NARCCAP MM5

and

Some Verrrry Preliminary Results of Simulations of Winds

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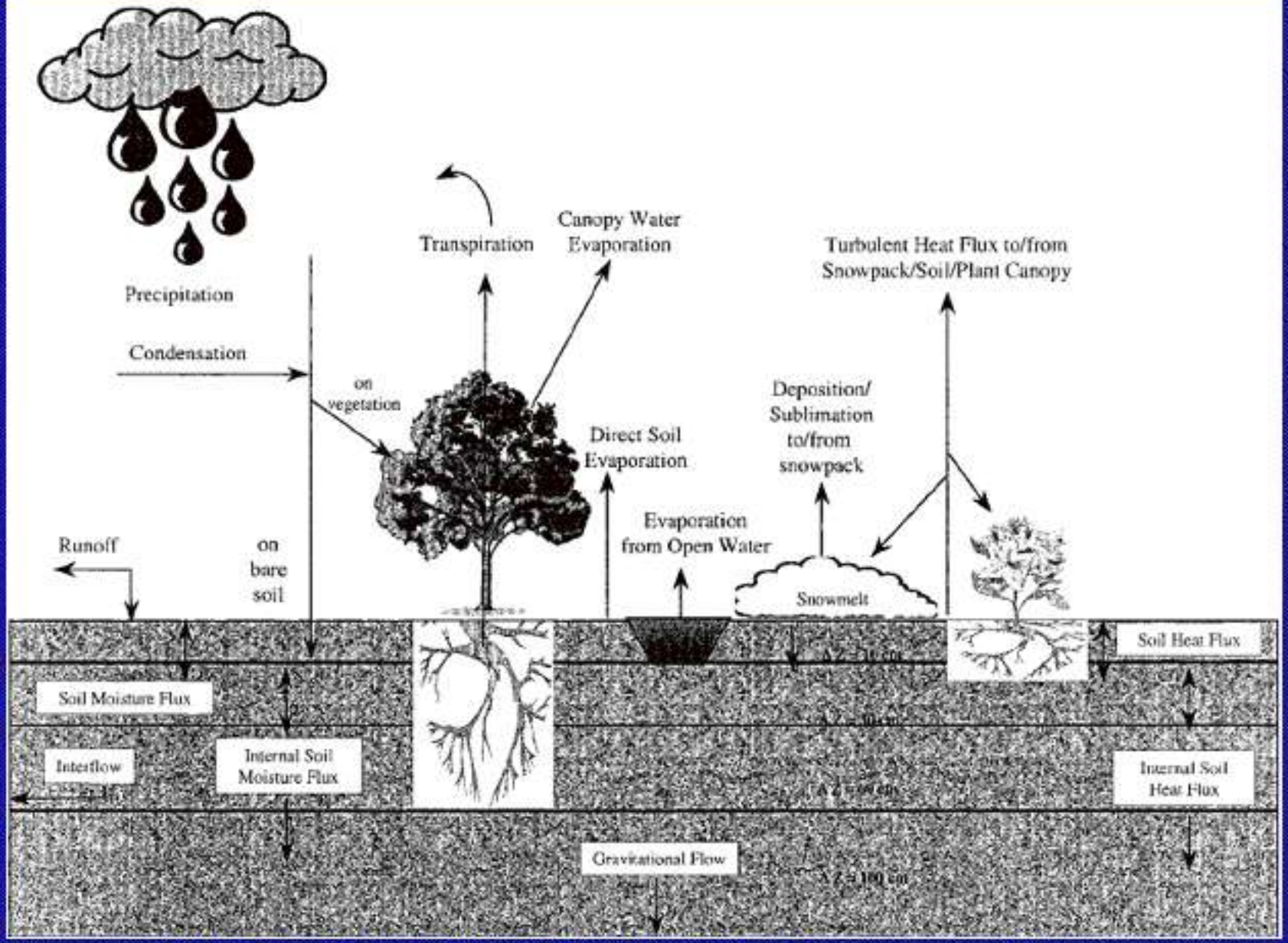
Model

NCAR/Penn State Non-hydrostatic MM5 (V3)

