Reference data D: DNS dataset of HIT at some Re_λ

Model data D': spectralLES of HIT at same Re_λ using $\tau_{ij}^F(\vec{c})$

$\vec{c} = [c_1, c_2, c_3, c_4]$

JHU database HIT: $Re_\lambda \simeq 400$, 1024^3, pseudospectral code, large-scale forcing

→ 3D volumes of $\vec{u}$

→ Right now, we have a single snapshot in time. ⇒ we can't use a time average in our reference summary statistic S

spectral DNS HIT: identical forcing and Re_λ as model runs, more data in time.

⇒ we have to run this ourselves.

we can lower Re_λ and use 512^3

spectralLES HIT: data generated using $\tau_{ij}^F(\vec{c})$, verify that ABC algorithm can recover known values of $\vec{c}$

Pablo's plan:

1. Generate reference data D using spectralLES at 64^3 for the four parameter model, selecting $C_1^*, C_2^*, C_3^*, C_4^*$ from Olga's PRF draft, take data from one snapshot after statistically steady state has been reached. (0.8s) ⇒ 1 3D volume of $\vec{u}$ for reference run stored on hard drive.
2. Define priors $P(\vec{c})$ that are uniform distributions of C_i with width C_i^* ⇒ bounds are $C_i - C_i^*/2 : C_i^* + C_i^*/2$
3. Gridded approach with 7 intervals in each dimension of $C_i \Rightarrow 7^4 = 2401$ grid cells.

   ⇒ 2401 sets of $C_i = [C_1, C_2, C_3, C_4]$
4. Run spectralLES identically as in the reference case but using each of the 2401 different values of C_i ⇒ must use different random initial conditions.
5. 2401 3D volumes of $\vec{u}$ for the model runs, stored on hard drive.

Post-processing step (ABC):

1. Compute summary statistics; pdfs of $\tau_{11}, \tau_{12}, \tau_{13}$, P, spectrum ⇒ S

2. For each of the 2401 simulations, compute S' (pdfs of $\sigma_{11}, \sigma_{12}, \sigma_{13}, P$, spectra)

3. Compute the distance $\delta(S, S')$ for each of the 2401 parameter sets c_i

   $\Rightarrow$ Store in a single file c_i and $\delta(S, S')$; 2401 entries.

   For δ use: $\delta(S, S') = \overline{| \log_{10} S - \log_{10} S' |^2}^{1/2}$

   - pdf values over all bins.
   - spectra over all wavenumbers.

4. Compute CDF of δ to choose ε such that X% of parameters satisfy $\delta < \varepsilon$

   Acceptance rate.

   $\hookrightarrow$ A subset of $\delta(c_i)$ that satisfy $\delta < \varepsilon$ corresponding to an acceptance rate of X%

   $\hookrightarrow$ Store all "accepted" parameters c_i'

5. Joint pdf of $c_i' \rightarrow$ 4 dimensions for each of c_1, c_2, c_3, c_4.

6. Compute the MAP of joint pdf and compare with c_i^*