



DEDALUS

A FLEXIBLE FRAMEWORK FOR SPECTRALLY
SOLVING DIFFERENTIAL EQUATIONS

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Dedalus

Pseudo-spectral

Open-source

Python

****Very flexible equations**

dedalus-project.org

Common questions:

Is it slow because it's in Python?

Is it parallelized?

Can it solve the XYZ equations?

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Yes! (probably)

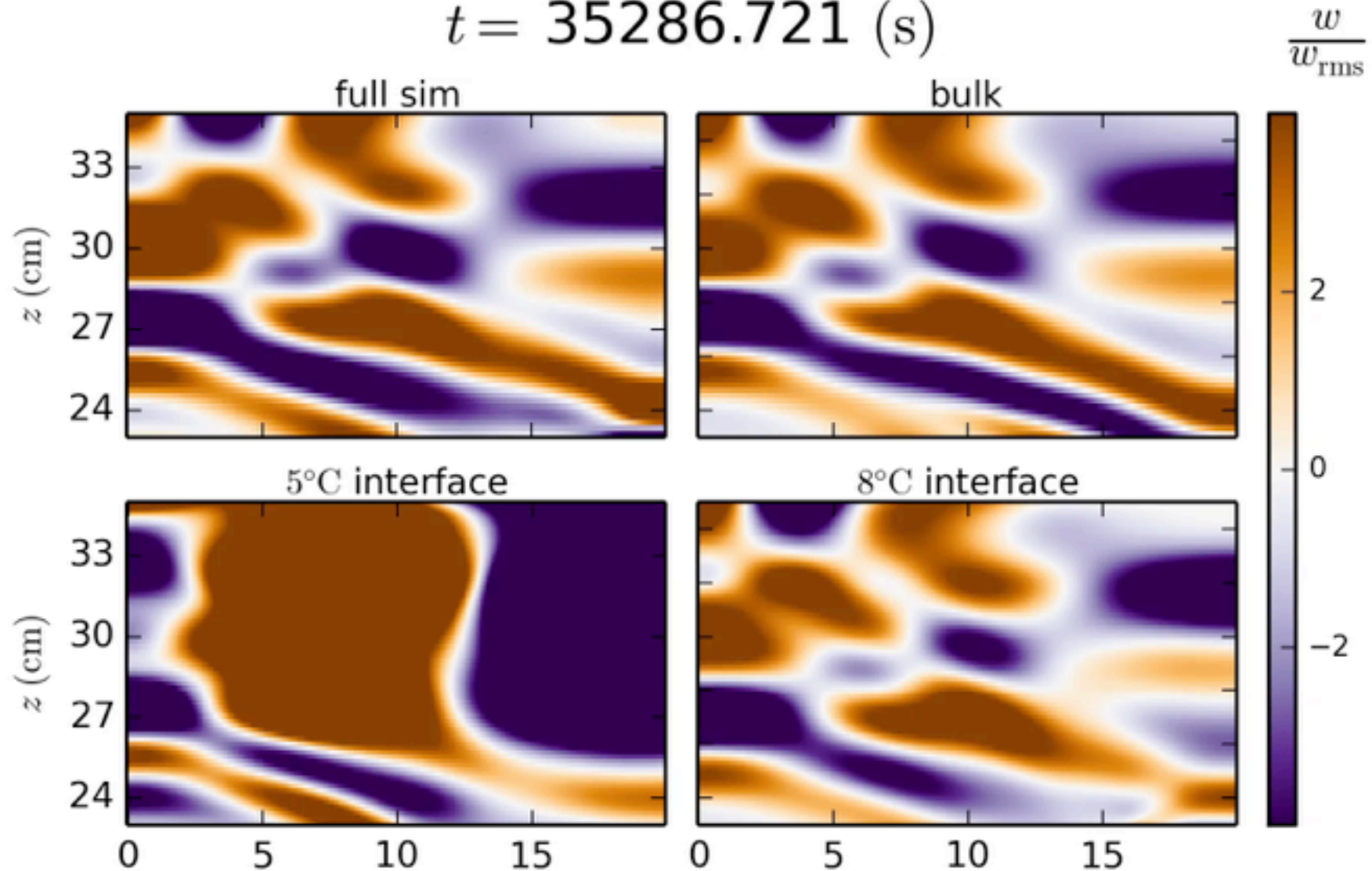
Great Use Cases:

