



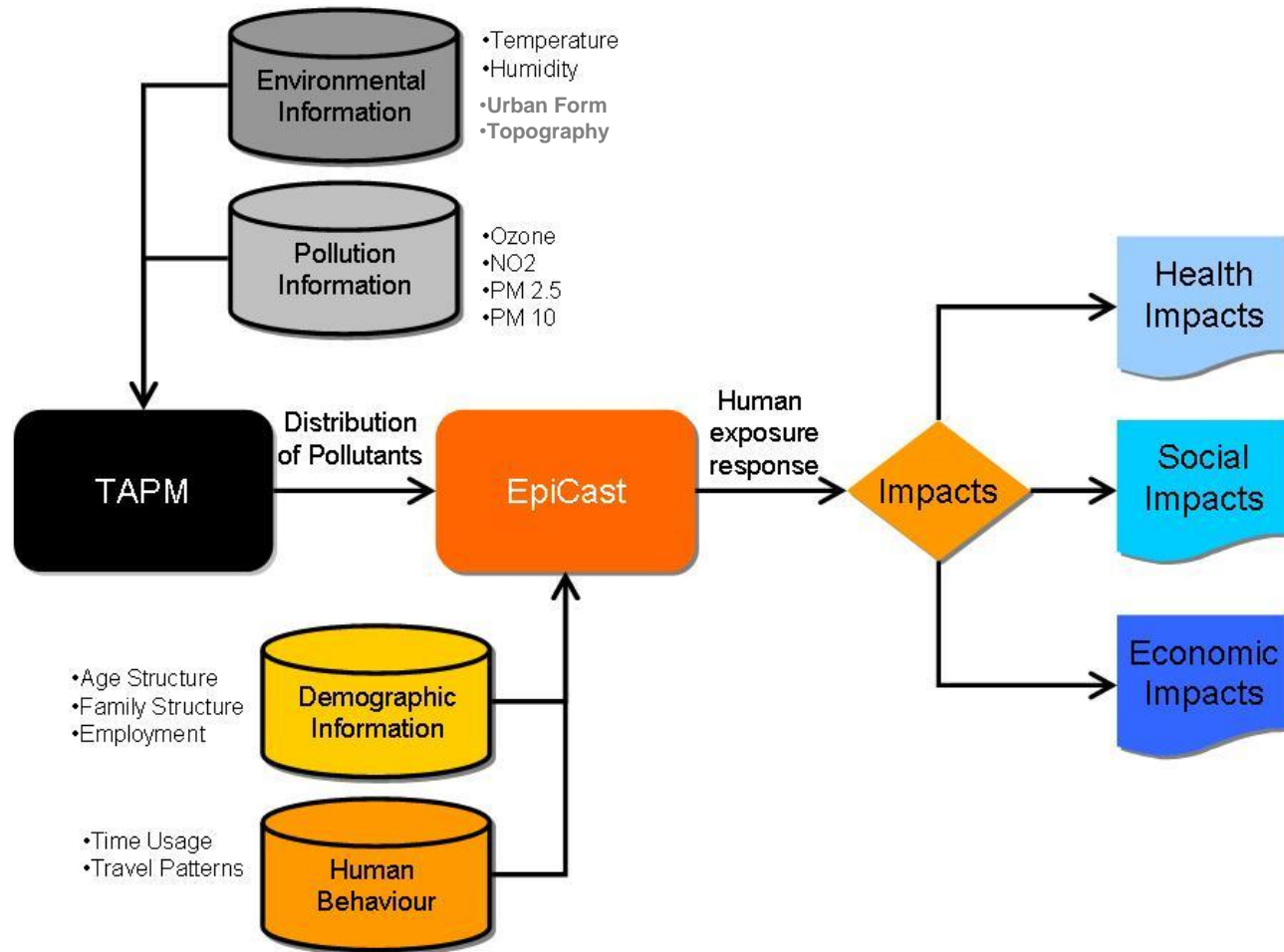
Human health impacts of air quality: a Sydney case study

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CSIRO Marine and Atmospheric Research
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Policy context

- **Limited analysis of health/economic effects of pollution control using Australian data/information and modelling**
- **Need better estimates of spatial variability/impacts of pollutants**
- **Focus of CSIRO work – to develop an *integrated analytical framework* (for policy evaluation) which incorporates:**
 - **Environmental and meteorological factors;**
 - **Spatial variation in air quality;**
 - **Population/demographic data;**
 - **Epidemiological data linking exposure and responses to pollutants;**
 - **Health and related effects;**
 - **Socio-economic impacts (e.g. absenteeism and labour productivity)**

