Atmospheric Turbulence

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1. Introduction

- Long connections between turbulence and atmo- oceanic flows
- The 1961 Marseilles meetings
- Great progress in geostrophic turbulence (rotation, stratification), internal gravity waves, 2D turbulence, atmospheric boundary layers……
- Convection, both dry and (in particular) moist; cumulus clouds now centre of much attention
- Tropics next frontier?
  Charney's riddle
  Special features of the tropics
- Scope of talk
  Cumulus clouds, atmospheric boundary layer, flux time series

2. Cumulus Clouds

2.1 Introduction

- Tropical skies dramatic, dynamic
- Importance in climate science, tropical circulations
- Two major parts:
  Microphysics
  Macro dynamics
  What links between the two?
- Looking for an effective fluid-dynamical model
- Lack of lab simulations has hampered research (no two natural cumuli the same)
- Cumulus clouds are transient flows:
  Life-time distribution

2.2 Early work:

Turner, Scorer, Paluch
Bhat+RN, Basu+RN, Breidenthal, Johari

2.3 Current research on lab simulations

(RN++ 2011 PNAS)

2.4 Computer simulations

- Basu+RN
- Prasad +
- J. Schumacher

2.5 Emerging picture

Suggested micro-macro links

The transient diabatic plume

2.6 Dry convection

- Cryogenic He experiments, asymptotic regime?

2.7 Challenges

3. Atmospheric boundary layer

3.1 Introduction

3.2 ABL in the tropics

- Experience in the monsoon trough boundary layer experiment
- Monin-Obukhov inadequate
- The 'nearly-free' convection limit
- Parameterization based on heat-flux scaling
- Challenges
- Episodic description of flux time series: the Jodhpur experiment.
- Results of analysis by Francis

4. Concluding Remarks

- Role of laboratory studies
- Value of canonical flows
- Computer simulations: LES, DNS, models
- Field experiments
- Role of satellites: TRMM, Megha-Tropiques, GPM
- Exciting times ahead?