International Civil Aviation Organization

WORKING PAPER

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HIGH-LEVEL GROUP ON INTERNATIONAL AVIATION AND CLIMATE CHANGE (HGCC)

THIRD MEETING

Montréal, 25 to 27 March 2013

Agenda Item 3: Policy issues related to market-based measures (MBMs)

CO_2 EMISSIONS COVERAGE OF THE GEOGRAPHIC SCOPE OPTIONS FOR THE FRAMEWORK FOR MBMs

(Presented by Belgium, France and the United Kingdom)

1. BACKGROUND

1.1 At the previous HGCC meetings, a number of options for the geographic scope of a framework on market-based measures have been discussed. Requests were also made for data to be presented on the effects of such a policy choice.

2. DISCUSSION

2.1 We would like to share the results of some analysis by Manchester Metropolitan University (MMU) on the CO_2 emissions coverage of different options on geographic scope. Attached to this paper is an Annex which includes a short presentation of the work.

2.2 The analysis by MMU used the 'FAST' modelling tool, recognised by ICAO-CAEP as this has the most complete database of flights from the latest available year. This model is regularly used within ICAO's CAEP for various calculations.

2.3 Based upon the findings of this analysis by MMU (page 8 of the Annex), the emissions coverage of the different geographic scope options would be:

Options	**Maximum potential coverage of international civil aviation CO_2 emissions if all States implement measures**
Arriving and departing flights within national airspace	22%

Flights arriving in, departing from and flying over national airspace	55%
Flights within the Flight Information Regions (FIRs) (including oceanic FIRs)	Full
Flights departing from an aerodrome in a State.	Full

3. CONCLUSIONS

3.1 The different geographic scopes will result in a varying degree of maximum potential emissions coverage. The exclusion of international airspace and over flights of national airspace from national and regional MBMs results in a significantly lower maximum potential coverage in emissions.

3.2 Analysis has demonstrated that MBMs are an essential part of the basket of measures needed to meet goals to stabilise and reduce international aviation emissions. In the absence of a global MBM, or pending its implementation, the reliance on a geographic scope approach that involves only a small portion of international aviation emissions being covered by MBMs would raise serious questions as to how the global goals can be met.

4. RECOMMENDATION

4.1 That the HGCC note the information presented in this paper.

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The University for
World-Class Professionals

Manchester
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MMU analysis of potential global MBM scenarios to mitigate international aviation emissions

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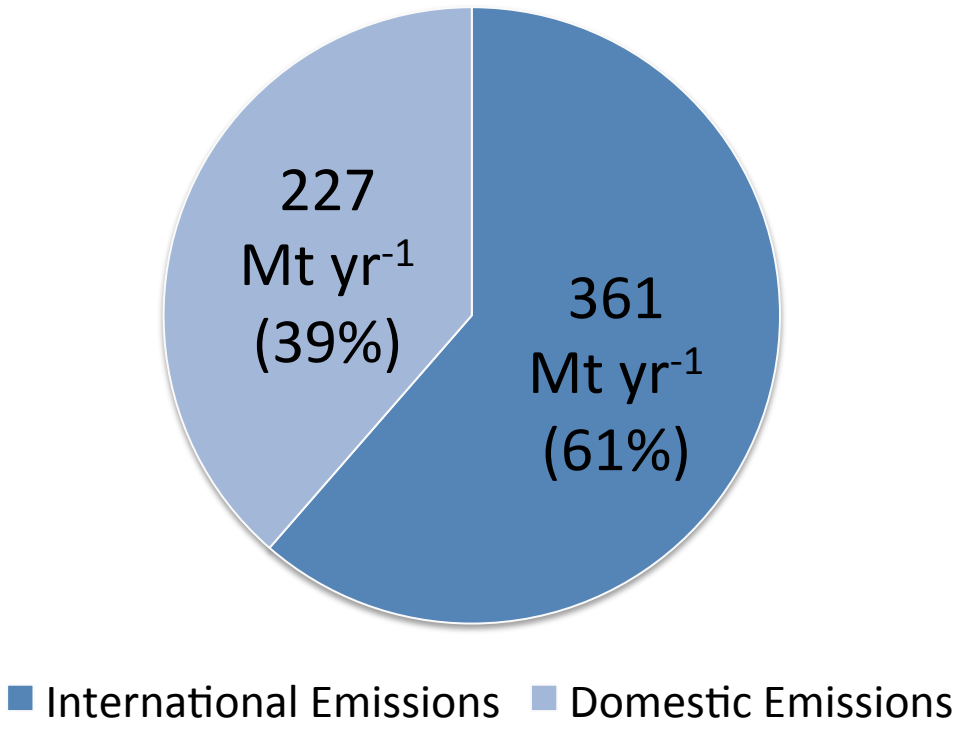
The analysis