- **Kain-Fritsch cumulus convection**
- **Mixed-phase (Reisner) microphysics**
- **RRTM radiation**
- **Non-local MRF PBL**
- **Five layer soil model (1, 2, 4, 8, 16 cm)**

Noah Land Surface Model



NOAH LSM Schematic

(Chen and Dudhia, 2001)

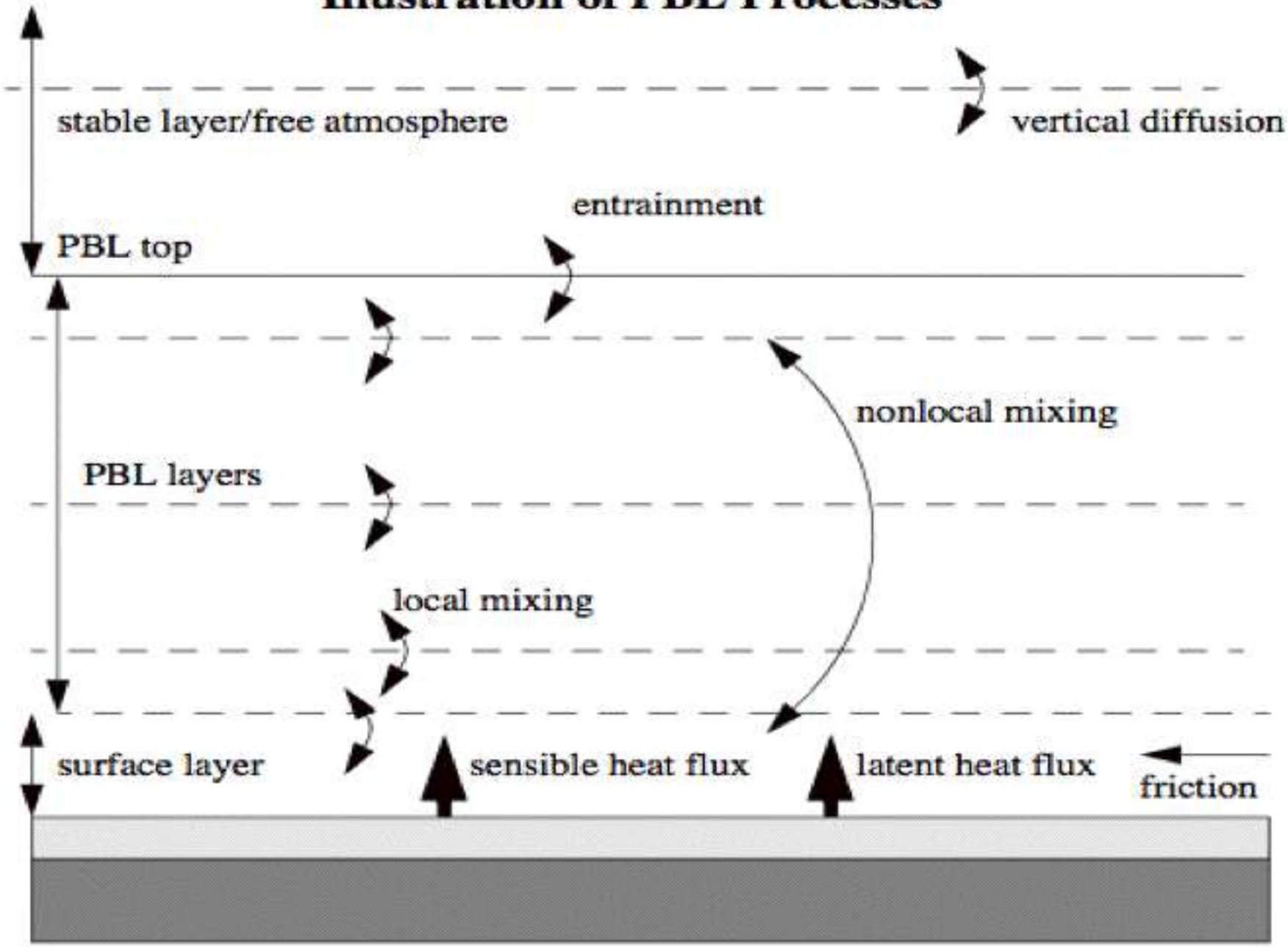
Standard Landcover Types

1) Broadleaf-evergreen trees
2) Broadleaf-deciduous trees
3) Broadleaf and needleleaf trees
4) Needleleaf-evergreen trees
5) Needleleaf-deciduous trees (larch)
6) Broadleaf trees with groundcover
7) Groundcover only
8) Broadleaf shrubs with groundcover
9) Broadleaf shrubs with bare soil
10) Dwarf trees/shrubs with groundcover (tundra)
11) Bare soil
12) Cultivations
13) Wetland
14) Dry coastal complex
15) Water
16) Glacial

