Validation of NLDAS-3 Tair product using in situ data

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Introduction

• How well does NLDAS-3 estimate near surface air temperature?

• Validation of NLDAS-3 temperature data using GHCN station data for one year (2005)

• NLDAS-3 near surface air temperature (M. Pan, Princeton)
  • Downscaled from 1/8-degree NLDAS-2

• Uncertainties in observations
  • Scaling from point to area
  • Sensor height above ground/topographic setting

• Therefore, we use in situ observations to evaluate:
  • Absolute temperature (with caution)
  • Spatial variability
  • Elevation adjustment

http://www.nws.noaa.gov/om/csd/pds/PCU6/IC6_2/tutorial1/Factors_exposure.htm
Data

- NLDAS-3 three km hourly temperature data
- GHCN station daily Tmax and Tmin
- 3 regions with sufficient station data
  - 2 mountainous regions, 1 flat region
  - Each region consists of 3X3 3km grid boxes
  - At least 4 grid boxes must have at least 1 station
Method

• Only include grid boxes with station data

• \( Tav = \frac{(T_{\text{max}} + T_{\text{min}})}{2} \)

• Grid boxes with more than one station
  \( Tav = Tav_1 + Tav_2 + \cdots \)

• Usually only one station per grid box
Monthly Temperature

Region 1

Region 2

Region 3
Monthly Temperature

Jan 2005

Temperature: o—NLDAS2, x—GHCN

Jul 2005

Temperature: o—NLDAS2, x—GHCN
Monthly Temperature

Jan 2005

Temperature: o–NLDAS2, x–GHCN

Jul 2005

Temperature: o–NLDAS2, x–GHCN
Monthly Temperature

Jan 2005

Temperature: o–NLDAS2, x–GHCN

Jul 2005

Temperature: o–NLDAS2, x–GHCN
Daily Temperature

Jan 2005

Jul 2005

Reg. 1

Reg. 2

Reg. 3

Temp (°C)

01-Jan-2005, b: GHCN, r: NLDAS

01-Jul-2005, b: GHCN, r: NLDAS

NLDAS

GHCN
Daily Temperature

Jan 2005

Jul 2005
Daily Temperature

Jan 2005

Jul 2005

R

RMSD

BIAS

box number

box number
NLDAS-3 temperature performs worst over rocky mountains during the winter. Possible problem with snow(?)
Lapse Rate

- Lapse rate of monthly average temperature
- Slope from linear regression
- 5X5 three kilometer grid boxes
- NLDAS-3 Z from GTOPO30 (may change in future)
- GHCN Z = station elevation
Conclusions

• NLDAS temperature estimation may suffer significant bias in the rocky mountains during the winter.
• Temperature biases across the mountainous regions may be related to elevation difference between points and pixels
• NLDAS-3 overestimates lapse rate in rocky mountains