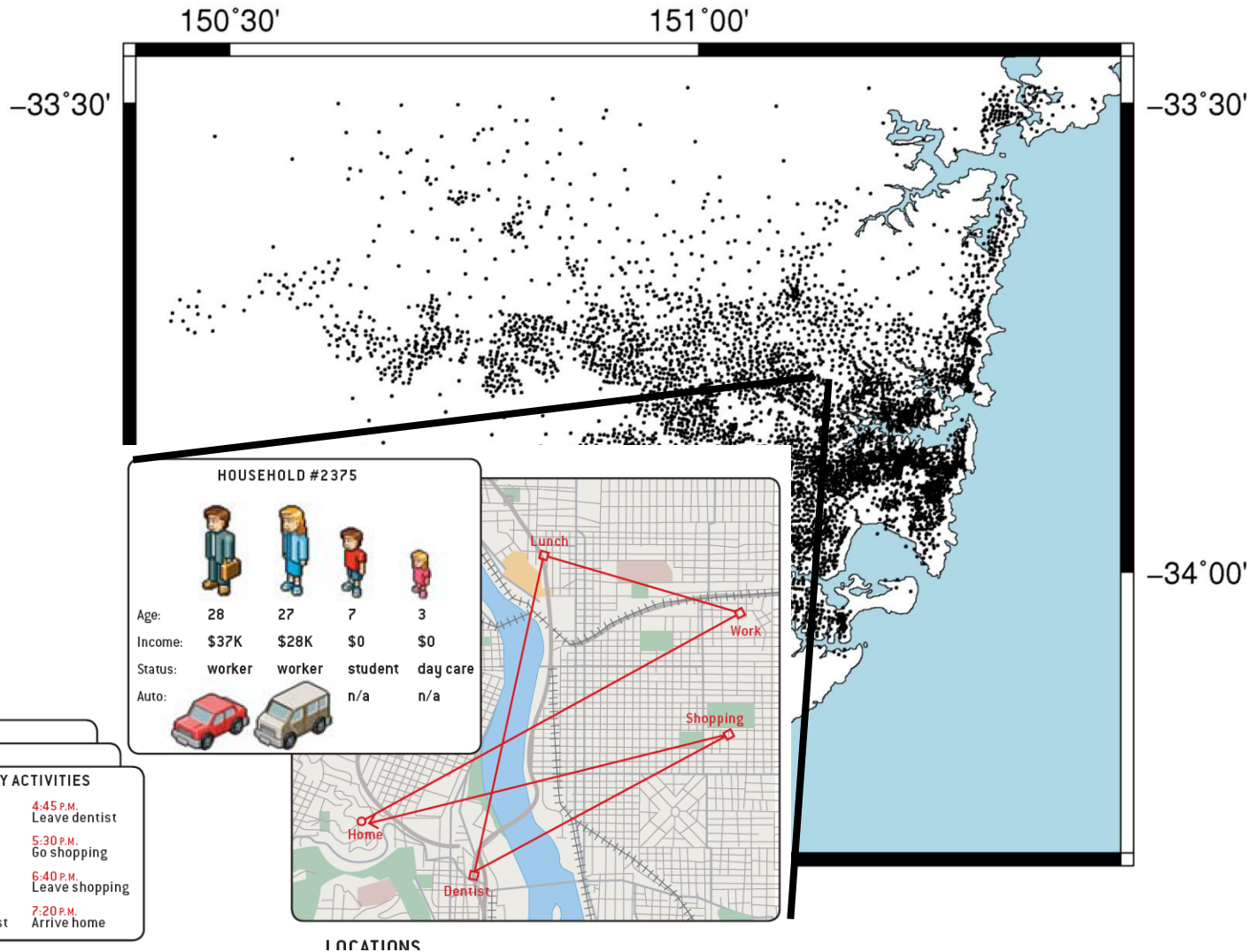
CSIRO Integrated Analytical Framework



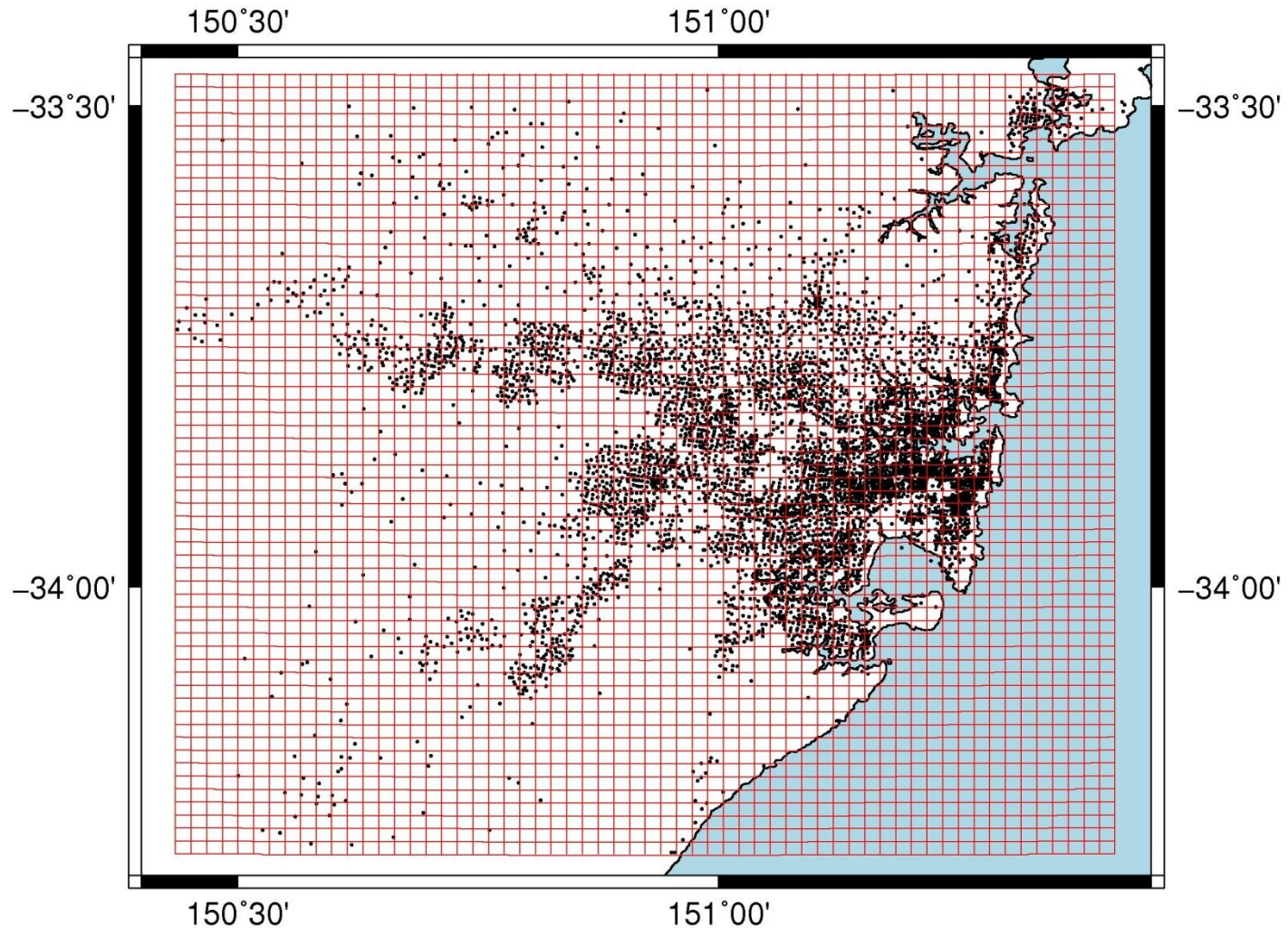
Scenario analysis

- **Illustrative only:** to demonstrate the capability/usefulness of the *CSIRO Integrated Analytical Framework*
- **Study area and focus: PM10 in Sydney GMR**
 - Hospital admissions – respiratory diseases
- **Baseline scenario:**
 - Assumed current pollution controls will remain unchanged
 - Based on 2005 detailed pollution data
 - Used health impacts data over 2003-06
- **High pollution scenarios:**
 - 10% and 25% increase in PM10 relative to baseline levels
- **Low pollution scenarios:**
 - 10% and 25% decline in PM10 relative to baseline levels