Standard Soil Textures

1) Sand
2) Loamy sand
3) Sandy loam
4) Silt loam
5) Silt
6) Loam
7) Sandy clay loam
8) Silty clay loam
9) Clay loam
10) Sandy clay
11) Silty clay
12) Clay
13) Organic material
14) Water
15) Bedrock
16) Other (land–ice)

Illustration of PBL Processes



Arm Chair Thought:

Models that simulate pressure fields pretty well should simulate wind speeds pretty well

but…

Surface winds simulated by models are subject to errors in both pressure fields and surface-layer parameterizations that translate lowest-model-level winds to the 10-m level

A 1% error in wind speed estimates for a 100 MW wind generation facility can lead to losses approaching $12,000,000 over the plant lifetime

Freedman et al, 2008: Recommendation 1. **DOE Workshop on Research Needs of Wind Resource Characterization**. 14-16 January 2008. Broomfield, CO

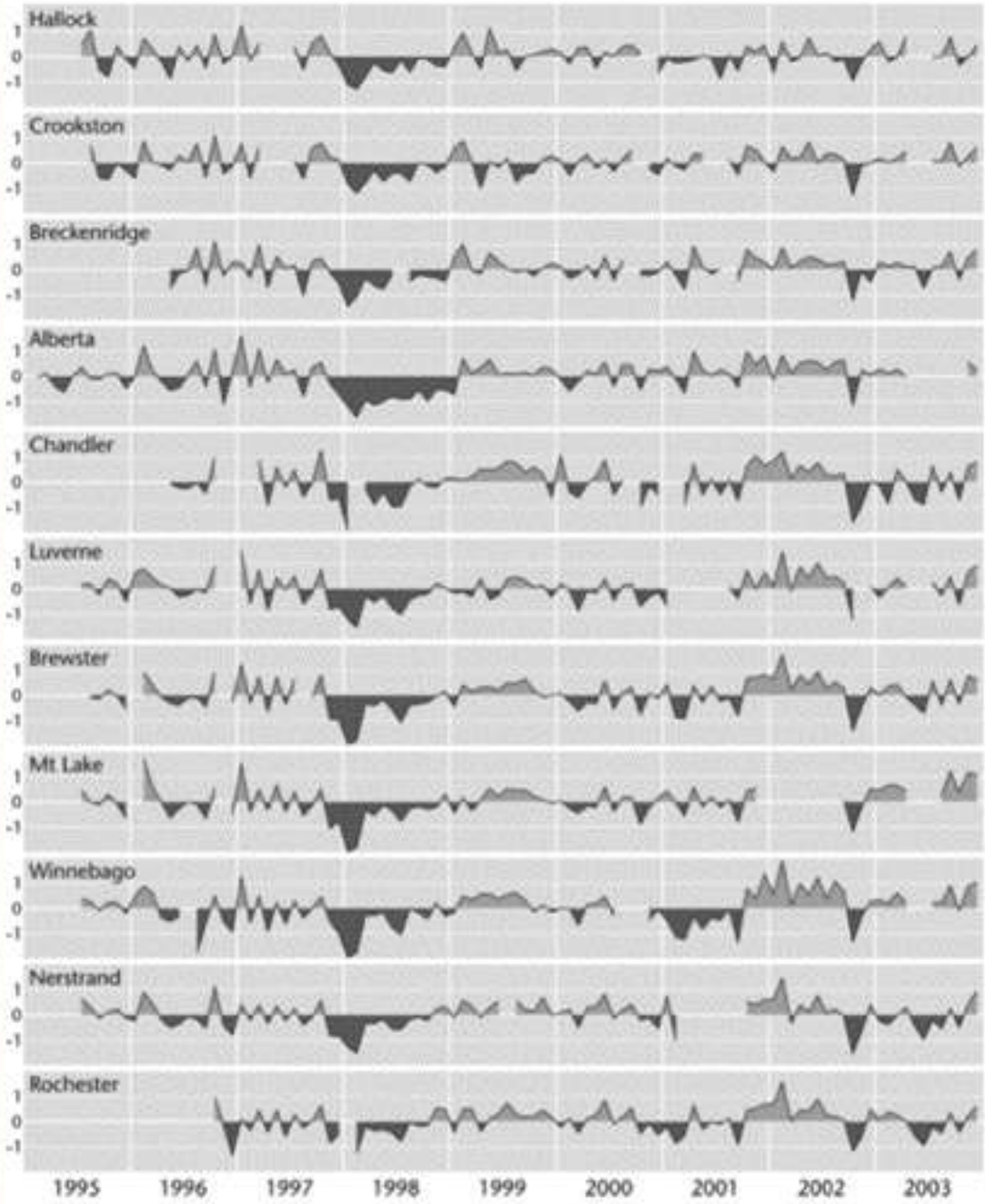
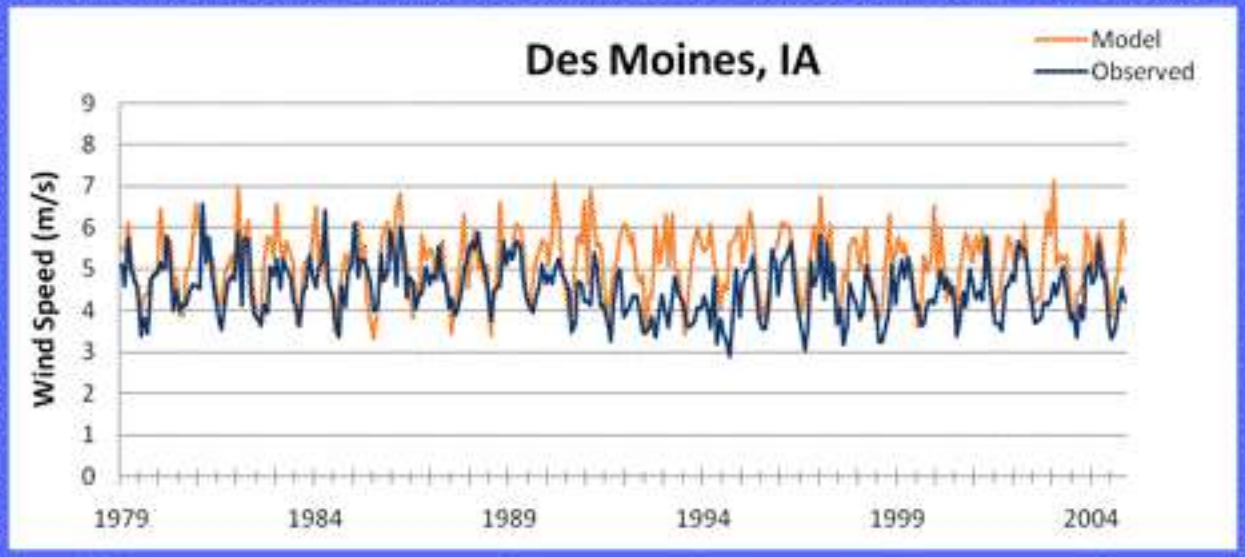
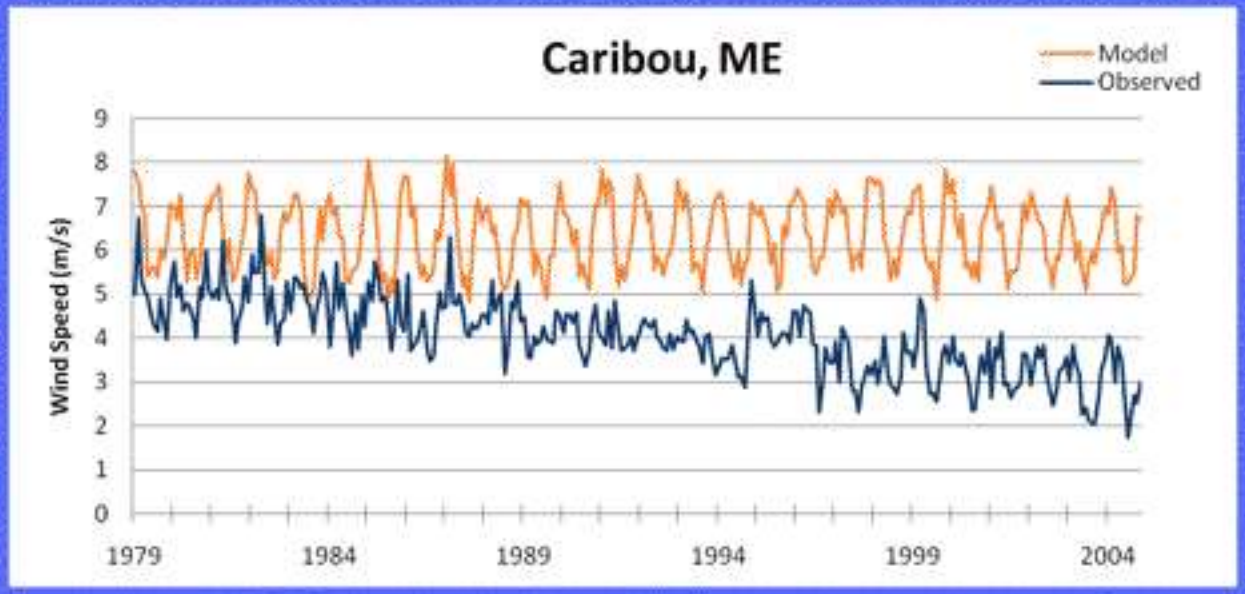