Equations other people normally don't solve
(e.g., asymptotic equations)

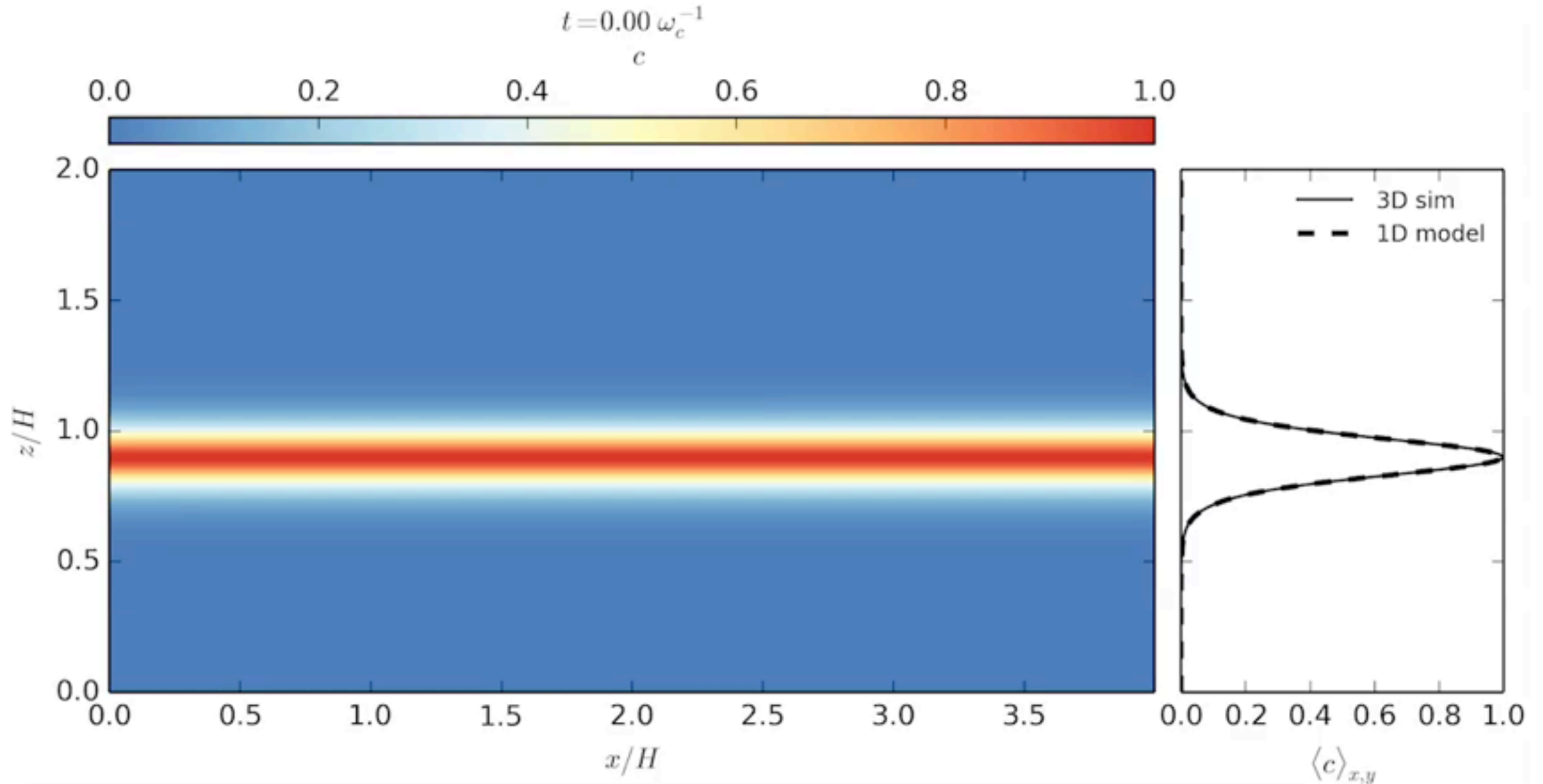
Data analysis

Wave generation by convection

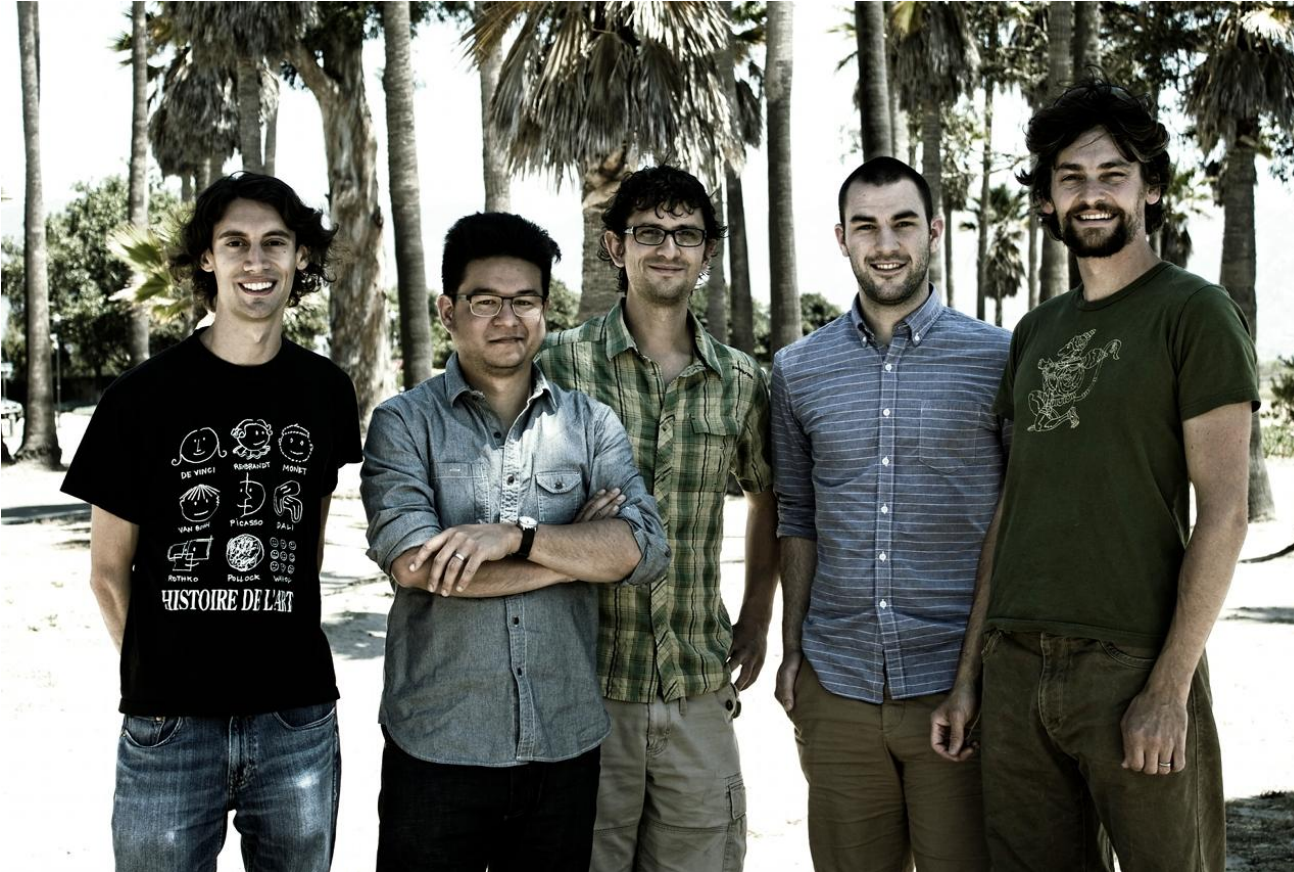
$t = 35286.721$ (s)



Diffusion by Convective Overshoot



The team so far



Daniel Lecoanet (Princeton) Keaton Burns (MIT)

Jeff Oishi (Bates) Ben Brown (Colorado)

