2019 Monash Energy Conference
18 September 2019
PROFESSOR MARC PARLANGE
PROVOST & SENIOR VICE-PRESIDENT
RESEARCH AGENDA FOCUS AREAS

AI & Data Science
Artificial intelligence (AI) powered by data science is changing the nature of work and human interaction - it is vast in its nature and application. As we enter a critical phase in its advancement, the potential for economic and societal impact through AI and data science creates an imperative for responsible and immediate action.

Monash is investing in AI and data science by bringing together multidisciplinary teams to develop and understand future technologies and consider the impact of innovation in this area. We will partner with industry to develop and understand future technologies, apply advancements and consider the impact of such applications.

Better Governance & Policy
Inclusive governance and policy are arguably the most significant challenges for the Asia-Pacific region. We draw research strengths from all faculties and disciplines to support local and global government and policy development.

By doing this, we support Monash’s commitment to innovative, enterprising and socially inclusive, locally, nationally and internationally.

Monash speaks with a collective voice to our research community and partners, as well as governments, industries, and communities about their own policy needs. We are working together towards improving human well-being.

Health Sciences
We have a long history of excellence and impact in health sciences, with our research breaking through changing millions of lives for the better. Today, the quality and significance of our research in health care, pharmaceutical sciences and the biosciences rightly positions us to lead the transformational impact on the largest and most complex health issues.

With access to world-class infrastructure, investment, and with the support of our partners, our leading researchers will be equipped to continue their work towards solving some of the world’s most significant health challenges and improving the human condition.

Sustainable Development
Sustainability is a core Monash value. Monash is at the forefront of developing practical solutions to the social, economic and environmental challenges of the SDGs. We need a multidisciplinary approach to this focus area.

Professor Jordan Nash, Dean of Science
Professor Jon Whittle, Dean of IT
Professor Bryan Horrigan, Dean of Law
Professor Sharon Pickering, Dean of Arts
Professor Simon Wilke, Dean of Business
Professor Chris Porter, Director, MIPs
Professor Gail Risbridger, Deputy Dean, Special Projects, MNHS
Professor Steven Chown, School of Biological Sciences
Professor Jacqui True, Director, Centre for Gender, Peace and Security
MONASH DATA FUTURES

AI and Data Science changing better governance and policy

AI and Data Science changing sustainable development

AI and Data Science changing health sciences
MONASH DATA FUTURES VISION

• **Nurture and co-ordinate capability** relevant to AI and Data Science education at Monash (UG and PhD)

• **Be a catalyst for collaboration and growth**, lifting existing areas of capability

• **Increase our research profile** nationally and internationally, both academic & with industry

• **Coordinate bids** for large research funding, leverage the research profile & capability

• **Facilitate the adoption** of AI and data science by our industry partners
BETTER GOVERNANCE & POLICY
BETTER GOVERNANCE AND POLICY NETWORK

Join-up capabilities across the University...

Policy platform: curate a repository of policy & governance research & evidence...

Apply capabilities & evidence to real world problems, with partners...

Build the policy and governance lessons into our teaching and research...
CENTRE FOR ANTI-MICROBIAL RESISTENCE
PROF. TREVOR LITHGOW

New Centre developed to address antimicrobial resistance and superbugs

Cohesive use of all Research Agenda Focus Areas

Prof. Trevor Lithgow
Centre Director

Centre for Anti-Microbial Resistance

NEW HEAD OF MONASH SUSTAINABLE DEVELOPMENT INSTITUTE (MSDI)

Tony is an expert in sustainable development and population health.

MSDI is bringing together Monash University’s leading researchers to focus on large-scale, interdisciplinary projects that address global issues aligned to the United Nations’ 17 Sustainable Development Goals.

Prof. Tony Capon
Director, Monash Sustainable Development Institute

Commences in October
Working together, across our university campuses and partners, we can:

- Bring together our cities research for impact on the sustainable development goals
- Give greater visibility to the breadth of cities research across Monash
- Address local problems for international impact and engagement
- Co-create a platform and research focus for our Net Zero commitment
- Harness the potential of the Monash Technology Precinct as a Living Laboratory

Communication, collaboration and co-creation for a sustainable future.
3.7% of the worldwide global electricity supplied by wind power in 2015.

38% of Denmark’s electricity from wind energy 2016

Global Wind Energy Council
Impact of a Fully Developed Wind-Turbine Array Boundary Layer on evaporation: will a farmer need to irrigate more & does it change the wind fields?

...a question from an Australian farmer
Instantaneous stream-wise velocity field through a wind farm (Large Eddy Simulation - LES)
an other way of looking at the LES results:

\[ \frac{\bar{u}}{u_*} = \frac{1}{\kappa} \ln \left( \frac{z}{z_0} \right) \]

Fully developed WTABL profile:

\[ \frac{\bar{u}}{u_{*,hi}} = \frac{1}{\kappa} \ln \left( \frac{z}{z_{0,hi}} \right) \]

Ground profile, \( f(z_0) \):

\[ \frac{\bar{u}}{u_{*,lo}} = \frac{1}{\kappa} \ln \left( \frac{z}{z_0} \right) \]

Top profile, \( f(z_{0,hi}) \):

 Wake layer
Study cases:

- Logarithmic velocity profile:

\[ f_1 = -\frac{1}{2} C'_T \overline{U}^2 d \frac{\delta A_{yz}}{\delta V} \]

These results can be explained analytically.

- Grid - spacings 100’s of Km, first vertical grid point ~ 80 m (Meso-scale model)
- Parametrizes the wind farm by a surface roughness: \( z_{0,hi} = 0.8 \text{ m} \) (Lettau, 1969)

\[
z_{0,hi} = \frac{z_h \pi}{8 s_x s_y}
\]
Instantaneous wind speed and scalar concentration:

\[ \frac{\tilde{u}(t)}{u_G} \]

\[ \frac{(\theta_s - \theta_{zh})}{(\theta_s - \theta_{\infty})} \]
Vertical profiles of scalar flux and scalar difference:

10% increase in scalar fluxes
A simplified way of looking at the LES results:

\[ \langle \theta_0 \rangle \]  
\[ \langle \theta_f \rangle \]  
\[ \langle \theta_s \rangle \text{ is fixed} \]

*Large Wind Farms increase scalar flux about 10%!*  

*These results can also be explained analytically*
THANK YOU