FIG. 5. Monthly wind speed anomalies (m s^{-1}) at the 11 70-m wind-monitoring sites. Anomalies are computed from monthly means derived from the 1995–2003 base period.

Mean Monthly Wind Speeds

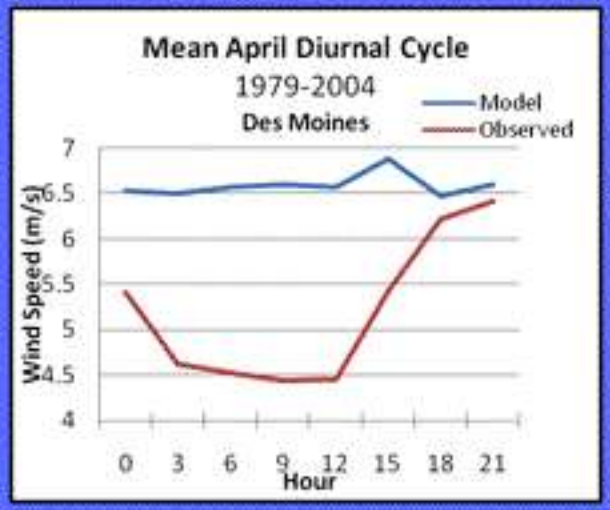


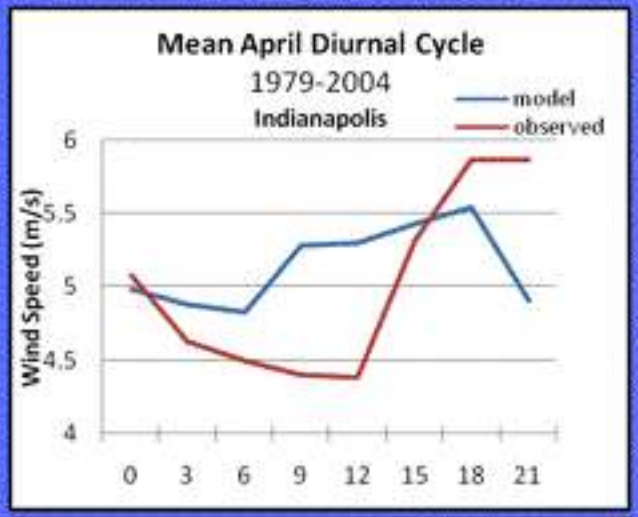
Wind speeds too high after 1990 – slight negative trend

