Welcome to instats

The Session Will Begin Shortly

(At the top of the hour, Eastern USA time)

1

START

2

Nonlinear Time Series Analysis, Part II: Modeling and Phenomenology

Barney Ricca
Lyda Hill Institute for Human Resilience
University of Colorado Colorado Springs

3

Seminar Outline

- Day 1
  - Session 1 – Overview of Phenomenology
  - Session 2 – Dynamical Systems Analysis
- Day 2
  - Session 3 – Sparse Identification of Nonlinear Dynamics
  - Session 4 – Dynamic Mode Decomposition
- Day 3
  - Session 5 – Hidden Markov Models
  - Session 6 – Machine Learning Approaches
- Day 4
  - **Session 7 – Putting it All Together: Lorenz**
  - Session 8 – Putting it All Together: Infectious Diseases

4

Putting it all together

- Lorenz system
  - Simulated data: Can control the length, noise level, missingness, etc.
- Embedding and recurrences
- Tests
- Singular Spectrum Analysis
- Tests (again!)
- Convergent cross mapping
- SINDy
- DMD (and Havoc)
- Extreme value statistics

5

Extreme Value Statistics (if time)

- Mitigating extreme value impacts is important
  - Floods, mental health depression, etc.
  - Irregular (a.k.a., noise)
- Model the noise
  - Can determine *return time*
    - How long before a given level of noise is seen again
- This assumes a particular distribution, the *Generalized Pareto* distribution
  - Not a big assumption: In natural systems, GP is more common than the so-called Normal distribution

6

Questions

7

STOP

8

Next session @ UTC 1900

9