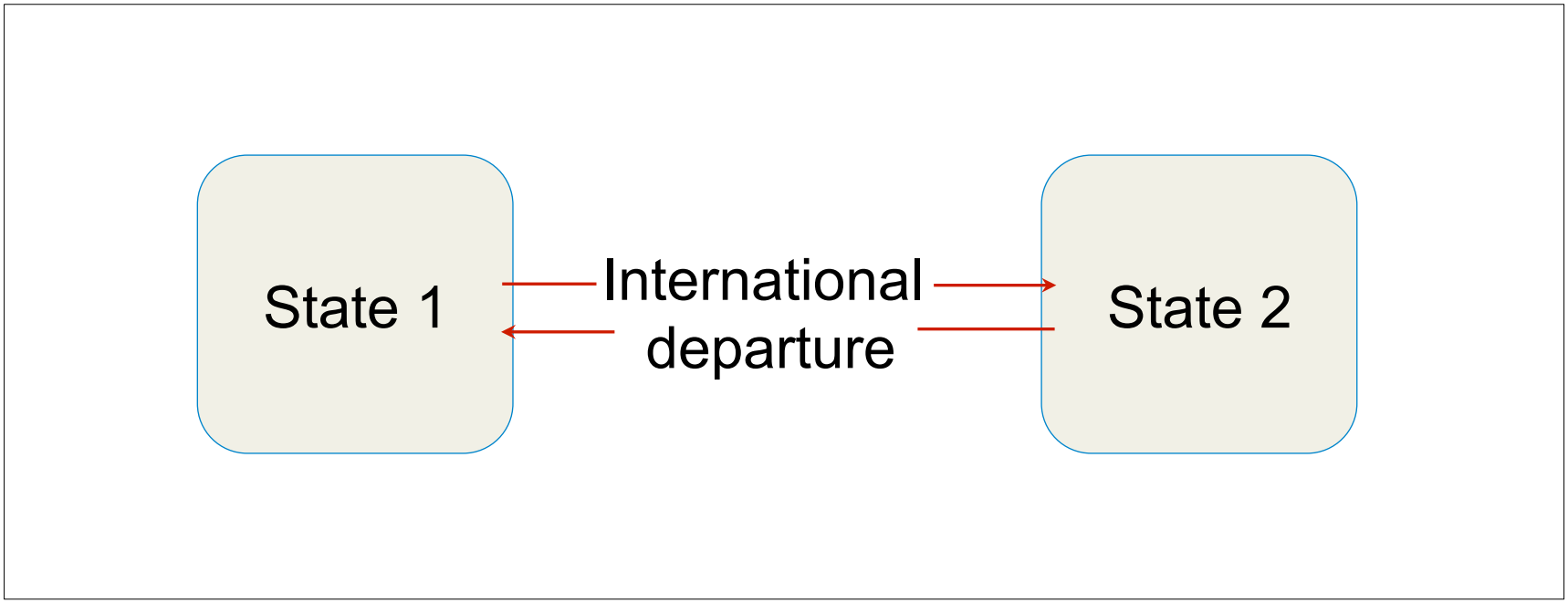
- An analysis of the coverage and allocation of 3 global scenarios for international aviation emissions of CO_2:
  - Case 1: departing flights, whole segments
  - Case 2: departing and arriving flights, sovereign airspace
  - Case 3: all (international) flights, FIR airspace

Global aviation emissions – a breakdown



Analysis made with MMU FAST model for 2006

Case 1: Globalized departing flights ETS



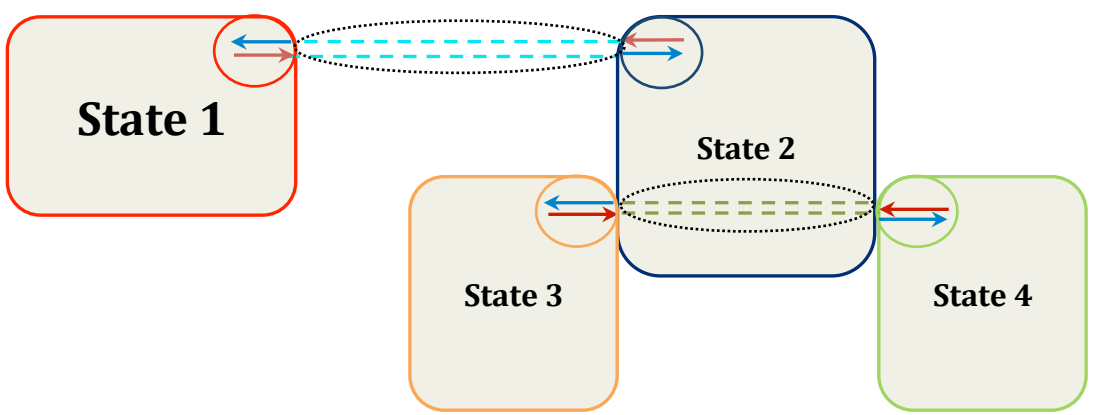
Case 1: Globalized departing flights ETS

- This would cover all departing international flights, 361 Mt yr^{-1} CO_2 or 61% of global emissions.

