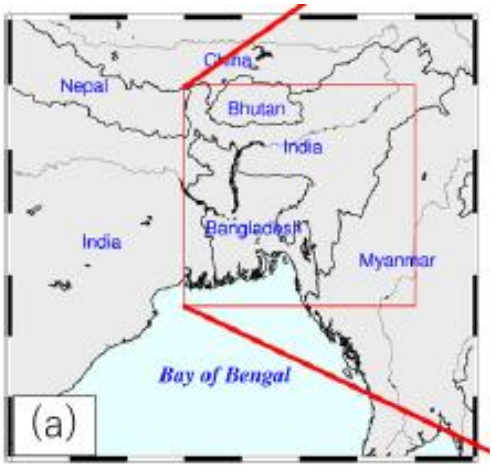
11 Oct. 2018: Annual Workshop on
Science of Climate Change @ IITG/Pune

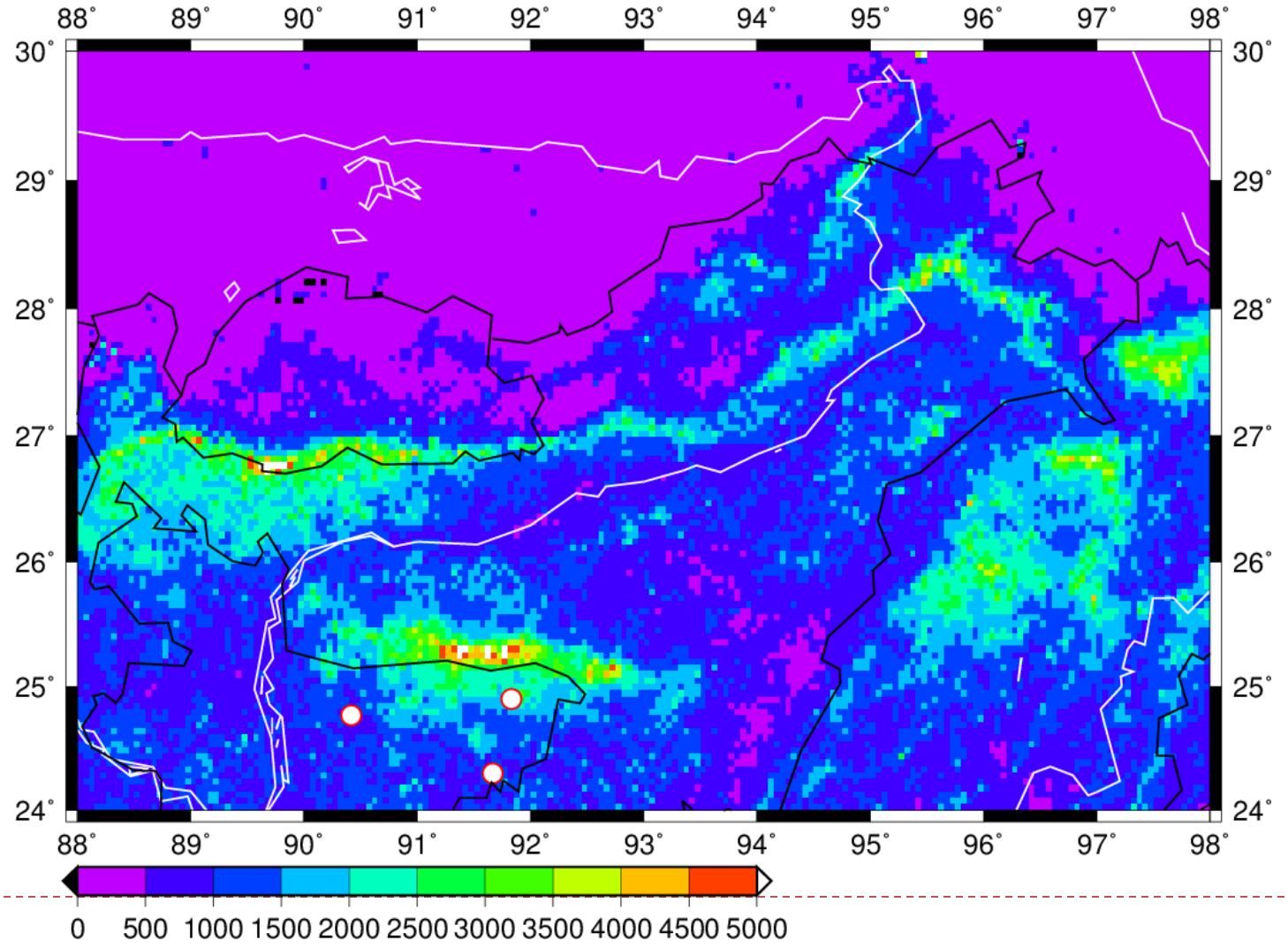


Hands-on Training: Bootstrap Test

Toru Terao (Kagawa Univ.)

