Advanced Emission Model (AEM III) were used to analyse fuel burn use and hence CO\textsubscript{2} emissions in aviation for the UK. These studies have their limitations and assumptions. Here, we present a new methodological approach to estimate total aviation CO\textsubscript{2} emissions for the UK. This approach is a Flight Schedule Approach, where emissions are calculated for each flight using detailed simulations of air traffic. This approach also allows us to disaggregate the emissions into aircraft groups and route profiles, offering an important tool for analysis of various policy effects, which other estimates cannot provide.

METHODOLOGY

The Reorganized Air Traffic Control Mathematical Simulator (RAMS Plus) and the Advanced Emission Model (AEM III) are used. The results from these detailed simulations are compared with two of the most-widely used aviation CO\textsubscript{2} emission estimates that have been made for the UK: the SERAS study and NETCEN estimate. Their estimates for the year 2004 are 26.1 Mt and 31.4 Mt, respectively. In addition, the most recent NETCEN estimate for the year 2003 is 34.1 Mt of CO\textsubscript{2}. Our estimate of total aviation CO\textsubscript{2} emissions, using detailed simulations and real air traffic data, is 34.7 Mt for the year 2004. Furthermore, contributions of the highest-emitting flights and aircraft types are identified. International departures dominate; six percent of flights account for 50 percent of total emissions. The largest aircraft emit the most per flight-km, although not per passenger-km. Different methodologies and their implications are also discussed.

INTRODUCTION

CO\textsubscript{2} is the major greenhouse gas contributing to anthropogenic climate change and air transport is the fastest growing source. With estimated world wide growth in air transport, emissions from transportation are expected to increase at a high rate with significant increases in CO\textsubscript{2} emissions due to transport. With non-CO\textsubscript{2} effects (such as NO\textsubscript{x} and contrail-cirrus) considered, aviation’s share of anthropogenic climate impact increases. Despite improvements in efficiency, the impact of aviation on climate change is increasing.

Currently, countries only have to include domestic traffic in their total national emissions. Total international aviation fuel sales in each country are reported separately (as bunker fuels), but there is no agreed allocation procedure to attribute the associated CO\textsubscript{2} emissions to national totals and bring them within targets for emission reduction. In the context of national progress towards Kyoto targets, it is important to have a clear understanding of the total contribution of aviation, not just domestic flights, to ensure that policy priorities can be fairly assessed.

Several air transport CO\textsubscript{2} emission estimates have been provided for the UK in the past few years. These studies have their limitations and assumptions. Here, we present a new estimate using an alternative calculation method.

CONCLUSIONS

This study has shown that by using real traffic profiles and applying different fuel burn rates to the different modes of flight, it is possible to calculate a CO\textsubscript{2} emissions inventory comparable to other estimates. Furthermore, our method allows better disaggregation of domestic and international flights and their emissions. CO\textsubscript{2} emissions of international traffic are calculated using real traffic profiles within UK airspace and applying appropriate fuel burn rates for each mode of flight results in higher accuracy for this method. This approach also provides an assessment of which flights and associated aircraft account for the bulk of emissions. Furthermore, this methodology can disaggregate the emissions into aircraft groups and route profiles, offering an important tool for analysis of various policy effects, which other estimates cannot provide.

Understanding of the total contribution of aviation, not just domestic flights can ensure that policy priorities can be fairly assessed. Even if national targets for CO\textsubscript{2} emissions reduction are met, a very small proportion of international departures can consume a large amount of the national allowances. This has implications for how the associated CO\textsubscript{2} emissions of international aviation can be brought within national targets for emission reduction.