

Integrated assessment modelling for aviation

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ACCLAIM

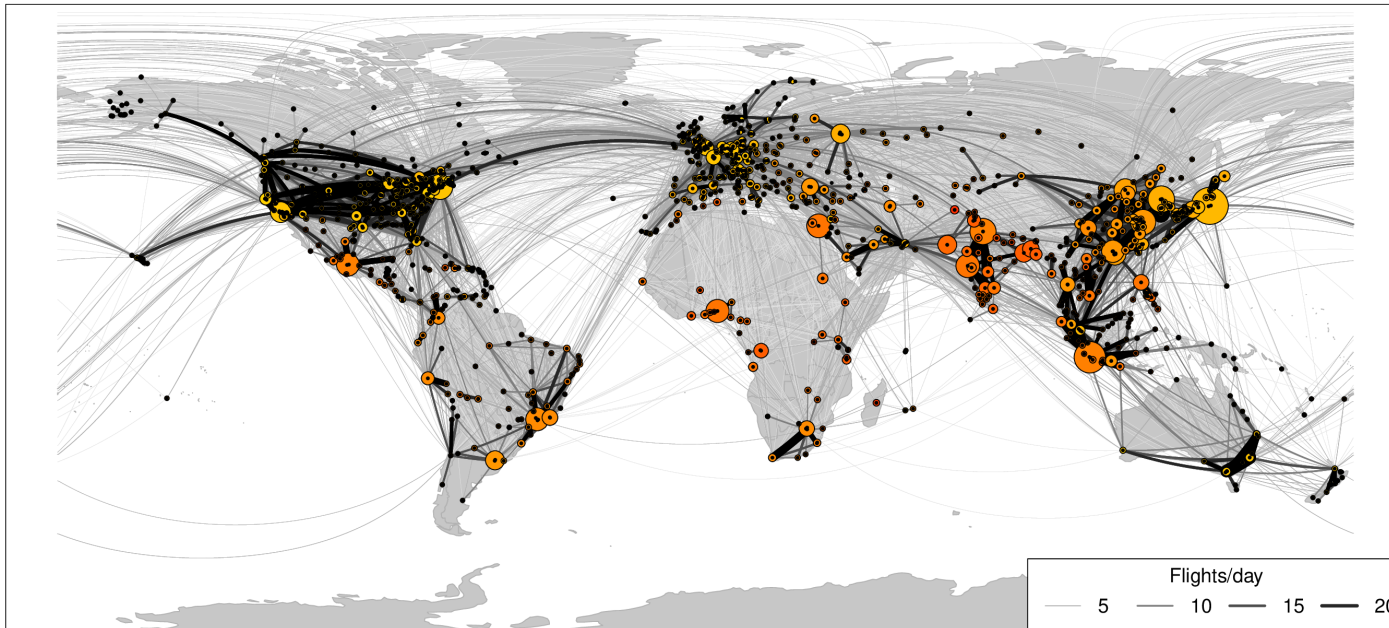
Background

- Aviation policy outcomes depend on the interaction of multiple stakeholders across different geographic scopes
 - Airlines, airports, passengers, regulators, manufacturers...
 - Complex relationships between capacity, scheduling, fleet, passenger demand, networks etc.
- Applies particularly to capacity expansion
 - Current total value of airport construction/expansion projects globally is > \$600 billion (CIC, 2016)
 - Response to capacity expansion can be complex, e.g. will airlines increase frequency to try and capture market share?

Airport Capacity Consequences Leveraging Aviation Integrated Modelling (ACCLAIM)

- Three year EPSRC-funded project between UCL, the University of Southampton and Imperial College

