une concentration sanguine plus importante en strontium et cadmium que les individus vivants.
- Cause ou conséquence de la mort ?

## Article

# New Method for Imputation of Unquantifiable Values Using Bayesian Statistics for a Mixture of Censored or Truncated Distributions: Application to Trace Elements Measured in Blood of Olive Ridley Sea Turtles from Mexico

Inmaculada Salvat-Leal <sup>1,†</sup>, Adriana A. Cortés-Gómez <sup>2,†</sup>, Diego Romero <sup>1</sup> and Marc Girondot <sup>2,\*</sup>

<sup>1</sup> Toxicology Area, Faculty of Veterinary Medicine, Regional Campus of International Excellence 'Campus Mare Nostrum', University of Murcia, Espinardo, 30100 Murcia, Spain

<sup>2</sup> Laboratory Ecologie Systématique et Evolution, Université Paris-Saclay, CNRS, AgroParisTech, 91190 Gif-sur-Yvette, France

\* Correspondence: marc.girondot@universite-paris-saclay.fr

† These authors contributed equally to this work.

**Simple Summary:** Analytical science in environmental research is frequently confronted with the problem of detection limits or missing data in the analyzed variables. This situation precludes the use of common methods of statistical analysis. We have developed a method to estimate the distribution of samples below or above the detection limit and were able to estimate the statistical distribution of the missing data. We test this method using a dataset of 25 trace elements measured in dead and alive marine turtles. We confirm previous finding that Cd and Na are significantly associated with dead or alive status, and we show that strontium concentration is also linked to this status.

**Abstract:** One recurring difficulty in ecotoxicological studies is that a substantial portion of concentrations are below the limits of detection established by analytical laboratories. This results in censored distributions in which concentrations of some samples are only known to be below a threshold. The currently available methods have several limitations because they cannot be used with complex situations (e.g., different lower and upper limits in the same dataset, mixture of distributions, truncation and censoring in a single dataset). We propose a versatile method to fit the most diverse situations using conditional likelihood and Bayesian statistics. We test the method with a fictive dataset to ensure its correct description of a known situation. Then we apply the method to a dataset comprising 25 element concentrations analyzed in the blood of nesting marine turtles. We confirm previous findings using this dataset, and we also detect an unexpected new relationship between mortality and strontium concentration.

**Keywords:** detection limit; Bayesian model; censored distribution; truncated distribution



**Citation:** Salvat-Leal, I.; Cortés-Gómez, A.A.; Romero, D.; Girondot, M. New Method for Imputation of Unquantifiable Values Using Bayesian Statistics for a Mixture of Censored or Truncated Distributions: Application to Trace Elements Measured in Blood of Olive Ridley Sea Turtles from Mexico. *Animals* **2022**, *12*, 2919. <https://doi.org/10.3390/ani12212919>

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## 1. Introduction

Missing data are a common problem in the analytical sciences. In some fields, concentrations can be too low to be quantitatively detected because they are below the detection limit. For instance, this commonly occurs when determining the concentration of chemical elements in different samples. If the concentration is low, some laboratories cannot detect the presence of the chemical. However, it may still be present but at a concentration below the detection limit of the laboratory equipment. On the other hand, some concentrations may be too high, and detector saturation may prevent the accurate reporting of values [1]. The resulting data distributions are known as left and right cuts, respectively, and the limits of detection are the lower (LDL) and upper (UDL) detection limits. It is important to note that the LDL and UDL can simultaneously occur in a dataset. The measurements below the LDL or above the UDL are sometimes referred to "missing" [2], "nondetectable" [3], or