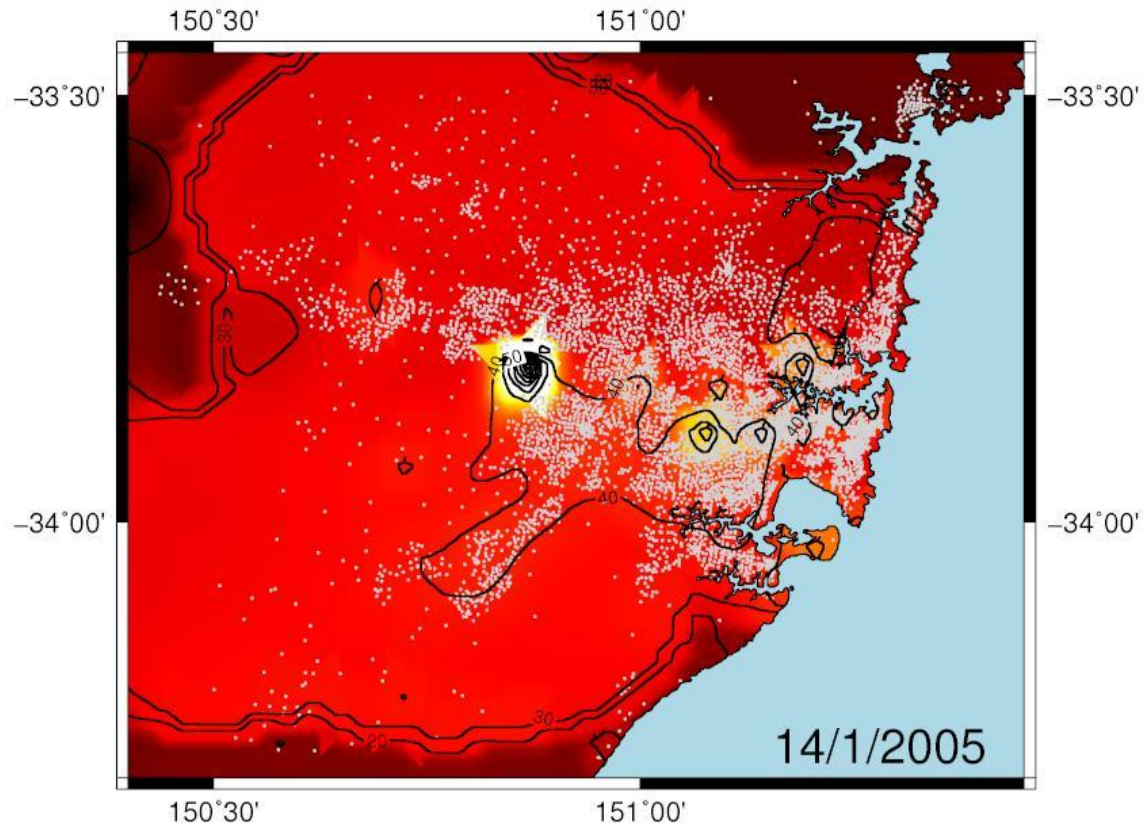
Spatial distribution of census collection districts in Sydney GMR



TAPM grid cells and EpiCast demographic data (based on ABS 2006 census)



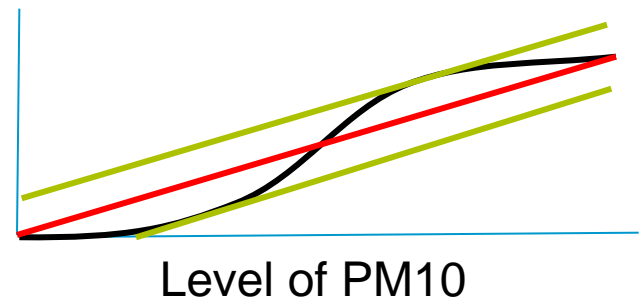
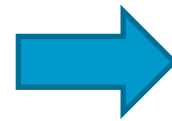
Distribution of PM10