Modelling Scope

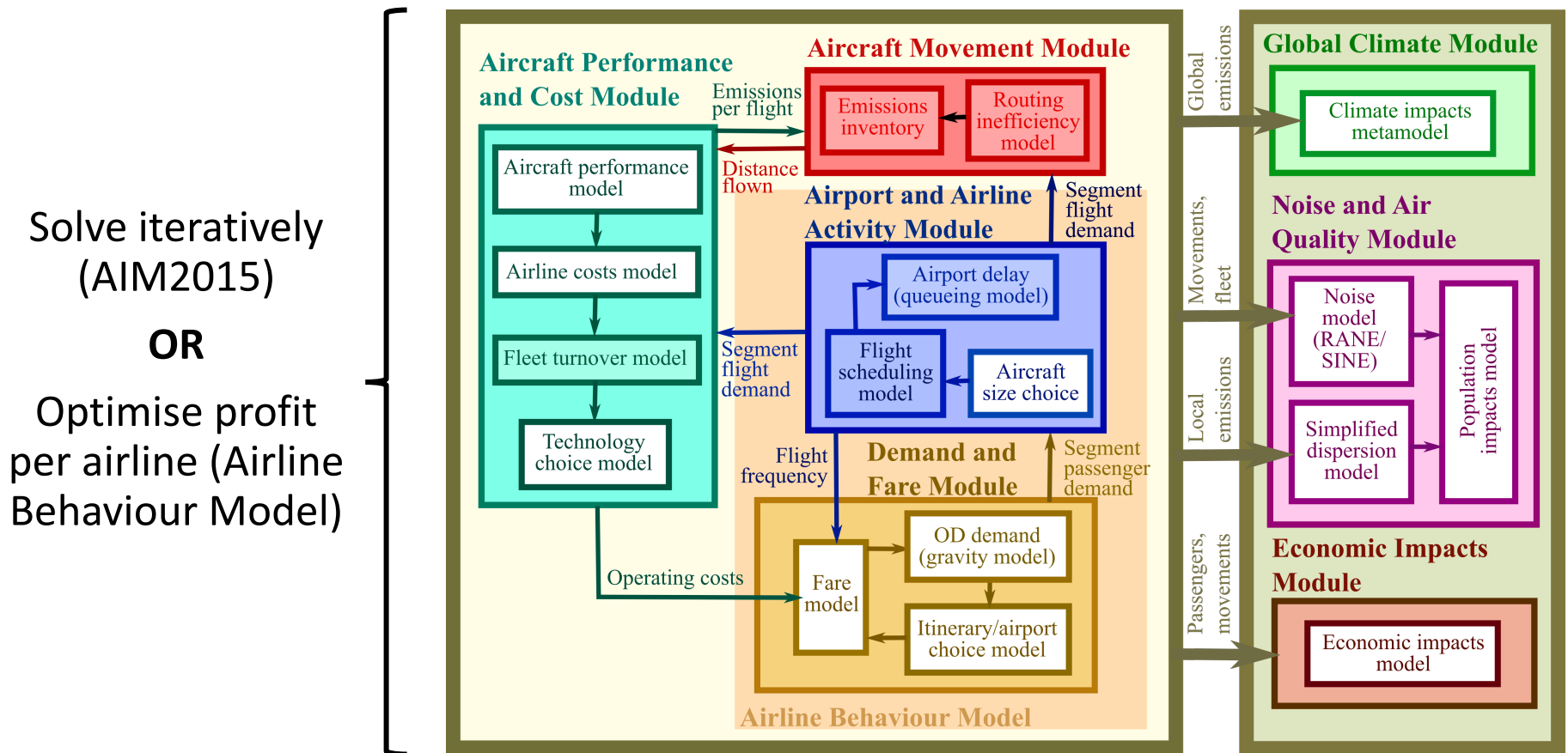


- Flights between 1169 airports in 878 cities modelled
- 2015 base year

- Future projections to 2050 and beyond:
 - Given projections of population, GDP/capita, oil price, technology etc.
- Includes uncertainty
 - Lens approach for technologies
 - Plus a range of input scenarios