Monsoon TRMM NSR Climatology

1998-2011 Jun.-Sep.



TRMM-2A25(V7) dataset

- TRMM
  - Sun async., 36N-36S, 402.5km
- TRMM-PR
  - Precipitation Radar
  - Swath: 247km
  - Resolution: 5km
  - vertical 250m(0-20km)
- TRMM 2A25(V7)
  - Renovation of algorithms for vertical rain profile (V6→V7)
  - rain, surface_rain were utilized.

Hypothesis to be rejected

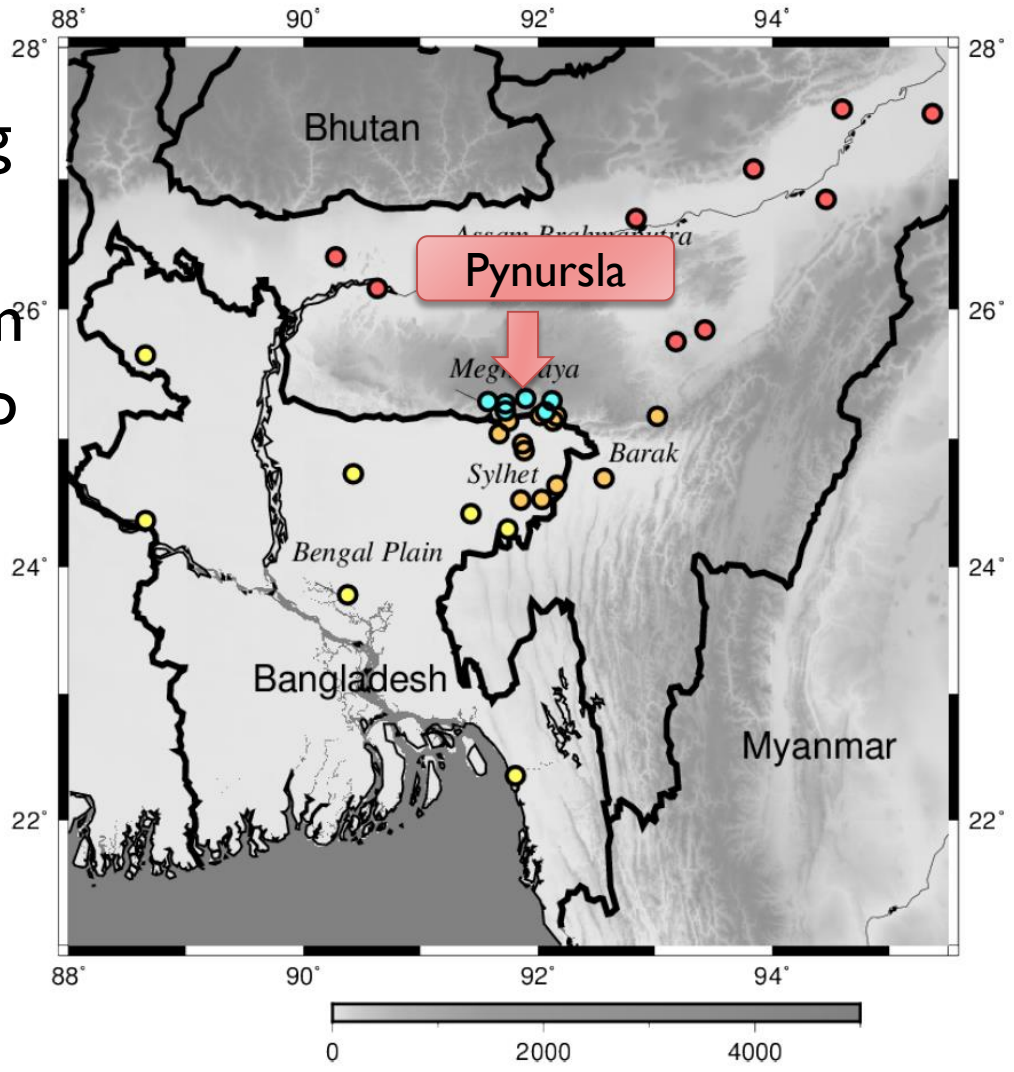
- Definition of rainfall intensity:
  - Rt: TRMM observation of rainfall
  - Rg: matchup raingauge observation estimated by tipping occurrence frequency for specific time window $2\Delta t$ (we used 5 minutes (300 seconds) in this paper)
- We evaluate the difference, d=Rt-Rg, for matchups.
  - all matchups / matchups for specific areas / matchups for specific ranges of Rt values, or other criteria
- Confidence interval of d should include {0}.
- Otherwise, we conclude that Rt overestimates or underestimates real rainfall intensity.

