



# International Union of Aerospace Insurers (IUAI)

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# SPACE CARBON FOOTPRINT

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# Plan

1. Carbon footprint and climate change: where do space activities stand?
2. Top of the iceberg
3. Climate monitoring based on space missions



# 1. Carbon footprint and climate change: where Space missions stands?



## AVIATION

Controversial topic in climate debates

1.9% greenhouse gas emissions

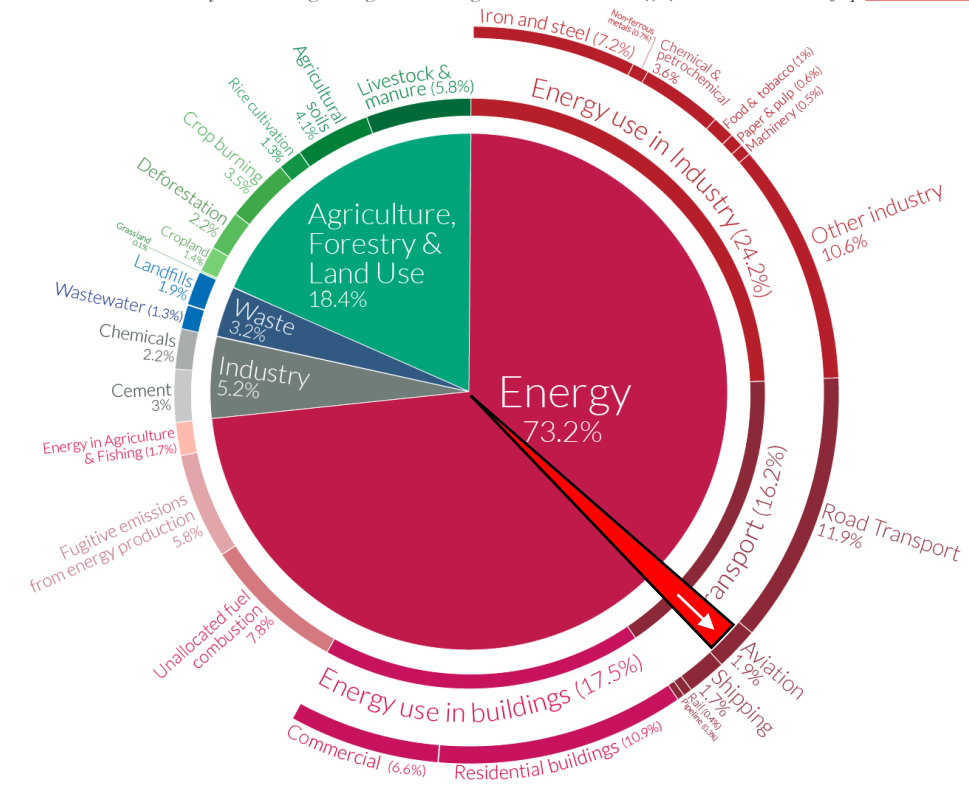
~2.5% of CO2 emissions

Non CO2 effects

## Global greenhouse gas emissions by sector



This is shown for the year 2016 – global greenhouse gas emissions were 49.4 billion tonnes CO<sub>2</sub>eq.



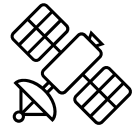
OurWorldinData.org – Research and data to make progress against the world's largest problems.

Source: Climate Watch, the World Resources Institute (2020).

Licensed under CC-BY by the author Hannah Ritchie (2020).

Aviation carbon footprint is measured

# 1. Carbon footprint and climate change: where Space missions stands?



**SPACE**



## 2. Top of the iceberg

Environment-friendly rocket propulsion\*

### Solid propulsion

Aluminium oxide,  
Soot, Black  
carbon, CO<sub>2</sub>,  
Hydrogen chloride,  
Nitrogen Oxides,  
Hydrogen