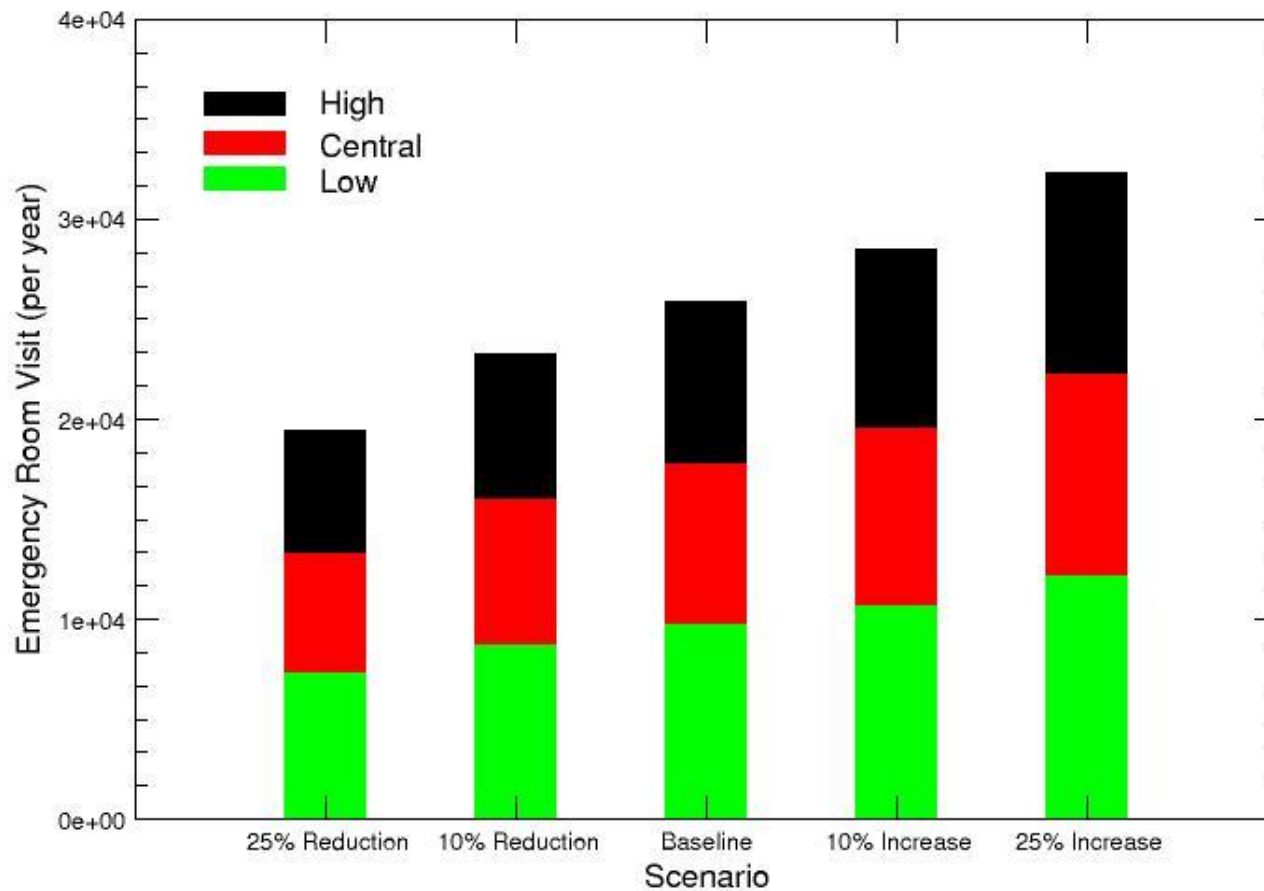
24hr Average PM 10 ($\mu\text{g}/\text{m}^3$)