# Le changement climatique

Marc Girondot



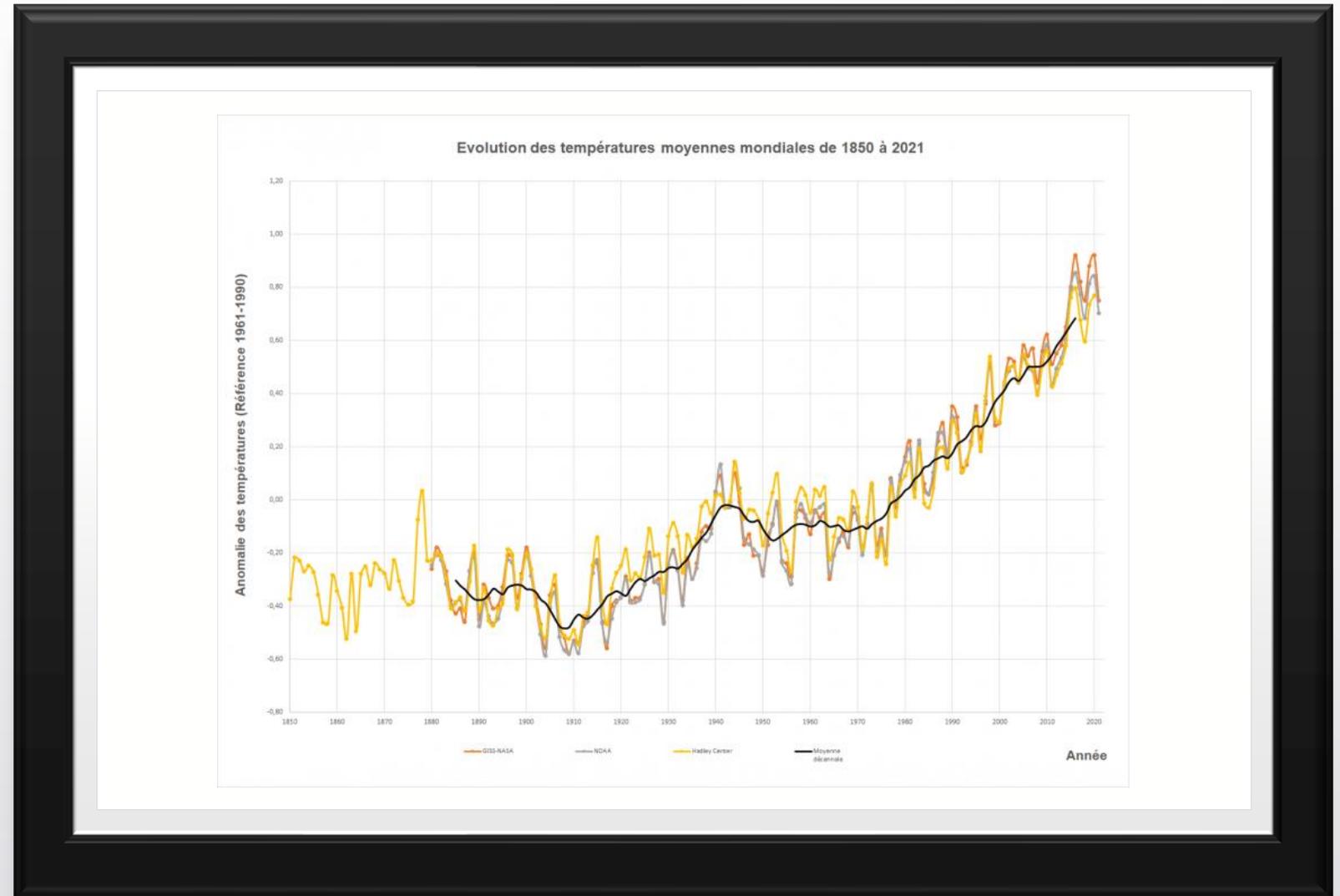
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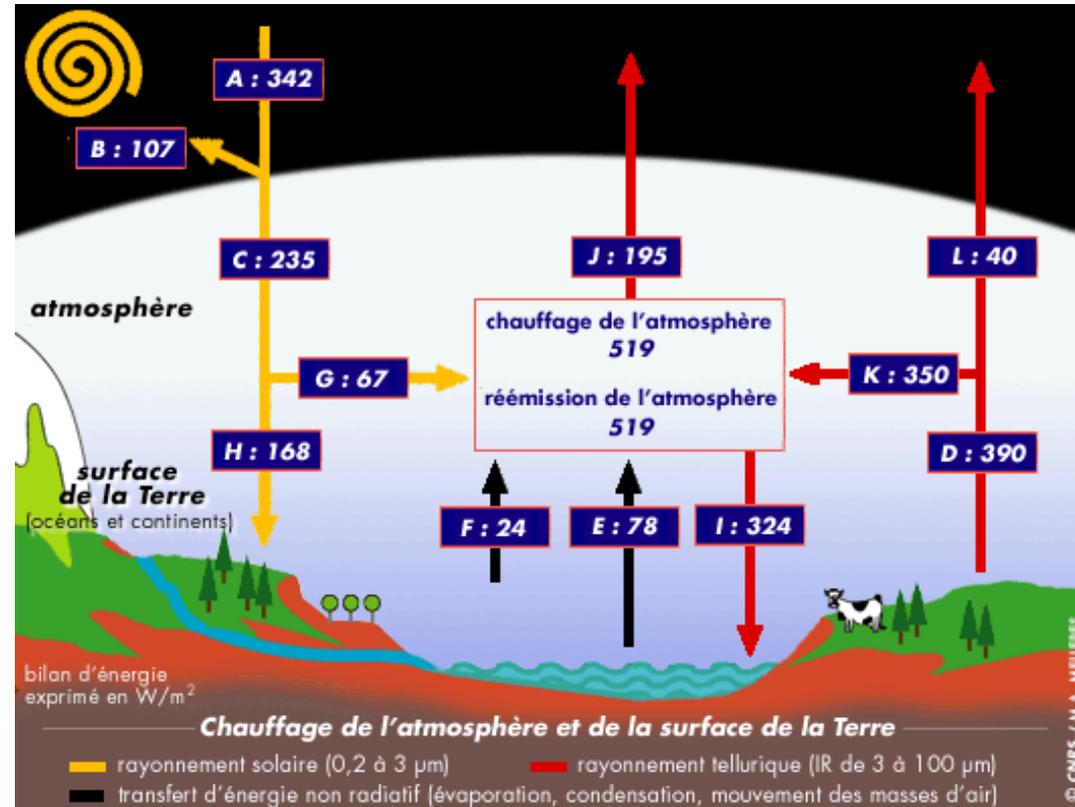
# Evolution des températures moyennes sur la terre

