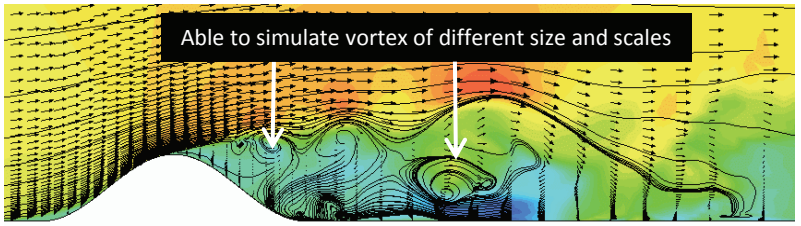
Advantages of LES over RANS

LES and RANS Software

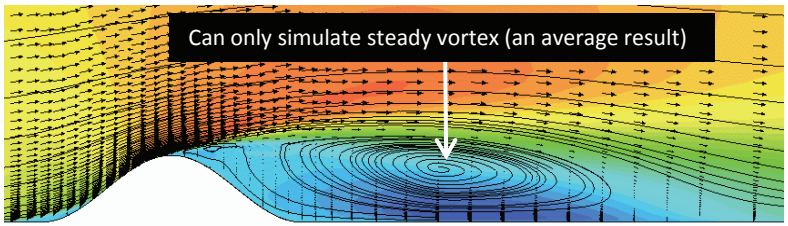
Unsteady Turbulence Model	Steady Turbulence Model
LES (Large Eddy Simulation)	RANS (Reynolds Averaged Navier-Stokes Simulation)
Ansys Fluent	WindSim
Ansys CFX	Meteodyn
Phoenics	WAsP CFD
OpenFOAM (LES)	OpenFOAM (RANS)
Star CCM+ (LES)	Star CCM+ (RANS)
RIAM-COMPACT	VENTOS

Advantages of LES over RANS

LES



RANS



Flow field behind a three dimensional hill

Unsteady models (LES turbulence model) such as RIAM-COMPACT® simulate the wind flow that we experience every day. The wind disturbances can be understood intuitively.

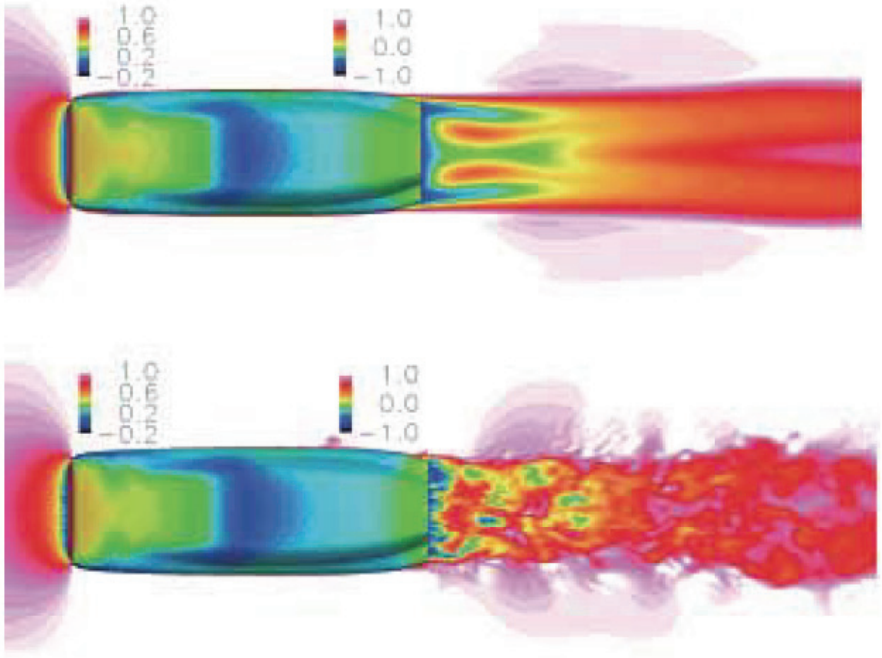
Steady models (RANS turbulence model) simulate the same result but are averaged in time.

Transient turbulent structure can only be simulated by LES.