Dose response functions

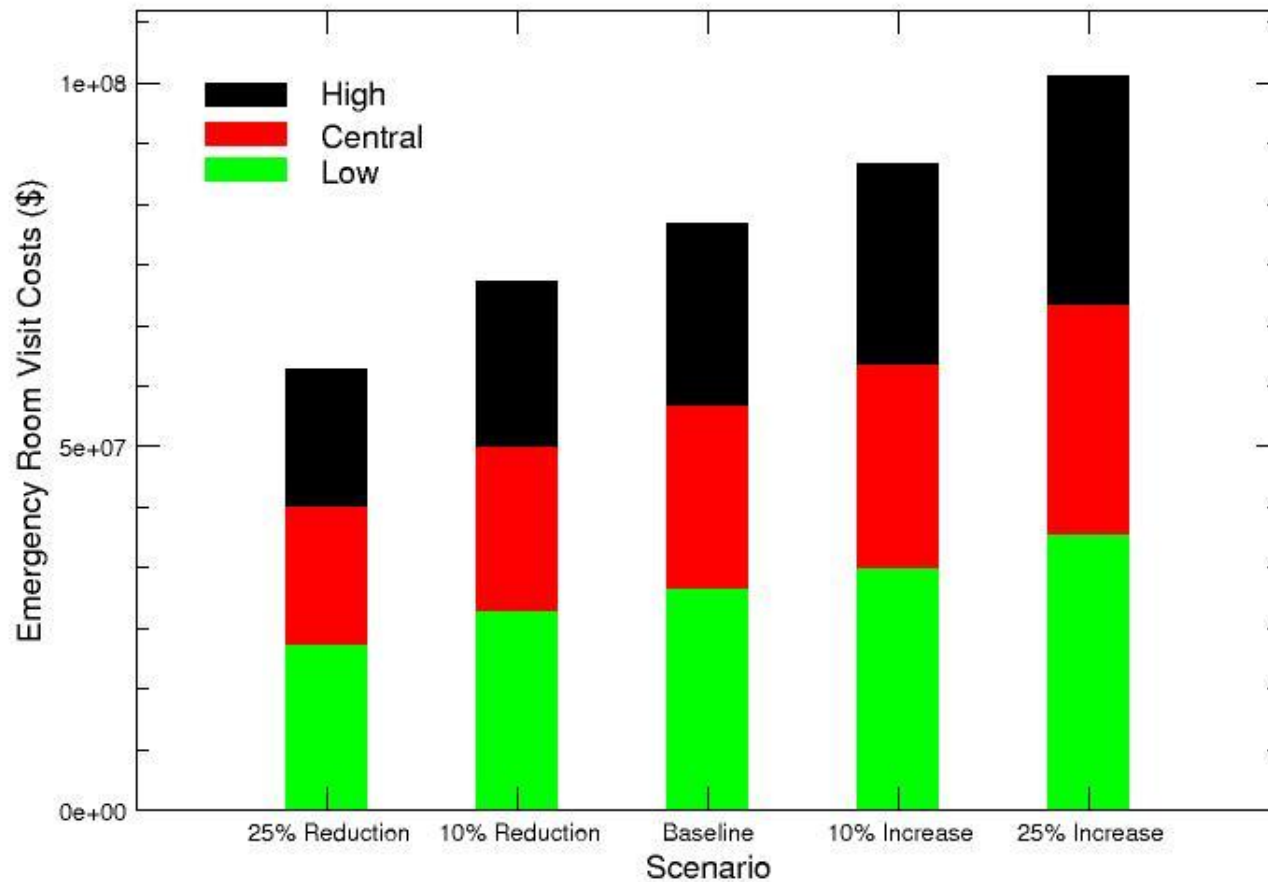
- Linearized dose response functions, based on World Bank (1994) analysis. Dose response captures the uncertainties around central forecasts.
- PM10 dose responses for
 - Premature mortality
 - Respiratory hospital admission
 - Asthma attacks
 - Lower respiratory infections
 - Emergency Room Visits
 - Reduced Activity Days
 - Chronic Bronchitis
 - Respiratory symptoms
- Map to
 - Absenteeism
 - Sectoral impacts
 - Health costs