Modelling systems

- Open source
- See www.atslab.org for more information/papers

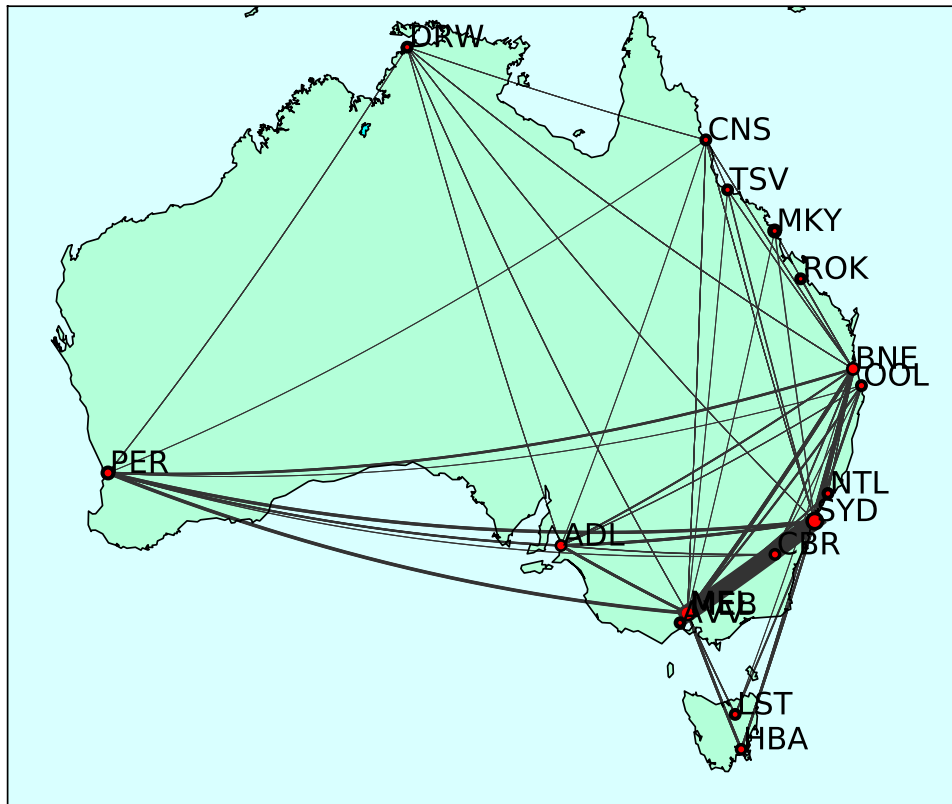


Application to airport capacity modelling

- Impacts of adding capacity can include:
 - New airlines operating from the expanded airport
 - Existing airlines altering their schedules (e.g. to increase frequency)
 - Changes in aircraft types used to/from the airport
 - Changes in airline costs, fares and demand
 - Changes in operations, frequency, fleet and demand at other airports (potentially across the world)
 - The resulting economic and environmental effects
- The idea of ACCLAIM is to make a first order assessment of these changes with one integrated model

Example – Airline Competition Model

- The Australian domestic market

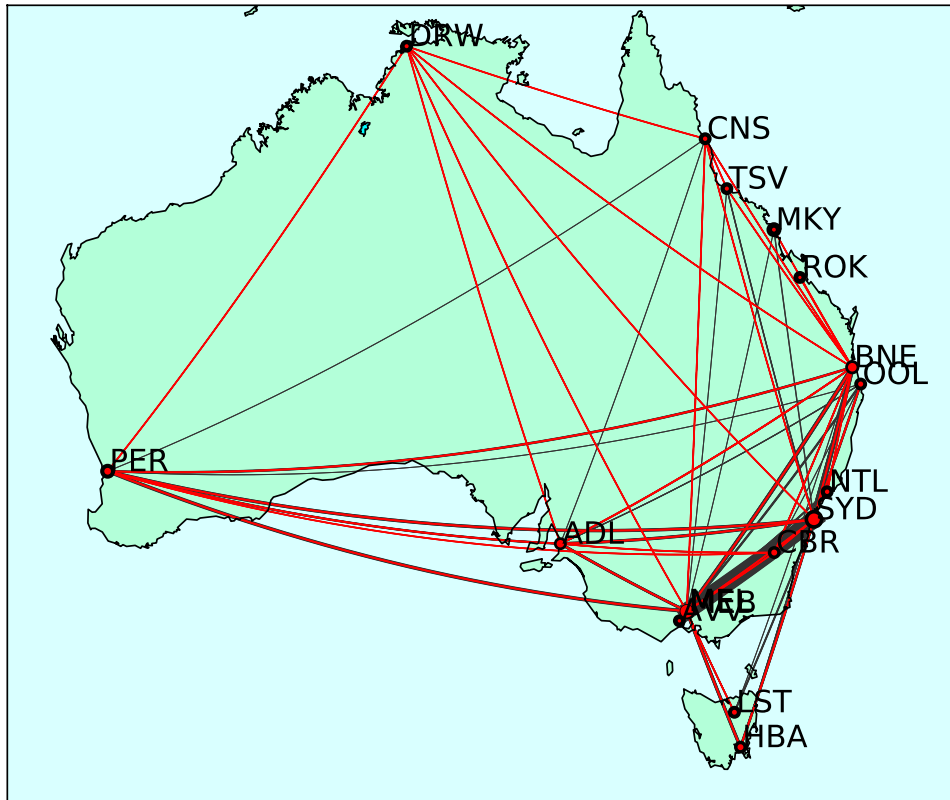


- The model contains four airlines:
Qantas, Virgin, Jetstar and Tigerair.