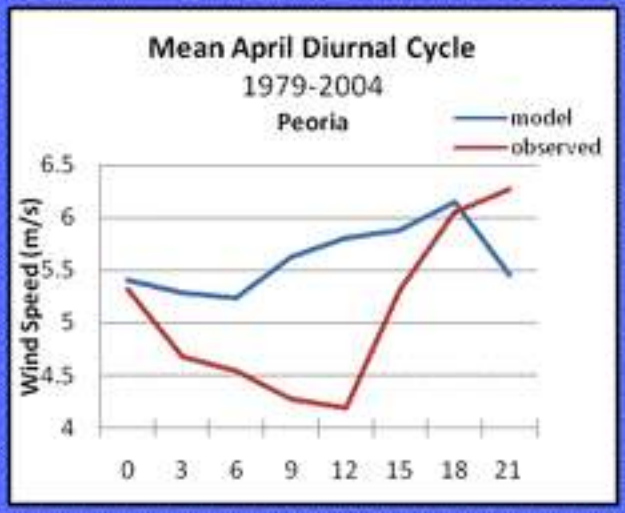


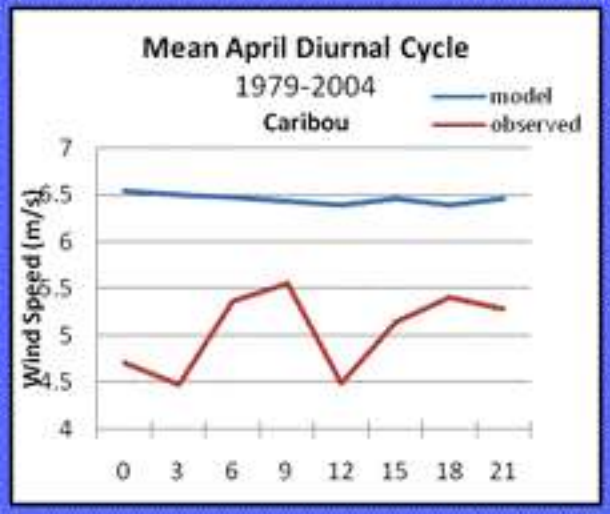
Wind speeds too high for entire period – no trend

