Air pollution in Buenos Aires: advances in the assessment of harmful effects associated with vehicle exhaust.

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Outline

- The research group of CNEA
  - Problems and solutions space
  - Our approach
- Associations
  - Research cooperations (S-S)
    - Example 1 - Natural sciences research
      - Buenos Aires on road transport VOC emissions and human health
    - Example 2 - Natural sciences + social science research
      - Air pollution impact on human health: Buenos Aires (Argentina) and Santiago (Chile)
- Cooperations with decision makers
Problems and solutions space
Technological and socioeconomic drivers
Production per capita, energy intensity, carbon intensity, population, gross domestic product, etc.

Mitigation

Particles, VOC, CO, NO\textsubscript{x}, SO\textsubscript{2}, NH\textsubscript{3}

Technological development
Changes in lifestyle

CO\textsubscript{2}
Other GEI

Carbon Cycle
Radiative forcing
Other forcings

Climate change
Extreme events

Vulnerability

Adaptation

Strategies

O\textsubscript{3}
SO\textsubscript{4}\textsuperscript{2-}

Technological and socioeconomic drivers
Production per capita, energy intensity, carbon intensity, population, gross domestic product, etc.
Our approach
From emissions to impacts

Transport Models

\[ \frac{\partial c}{\partial t} = -c \nabla \cdot \nu - \nabla \cdot \nu c - \nabla \cdot (\langle c' \nu' \rangle) + Q - S \]

Air Quality

Vulnerability and adaptation
Associations
Sur–Sur research cooperation
Research cooperations (2005-2009)

With the exception of Brasil, the earth sciences human resources were scarce and isolated.
<table>
<thead>
<tr>
<th>Country</th>
<th>Collaborations</th>
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<tbody>
<tr>
<td>Argentina</td>
<td>2 (Nature science) + 1 (social science)</td>
</tr>
<tr>
<td>Bolivia</td>
<td>1</td>
</tr>
<tr>
<td>Brasil</td>
<td>2</td>
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<tr>
<td>Colombia</td>
<td>3</td>
</tr>
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</tr>
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<td>Cuba</td>
<td>1</td>
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<td>Perú</td>
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On road vehicle emissions and human health effects
On road vehicles emission inventory for the Metropolitan Area of Buenos Aires

One relevant outcome: impact of the incorporation of Natural Gas, in terms of GHGs reductions
On road vehicles emission inventory for the Metropolitan Area of Buenos Aires

PE: pre-euro vehicles (older)
EU: euro (news)
Emissions of COVNM Speciation Results

- Parafinas
- HNS
- Oxigenados
- Aromáticos
- HAPs

Percentage distribution of emissions for different vehicle types:
- Veh. Livianos nafta
- Veh. Livianos GNC
- Veh. Livianos diesel
- Veh. Pesados diesel

Vehicle types and their respective COVNM contributions:
- 2C
- 3C
- 4C
- 5C
- 6C
- 7C
- 8C
- 9C
- 10C
- 11C
- 12C
- 13C
- 14C
- 15C
- 16C
- 18C
- Otros

Diesel
Nafta
GNC
where, 
PHT Human Potential Toxicity for specie \(i\) at time \(t\), in terms of 1,4-DCB 
\(m_i=\) emission of specie \(i\)

![Graph showing human potential toxicity](image)

This LCA analysis considers particulate matter undifferentiated as PM10 (particles size less than 10 \(\mu\)m).

It is well known, however, that there are many important particle properties, such as size, water solubility, chemical toxicity, which have significant influence on the effects human health.

Dominic Notter
Older vehicles (without control emission devices) are responsible of the 90% of the human health effects. Older vehicles (without control emission devices) are responsible of the 90% of the human health effects.

The health impacts from mobile sources emissions from vehicles will be significantly reduced by increasing the controls on gasoline light duty vehicles. These measures will be also beneficial for the use of biofuels.
Estatistical analysis between pollution and human health effects
CO increase has a strong impact on cardiovascular mortality.
The effects of Nox on the respiratory system are not enough high to provoke the death.

In Santiago there are 0.4 - 1% more cardiovascular deaths than in Buenos Aires y Santiago due to an increase of 10 ppb of NOx.

Nox impacts are lower than CO impacts.

The difference between cities may be due to the presence of other stresses such as the synergy with other pollutants co-present in Santiago’s atmosphere, like breathable particulate matter whose concentration is 3 times higher than in Buenos Aires, which can promote a greater susceptibility to particular stressors.
Colaboration with decision makers
First approach to link our results with decision makers

Science and technology

Questions → Research → Results

Decision makers
Outcomes delivered

- Air pollution modelling protocol for EIAs / Stack gas measurement guidelines - Nowadays part of the regulation of Argentina (electricity generation, gas production, industrial production)

- Emission inventory for the Metropolitan Area of Buenos Aires (IAI project) Used as reference information for the environmental authorities of the city - Clean Air Initiative

- Studies for National Communications of Argentina to the UNFCCC

- IPCC guidelines and special reports - Darío Gómez, lead author
Since our relation with social sciences researchers (IAI project) we are looking to expand our approach.
The incorporation of the scientific knowledge (C + T) in the process of decision making is a complex challenge.

Limited disclosure of science and technology research results

Absence of incentives to use the science and technology research results in decision making institutional channels for the incorporation of these results

Stress between

<table>
<thead>
<tr>
<th>Long term research objectives</th>
<th>vs.</th>
<th>Short term policy needs</th>
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<tr>
<td>Research results suitable to be published in high impact research journals</td>
<td>vs.</td>
<td>The need to have relevant local information for environmental policy</td>
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Muchas gracias