- Top 10 emitters account for ~50% of international emissions. The amounts and ranking are ~proportional to countries' traffic volumes and emissions.

- Some countries are quite different in that they are hubs.

Case 2: Airspace model



Key:

International Arrivals
International Departures
Over-water Departures and Arrivals
Over-flight Departures and Arrivals

Notes:

All international flights are covered.
Over-water and over-flight emissions are unallocated to states.

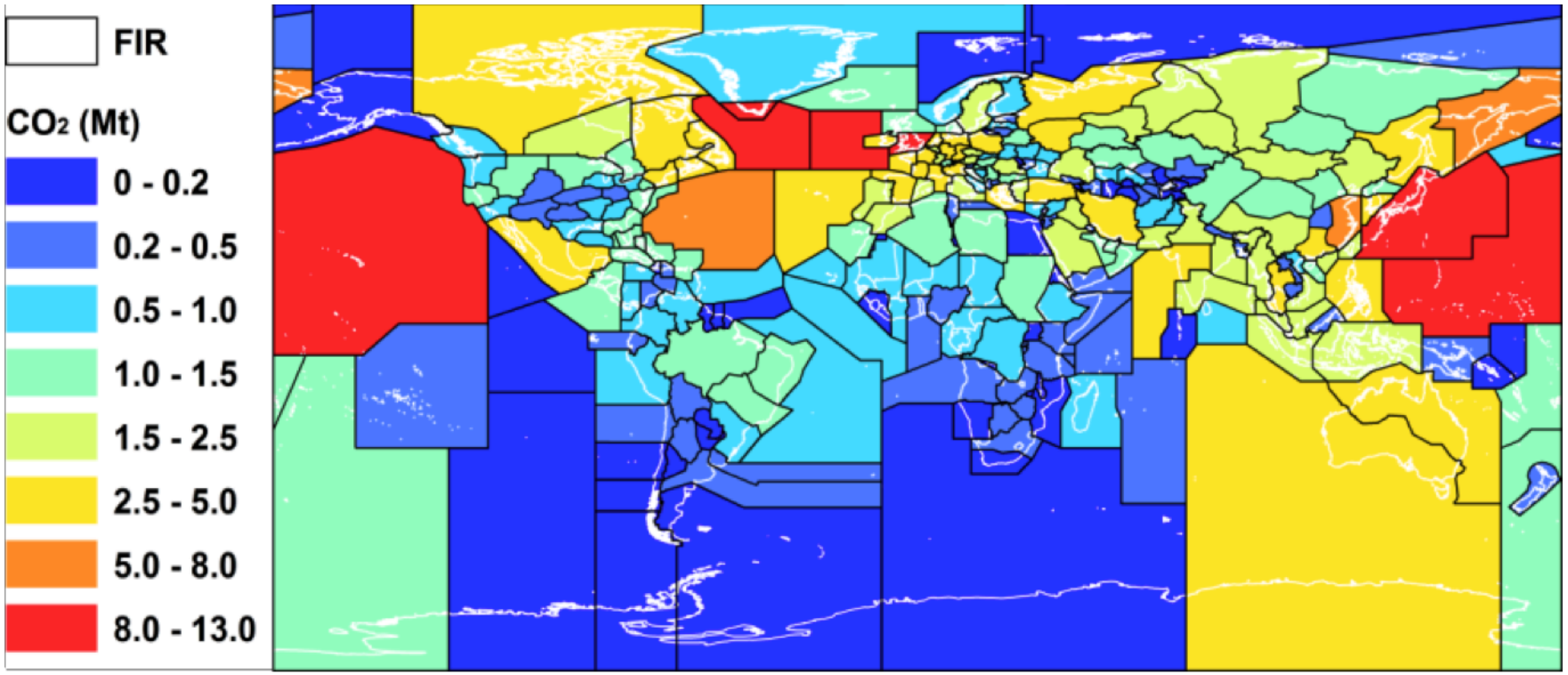
Case 2: Airspace ETS model

- Assumed that international departing/arriving flights allocated to sovereign airspace.
- Assumed that over-flights unallocated.
- Assumed that flights over international waters unallocated.