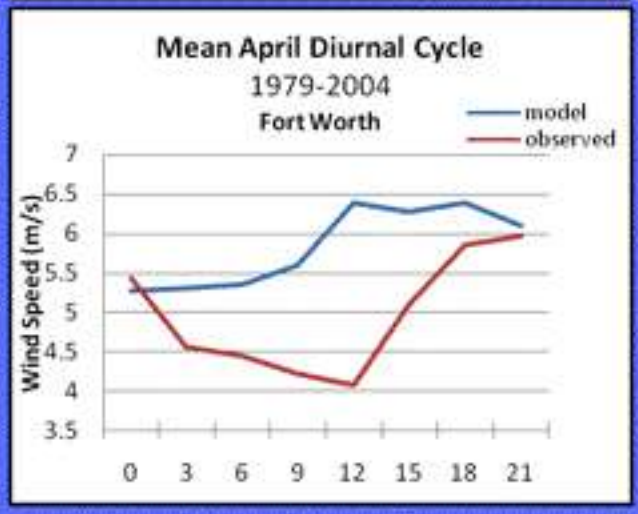
Diurnal Cycles

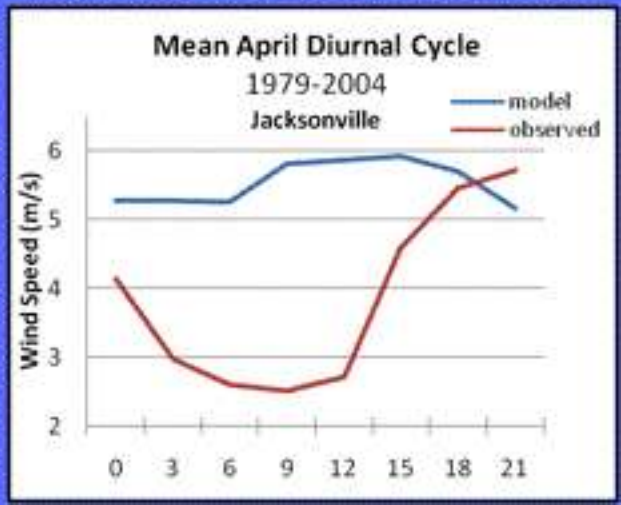












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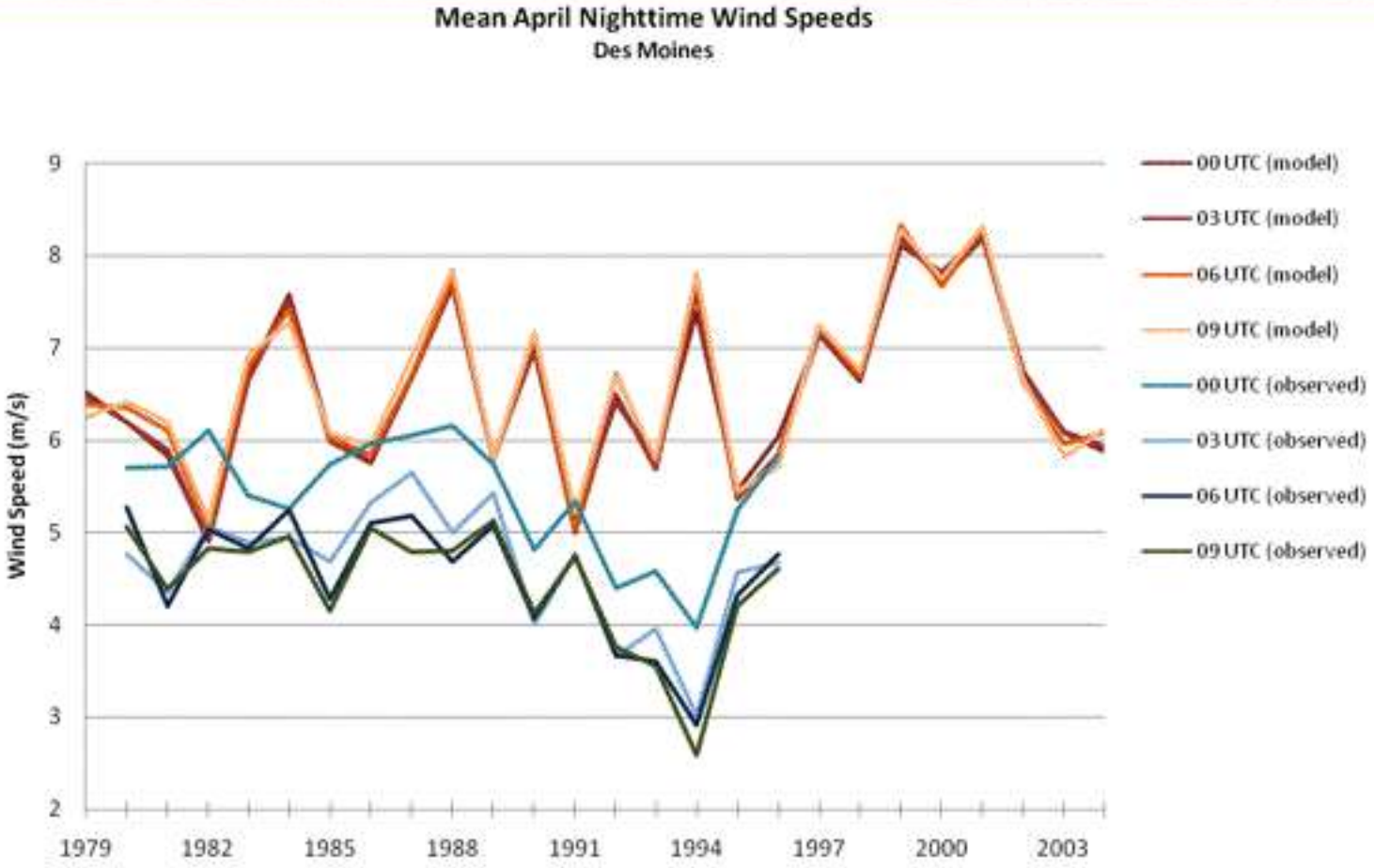
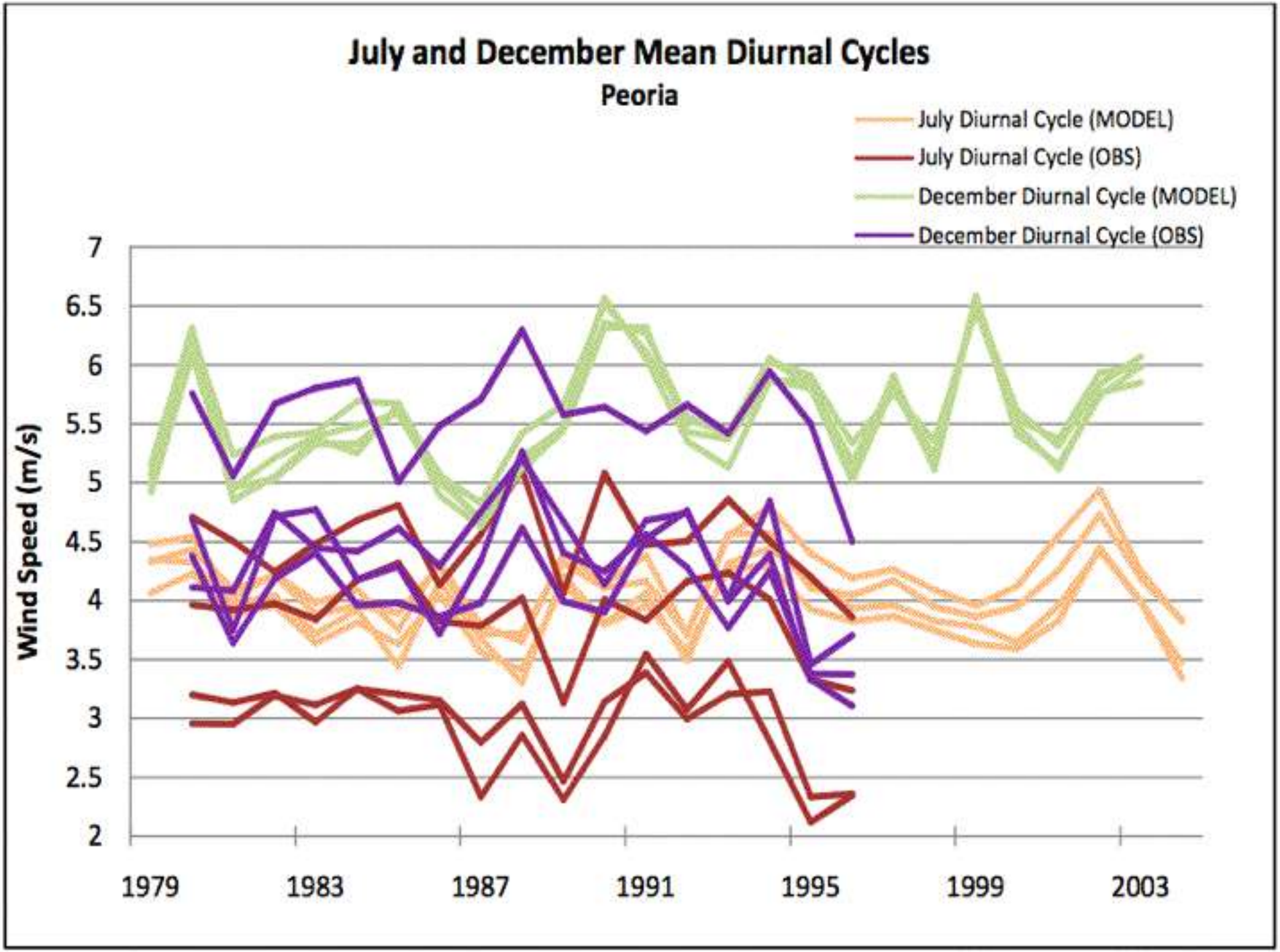


00-09 UTC winds are stronger up to 2001

00-09 UTC winds weaker up to 1994


July and December Mean Diurnal Cycles
Peoria
July Diurnal Cycle (MODEL)
July Diurnal Cycle (OBS)
December Diurnal Cycle (MODEL)
December Diurnal Cycle (OBS)
Wind Speed (m/s)
7
6.5
6
5.5
5
4.5
4
3.5
3
2.5
2
1979
1983
1987
1991
1995
1999
2003