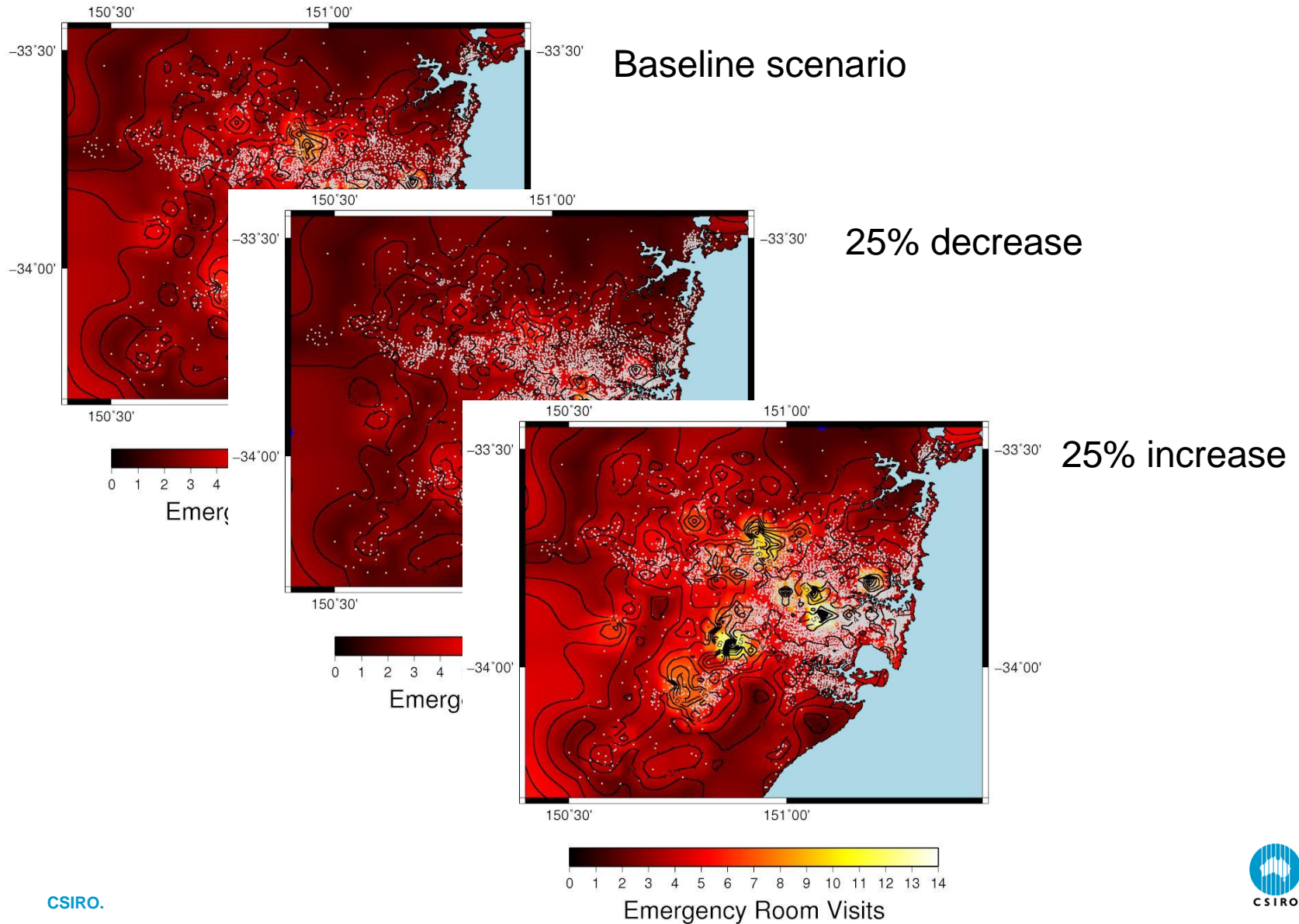
Example analysis: PM10 and emergency room visits