●=Airport (size indicates capacity) ●=Used capacity
— =Segments (thickness indicates passenger numbers)

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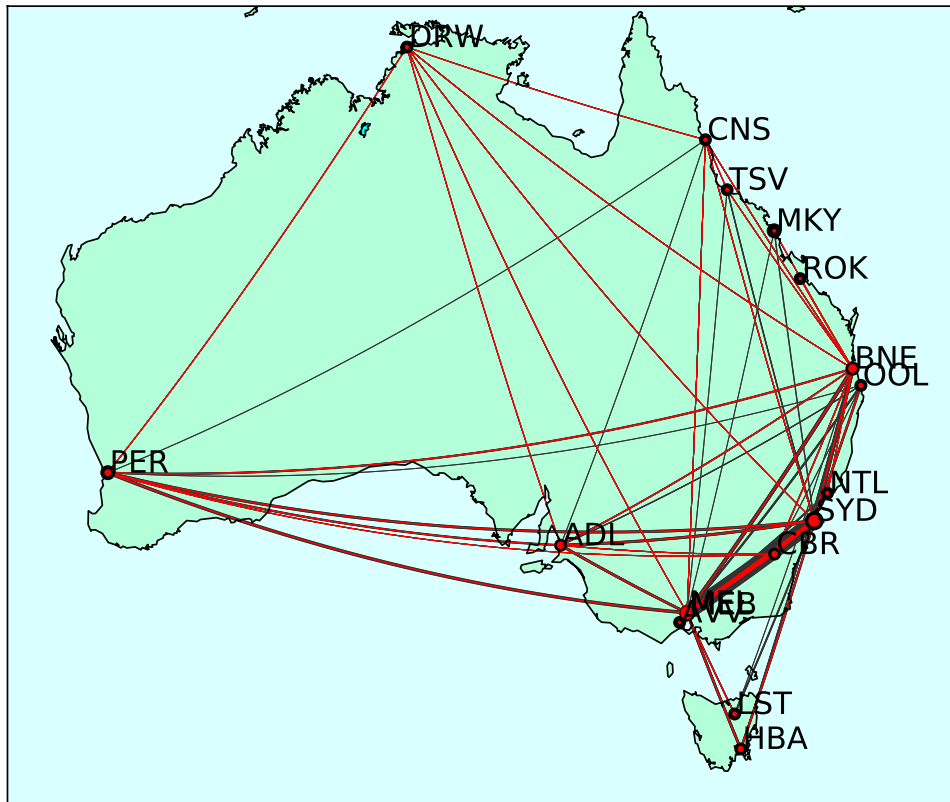


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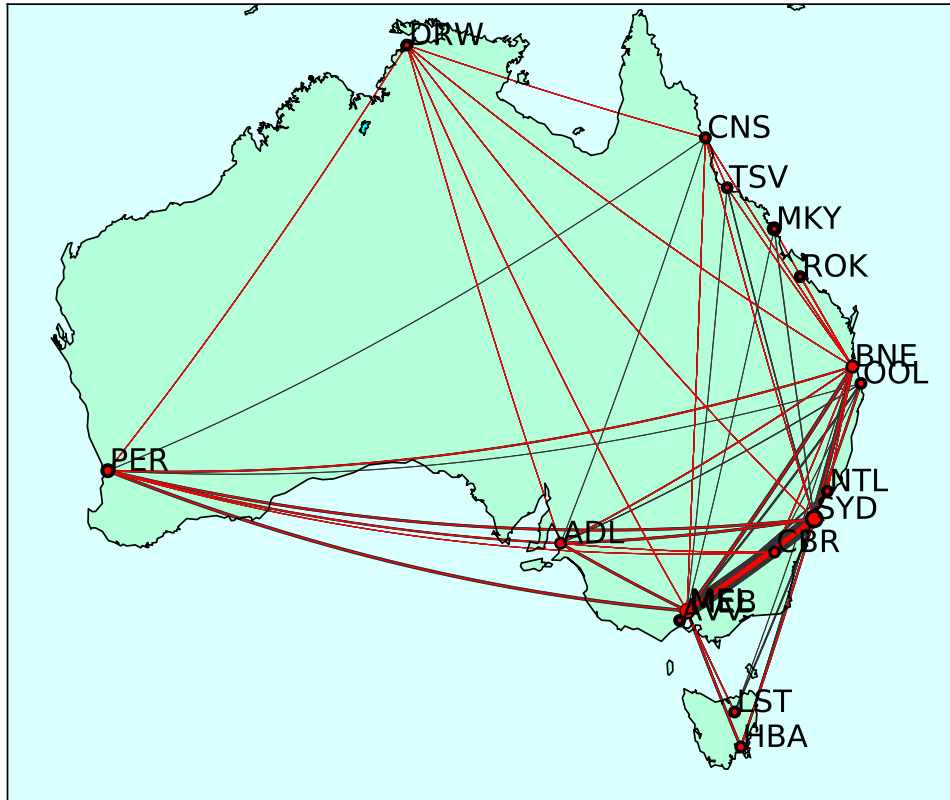


