In the face of global climate change various private and public stakeholders of the commercial aviation industry have proclaimed ambitious goals aimed at reducing the global fuel consumption and thus mitigating the future environmental impact of aviation by halving aviation’s fleet-level emissions by 50% compared to year 2005. Here, the potential of aircraft technologies, production ramp-ups and operational improvement options are assessed to quantify the global fleet-level emissions up to the year 2050. Based on the estimation of impact of next-generation aircraft types with market entries until 2020, fifteen fleet-level emission scenarios based on various technology, production and operational scenarios with their single contribution towards long-term emission goal, are the objectives of this paper. A numerical model of the global air transport fleet is employed to quantify the fleet-wide fuel demand and carbon-emissions reduction impact and conduct sensitivity analyses. New aircraft technologies together with up to radical ramp-up timelines might lower fleet-level fuel burn until year 2050 between -17% to -27%. Increasing aircraft productivity by increasing loadfactors, installed
seats and increased aircraft utilisation further reduce fleet-level fuel burn until year 2050 by -7 % to -8 %. The application of retrofit solutions for in-fleet aircraft can reduce the fleet-level fuel burn until year 2050 by around -3 %. Halving regional RPK growth rates might lead to fleet-level fuel burn reductions by around -6% until year 2050. The results obtained clearly indicate that the climate goals cannot be reached solely by following long-term research goals for aircraft technology improvements, because of slowing effects on fleet level. Even following the long-term research goals for aircraft technology improvements combined with radical production ramp-ups and significant improvements in aircraft productivities will lead to a carbon-neutral growth until year 2050 but at roughly 10% higher emission compared to the IATA goals until year 2035.