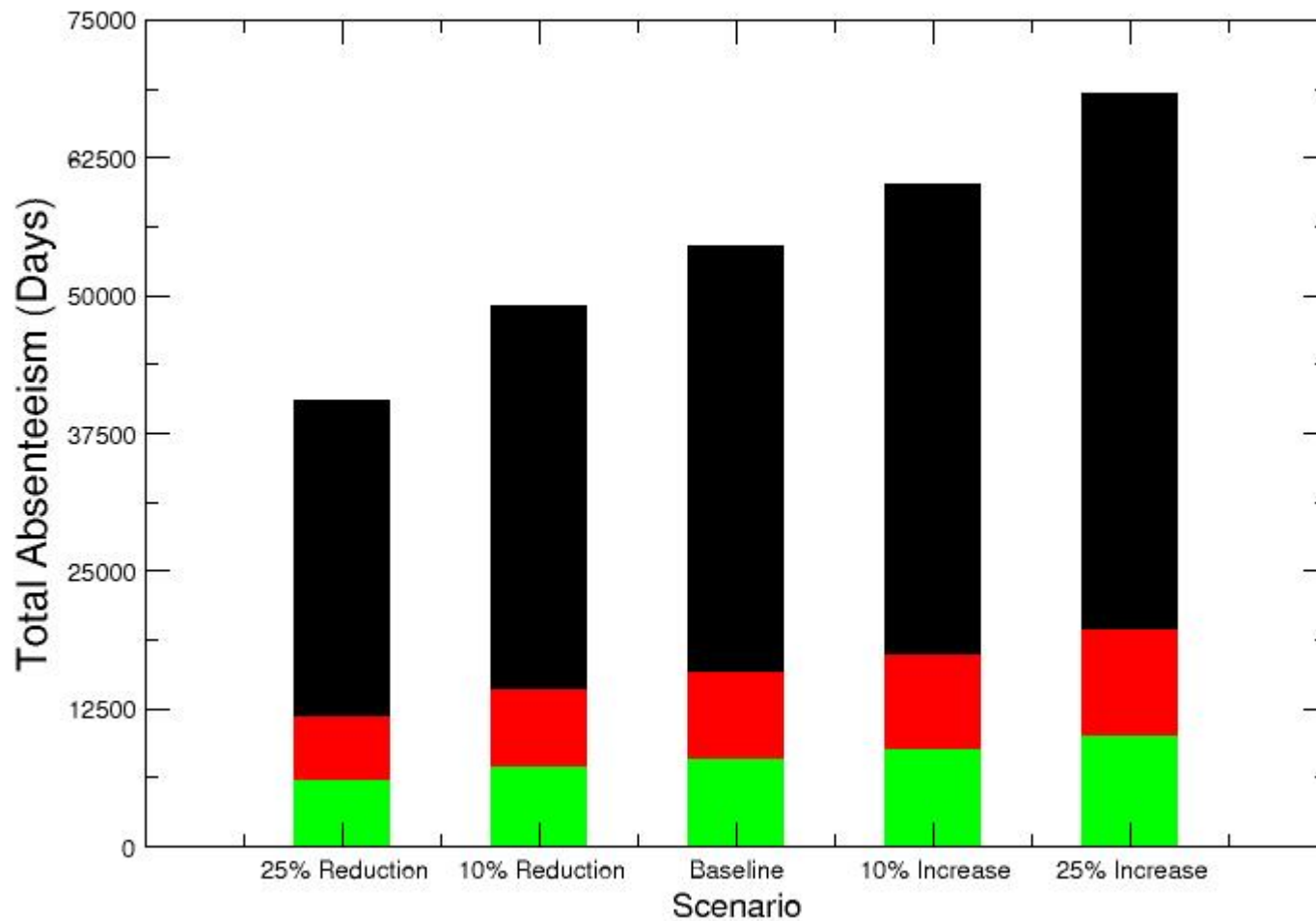
Example analysis: PM10 and emergency room visit costs



Example analysis: PM10 and emergency room visits



Example analysis: absenteeism – manufacturing sector



Results/key findings

- **25% increase in average PM10 results in >>25% economic impact. Reason is non linearity of pollutant transport combined with social behaviour.**
- **Large variations in total estimated health cost with relatively small change in PM10: \$297m under High pollution scenario, compared to \$201m under the baseline case. Under Low pollution scenario, the estimated health costs are \$136m.**
- **Large regional variations in:**
 - **Exposure to each AQI per day;**
 - **Potential hospitalisation cases and health costs; and**
 - **Economic implications (e.g. absenteeism, labour productivity)**
- **Indicating regional variation in demand for health services**

Key messages

- **CSIRO's *Integrated Analytical Framework* can help promote the development, analysis and synthesis of better information and knowledge about:**
 - **Pollutants, exposure and impacts to improve public policy making in pollution control**
- **Key strengths of the *CSIRO Integrated Analytical Framework*:**
 - **Detailed space and time mapping of pollutant levels;**
 - **Treatment of individuals as a heterogeneous group;**
 - **Explicit treatment of different features of individuals (gender, age, family structure, occupation, location of residence and work, travel etc);**
 - **Evaluates responses to external stimuli (e.g. withdrawal from outdoor activities due to high levels of pollution);**
 - **Maps seamlessly to health and economic impacts**

Potential directions for development

- **Environmental:**
 - Detailed urban canopy modeling to improve spatial resolution of pollutant predictions, and to
 - Produce peak concentrations as well as averages
- **Health**
 - Use of EpiCast capability to include joint susceptibility of individuals with other medical conditions to air pollution effects
- **Economic impacts**
 - Linking health impacts to economic models such as MMRF
- **Embedding of the system in a national integrated assessment model (e.g. CSIRO's NIAM) to project effects of urban and population developments in Sydney and other regions**

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Thank you

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