Geoff Vasil (Sydney)



Australian Government
Australian Research Council



Outline:

Burgers' equation
Kelvin-Helmholtz Instability

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- For a simulation, need:
 - Equations
 - A domain
 - Timestepping scheme

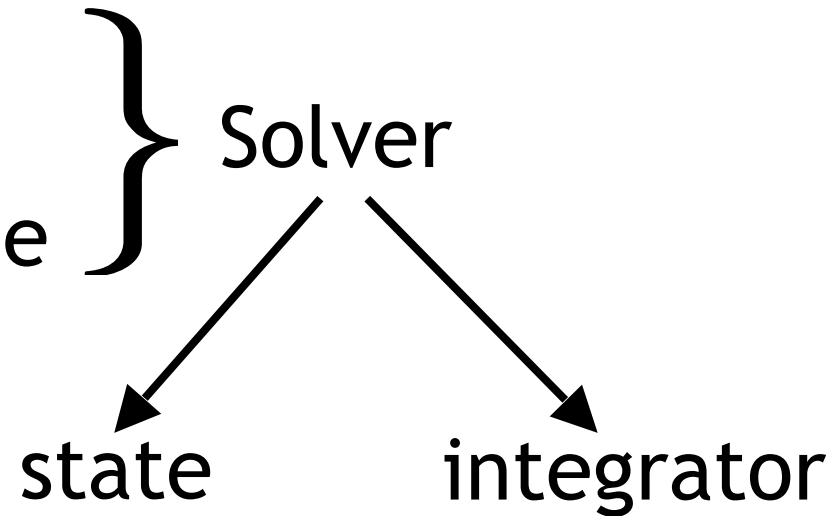
Dedalus

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- } Solver

Dedalus

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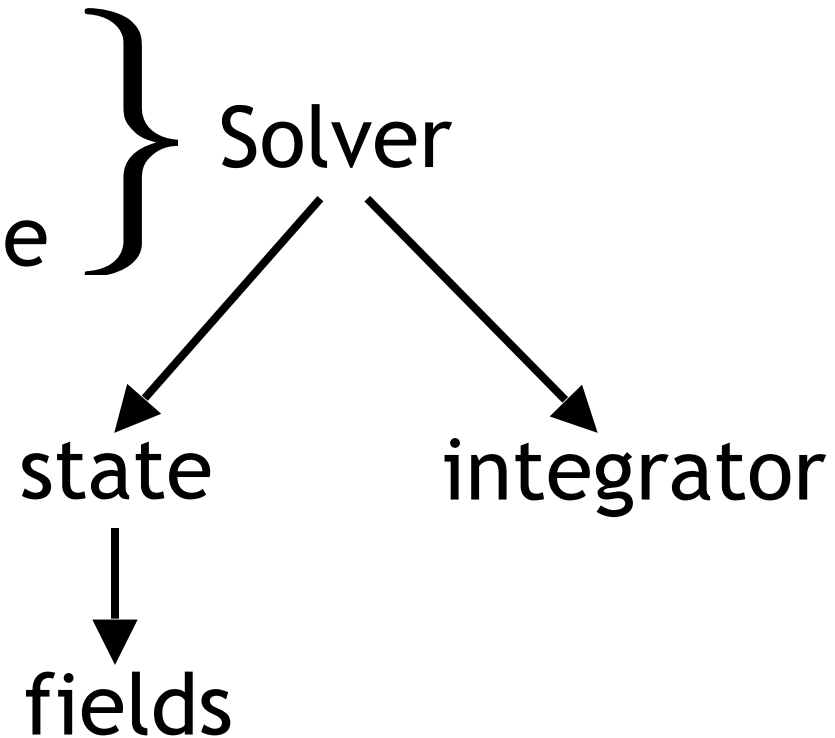
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Dedalus

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Fields

- Fundamentally a collection of coefficients
- Can transform to grid space, and back
- Can interpolate using "set_scales"

Example: Burgers' Equation

$$\partial_t u + u \partial_z u = 0$$

τ Method

Problem: N equations for N unknowns... plus BC's!

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Extra variables (τ 's) are added to the equations
Can check validity of sim by requiring τ is small