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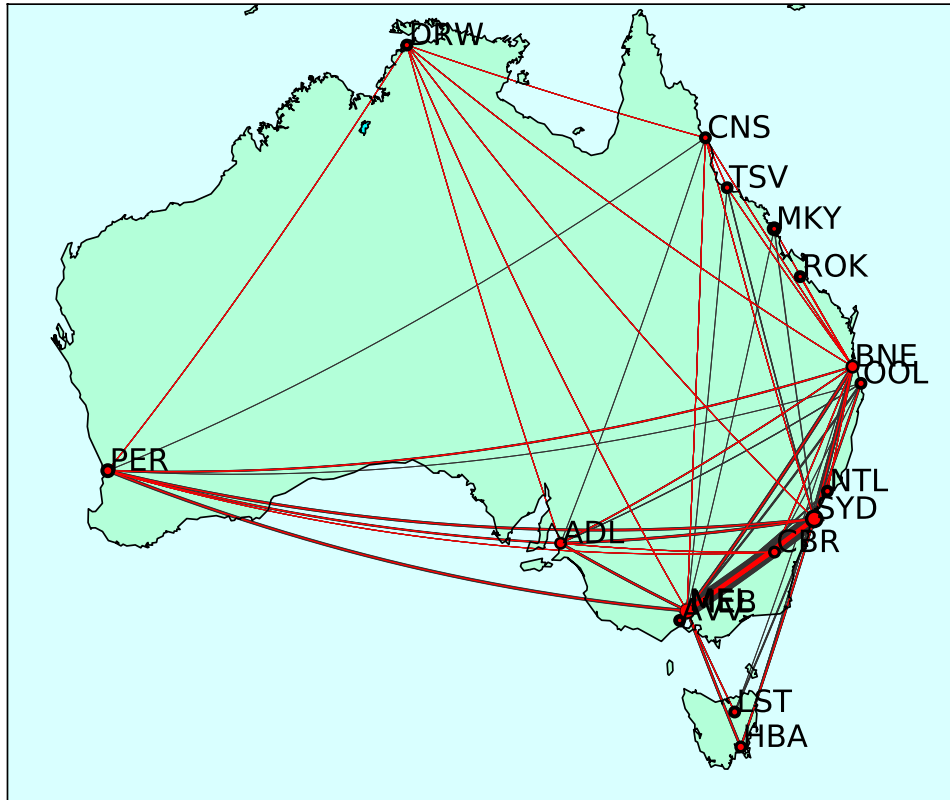
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- Fares decrease:

| ROUTE: | SYD->PER | BNE->PER | ADL->SYD | SYD->BNE |
|------------|----------|----------|----------|----------|
| Avg. Fare: | -4.1% | -11.7% | -4.8% | -3.3% |