Advantages of LES over RANS

RANS

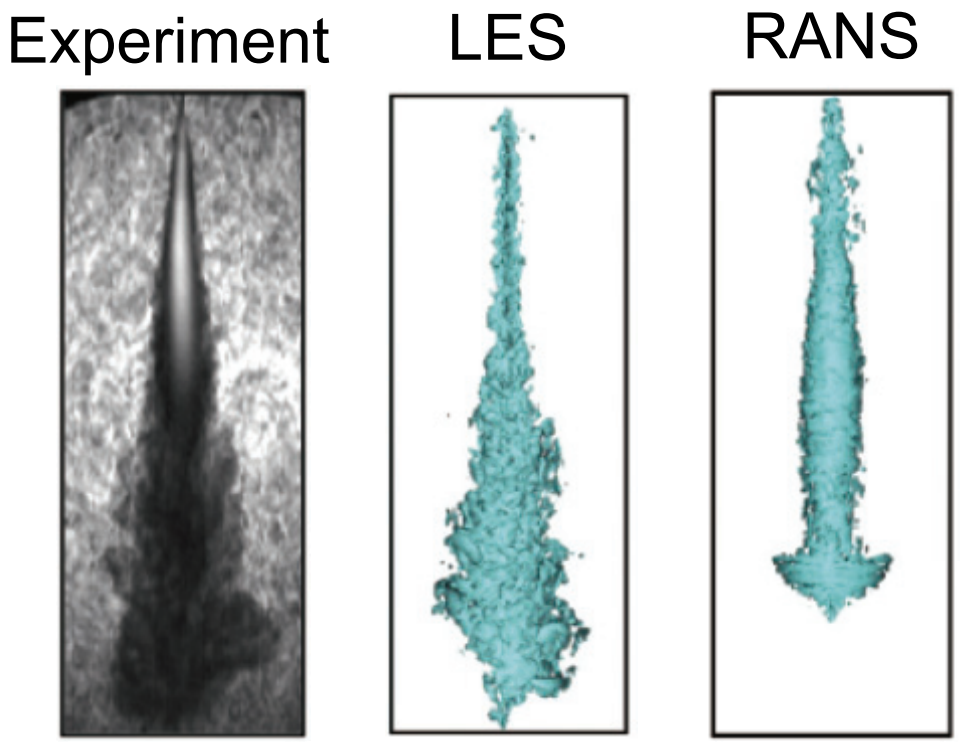
LES



Wake flow field behind car bodies[1]

LES is capable to resolve the important unsteady flow structure

Advantages of LES over RANS

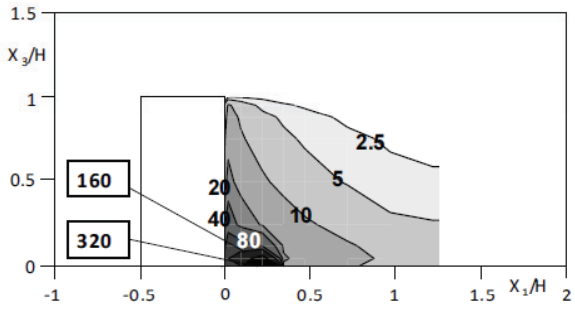


Diesel Injection – Turbulent Structure[2]

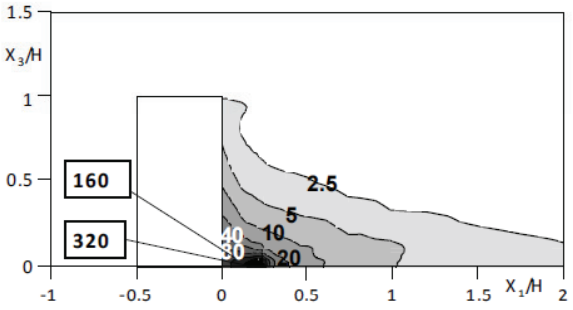
LES is able to reproduce turbulence with a much higher accuracy

Advantages of LES over RANS

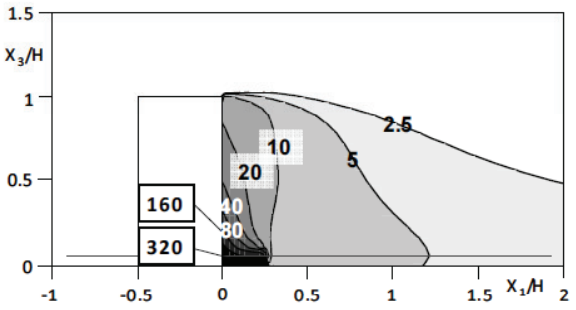
Experiment



LES



RANS



Gas Concentration behind building[3]

LES is able to predict the vortex shedding and flow recirculation accurately

Advantages of LES over RANS

Indeed, we remark that, except in cases of very simple flow situations, RANS models are never able to accurately reproduce an entire flow field. They may be quite accurate in some locations while being very inaccurate in others, even when model constants have been carefully “tuned”.

quoted from

INTRODUCTORY LECTURES on TURBULENCE (Physics, Mathematics and Modeling)
Departments of Mechanical Engineering and Mathematics
University of Kentucky

Advantages of LES over RANS

References:

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2. *Large Eddy Simulation (LES) of diesel spray in constant volume vessel. Transactions of the Japan Society of Mechanical Engineers. B 73(727), 879-886, 2007-03-25*

3. *LES Analysis of Urban Environment – Progress in the field of building environmental engineering over the past 20 years – Journal of Wind Engineering (121), 416-425, 2009-10-31*