Allocation of total international aviation emissions to different types of airspace

Location of aviation emissions (2006)	Distribution of international aviation emissions
Emissions in state of departure and arrival	22%
Emissions from over flights of another state (over land)	33%
Emissions in international airspace (over water)	44%
Total emissions	100%

Case 3: Globalized ETS, airspace using FIRs



Case 3: Airspace model ETS using FIRs

- Emissions analysed according to ‘Flight Information Regions’ – regions of airspace where flight information and alerting services provided.
- FIRs allocated to countries and ICAO regions.
- Covers all traffic, only international considered.

Top 10 international aviation emitters under Case 1

Country	CO_2 (Mt yr^{-1})	% of global international emissions	% of global emissions
1. UNITED STATES	55	15	9
2. UNITED KINGDOM	29	8	5
3. GERMANY	21	6	4
4. JAPAN	17	5	3
5. FRANCE	15	4	3
6. SPAIN	11	3	2
7. CHINA	11	3	2
8. HONG KONG SAR	11	3	2
9. UNITED ARAB EMIRATES	10	3	2
10. NETHERLANDS	9	3	1
Total:	189 Mt yr^{-1}	53%	33%

Top 10 international aviation emitters under Case 2

Country	CO_2 (Mt yr^{-1})	% of global international emissions	% of global emissions
1. UNITED STATES	14	4	2
2. RUSSIAN FEDERATION	7	2	1
3. GERMANY	6	2	1
4. CHINA	6	2	1
5. FRANCE	4	1	1
6. UNITED KINGDOM	4	1	1
7. AUSTRALIA	4	1	1
8. SPAIN	3	1	1
9. CANADA	3	1	0.5
10. BRAZIL	3	1	0.4
Total:	54 Mt yr^{-1}	16%	10%

Top 10 international aviation emitters under Case 3

Country	CO_2 (Mt yr^{-1})	% of global international emissions	% of global emissions
1. UNITED STATES	45	12	8
2. CANADA	30	8	5
3. RUSSIA	29	8	5
4. UNITED KINGDOM	19	5	3
5. CHINA	18	5	3
6. FRANCE	16	4	3
7. JAPAN	13	4	2
8. GERMANY	11	3	2
9. INDIA	10	3	2
10. SPAIN	8	2	1
Total:	199 Mt yr^{-1}	54%	34%

If 50% of international emissions were to be covered:

- Under Case 1: the top 9 countries would cover ~50% of international emissions.
  - 8 of these countries are countries of high income and 1 country of upper middle income
- Under Case 2: *all* the countries would only cover 22% of international emissions.
- Under Case 3: the top 8 countries would cover ~50% of international emissions.
  - 6 of these countries are of high income, and 2 are countries of upper middle income.

If 80% of international emissions were to be covered:

- Under Case 1: the top 28 countries would cover ~80% of international emissions.
  - 17 of these countries are from high income countries, 9 are countries of upper middle incomes, and 2 are countries of lower middle income
- Under Case 2: *all* the countries would only cover 22% of international emissions.
- Under Case 3: the top 38 countries would cover ~80% of international emissions.
  - 20 of these countries are of high income, 10 are countries of upper middle income, 7 countries of lower middle income and 1 country of low income.

If 90% of international emissions were to be covered:

- Under Case 1: the top 50 countries would cover ~90% of international emissions.
  - 30 of these countries are of high income, 13 of upper middle incomes, 6 are countries of lower middle income and one country which is a low income country.
- Under Case 2: *all* the countries would only cover 22% of international emissions.
- Under Case 3: the top 64 countries would cover ~90% of international emissions.
  - 32 of these countries are high income countries, 18 are of upper middle income, 12 of lower middle income and 2 countries are low income.

Comparison of Cases by World Bank income type

1. By percentage of global international aviation emissions

Economic income type	Case 1 (%)	Case 2 (%)	Case 3 (%)
High income	73	14	58
Upper middle income	20	7	28
Lower middle income	6	2	12
Low income	1	0.4	3

2. By percentage of global aviation emissions

Economic income type	Case 1 (%)	Case 2 (%)	Case 3 (%)
High income	45	9	35
Upper middle income	12	4	17
Lower middle income	4	1	7
Low income	1	0.2	2

Summary

- Three global ETS scenarios analysed:
  - Case 1: departing flights 61% global emissions, 100% international emissions
  - Case 2: sovereign airspace 14% global emissions, 22% international emissions
  - Case 3: FIR airspace 61% global emissions, 100% international emissions
- Proportions allocated to states differs between 3 cases.