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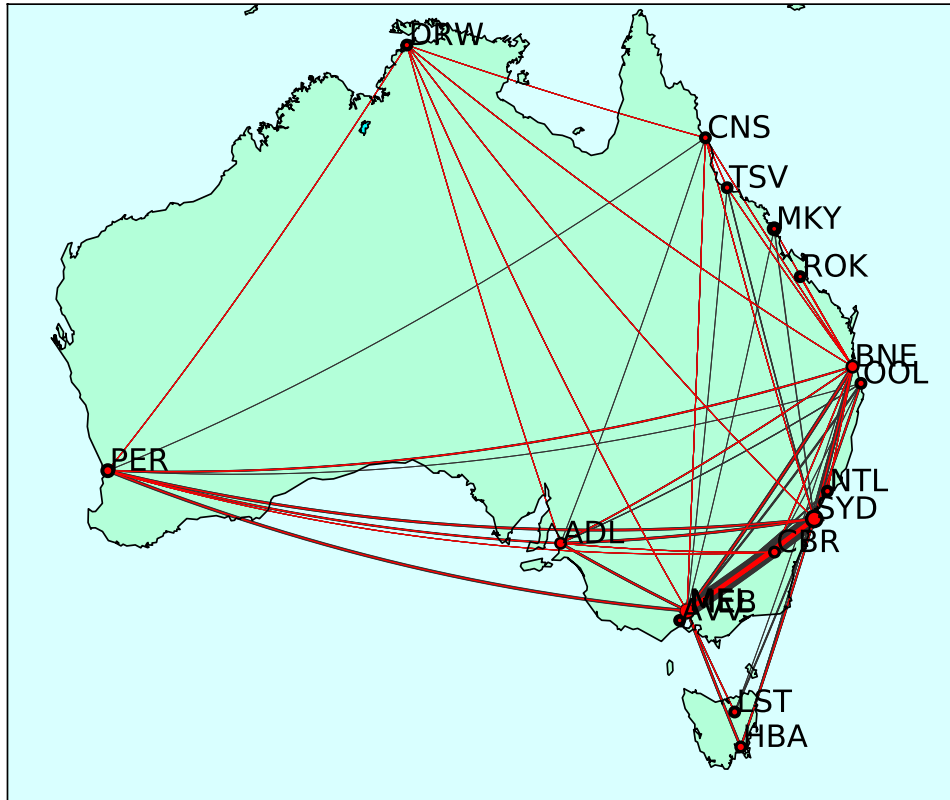
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- Demand increases:

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| Passengers: | 0.8% | 3.6% | 2.2% | 1.5% |

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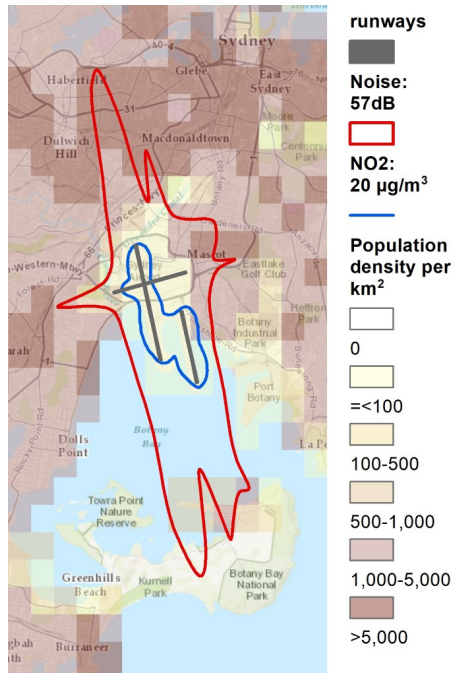
- ❑ Spare airport capacity decreases:

| AIRPORT: | SYD | PER | ADL | BNE |
|-----------------|-------|-------|-------|-------|
| Spare capacity: | -3.7% | -1.4% | -3.4% | -2.2% |

Example – Modelling Outputs and uses

LOCAL

- Demand, movements, delay
- Noise and local emissions



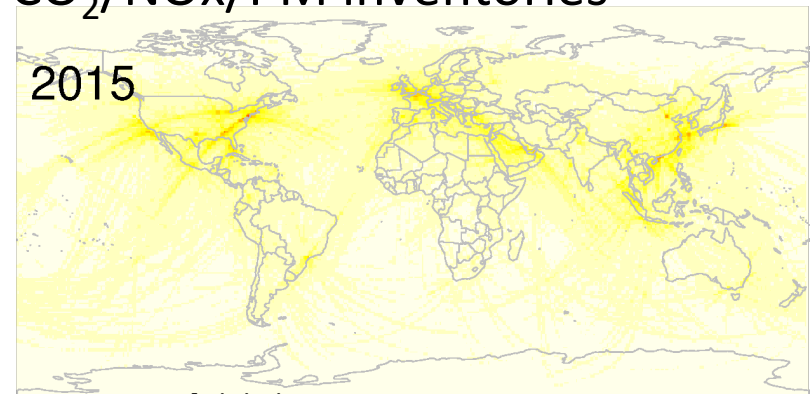
[Sydney International Airport, 2015]

REGIONAL

- Economic impact modelling (Dan Graham, Imperial College)
- Technology adoption and impacts (e.g. SAECA electric aircraft study)

GLOBAL

- CO₂/NO_x/PM inventories



[Global aviation CO₂ SSP2 scenario, no radical new technologies, central technology lens]

For more information: www.atslab.org