### Hypergolic fuel

CO<sub>2</sub>, Steam, Soot,  
Sulfure containing  
compounds, NO<sub>x</sub>

### RP-1

CO<sub>2</sub>, Steam, Nox,  
Soot, Carbon  
Monoxide and  
Sulfur Compounds

### Methane

CO<sub>2</sub>, Steam, traces  
of NO<sub>x</sub>

### Hydrogen

H<sub>2</sub>O  
(steam),  
traces of NO<sub>x</sub>



Launches are the top of the iceberg

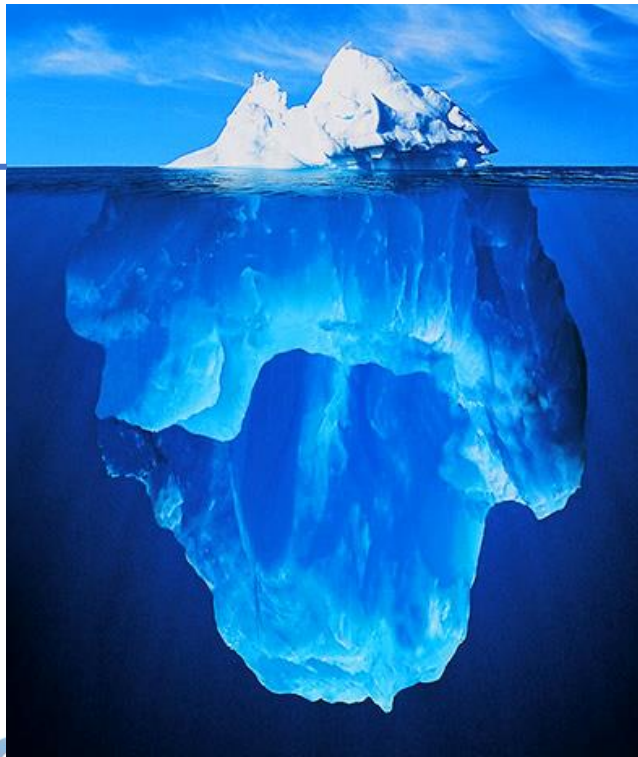
\*focus on 1st stages



## 2. Top of the iceberg

Environment-friendly rocket propulsion\*

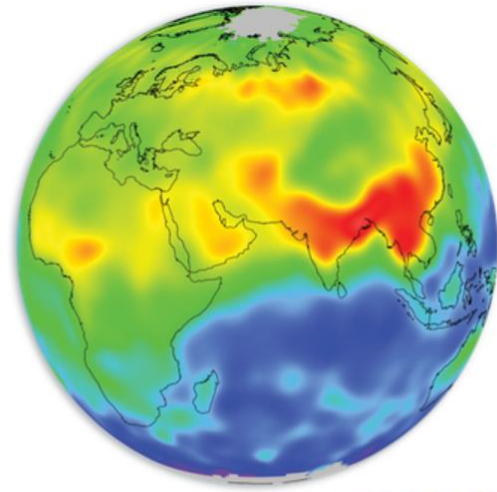
Solid propulsion	Hypergolic fuel	RP-1	Methane	Hydrogen
Aluminium oxide, Soot, Black carbon, Hydrogen chloride, Nitrogen Oxides, Hydrogen.	CO <sub>2</sub> , Steam, Soot, Sulfure containing compounds, NOx	CO <sub>2</sub> , Steam, NOx, Soot, Carbon Monoxide and Sulfur Compounds	CO <sub>2</sub> , Steam, traces of NOx	H <sub>2</sub> O (steam), traces of NOx



End-to-end Life cycle analysis are needed  
Re-entry effects to be studied in depth



### 3. Climate monitoring based on space missions



*Global concentrations of atmospheric methane produced by ESA CCI from satellite data provide important information about the distribution of sources and sinks of this powerful greenhouse gas. Source: ESA.*



?

Space missions provide unique data for climate monitoring and modelling.  
Relevance of space tourism?





# Conclusion

**YES** space as part of transportation activities is polluting..... But today effects are not fully measured

**YES** contribution of space activity are negligible..... But based on current launch activity

**YES** Improvement are being made on the propulsion and overall launcher development process

**YES** space missions are necessary ..... But what is the relevance of space tourism?





# Thank you

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