1850-2020



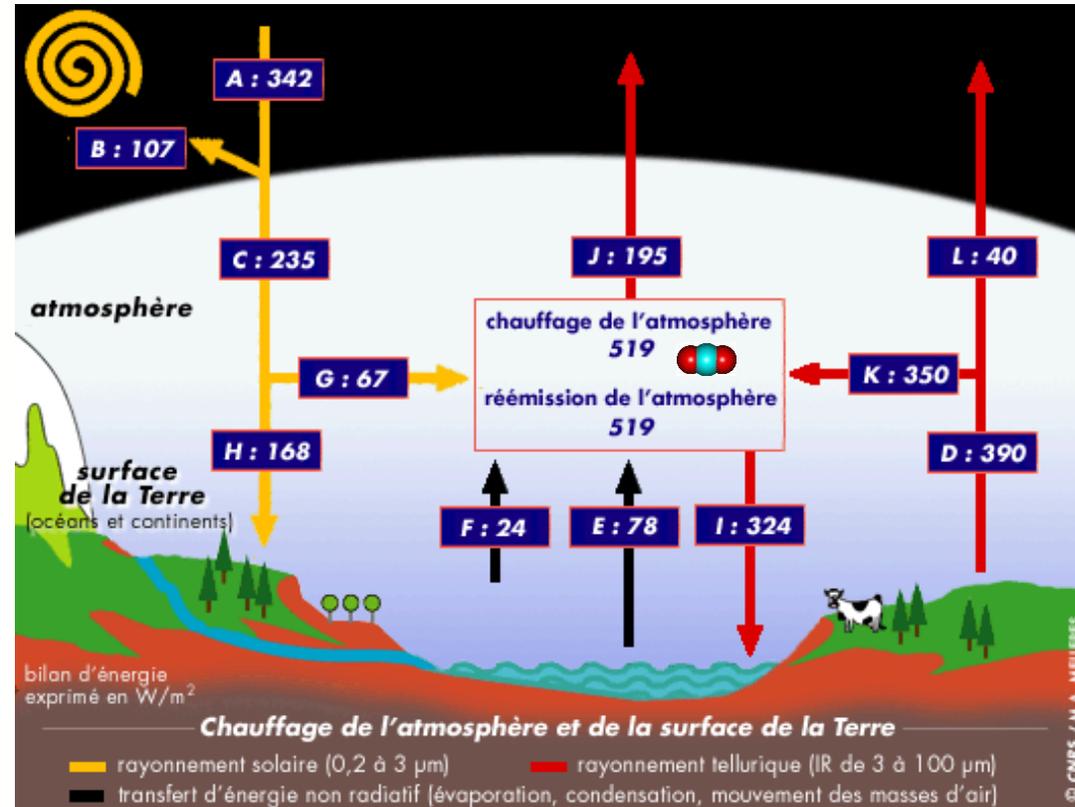


# Origine du réchauffement climatique





# Origine du réchauffement climatique





# Conséquences

- Augmentation des températures
  - Succès d'incubation et détermination du sexe
- Changements des courants
  - Changement de localisation des sites de pontes
  - Changement de localisation des sites d'alimentation
- Changement du niveau de la mer
  - 50% dû à la fonte des glaces – 50% dû à la dilatation des océans
  - Erosion - Submersion
- Cyclones