Confidence interval of Rt-Rg

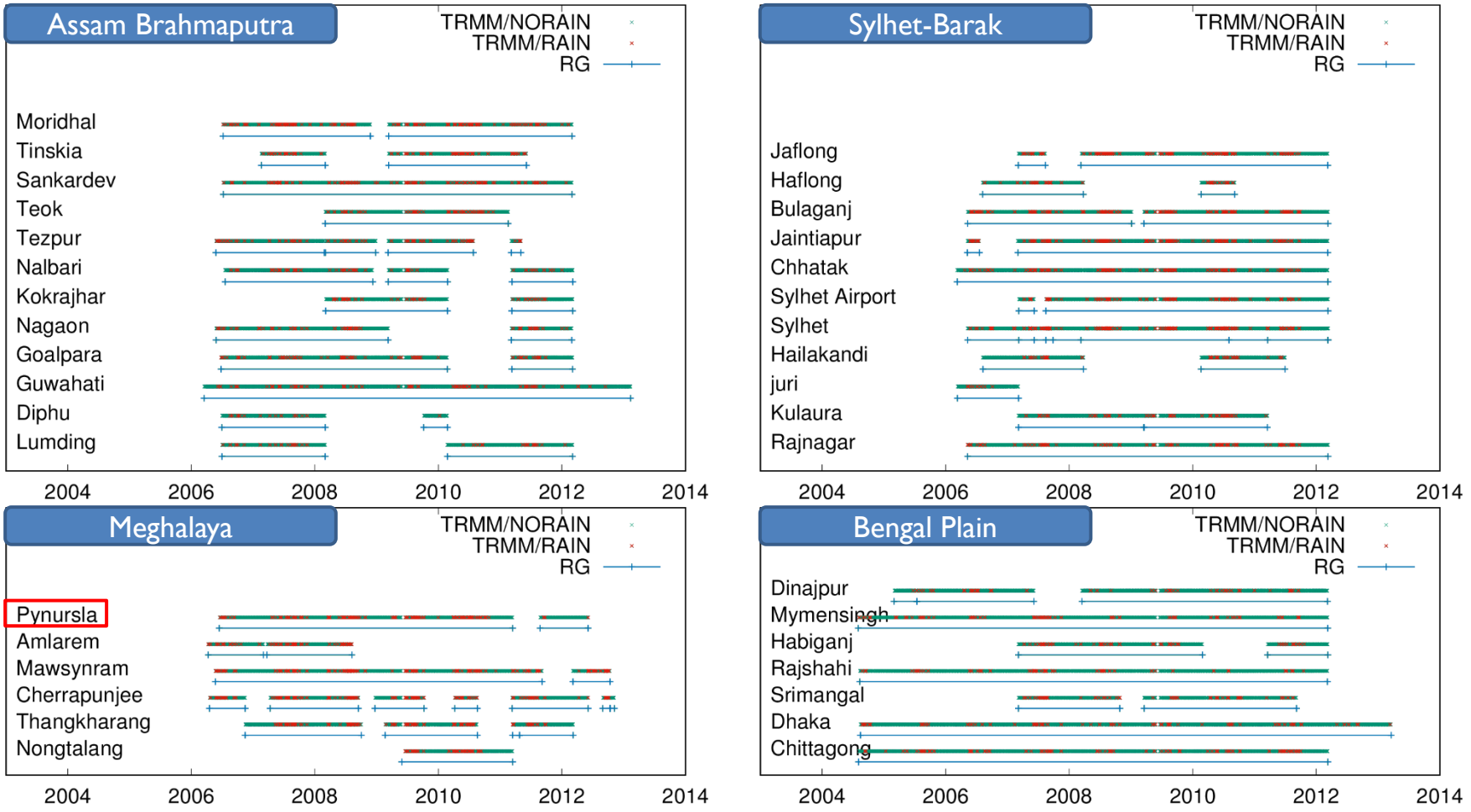
- Percentile method of bootstrap test (Efron 1979) was utilized in the present study
  - Start from samples {di|i=1, 2, ..., n}, Ave({di}).
  - We make B resamples {dj|j=ab1, ab2, ..., abn}b (b=1, 2, ..., B)
    - abi is determined by sampling with replacements.
    - Here we calculated Ave({dj})b for B=10,000.
  - An interval defined by 2.5 and 97.5 percentiles of calculated Ave({dj})b is defined as the 95% confidence interval. That by 0.5 and 99.5 percentiles is 99% confidence interval.

RG network in NE Indian subcontinent

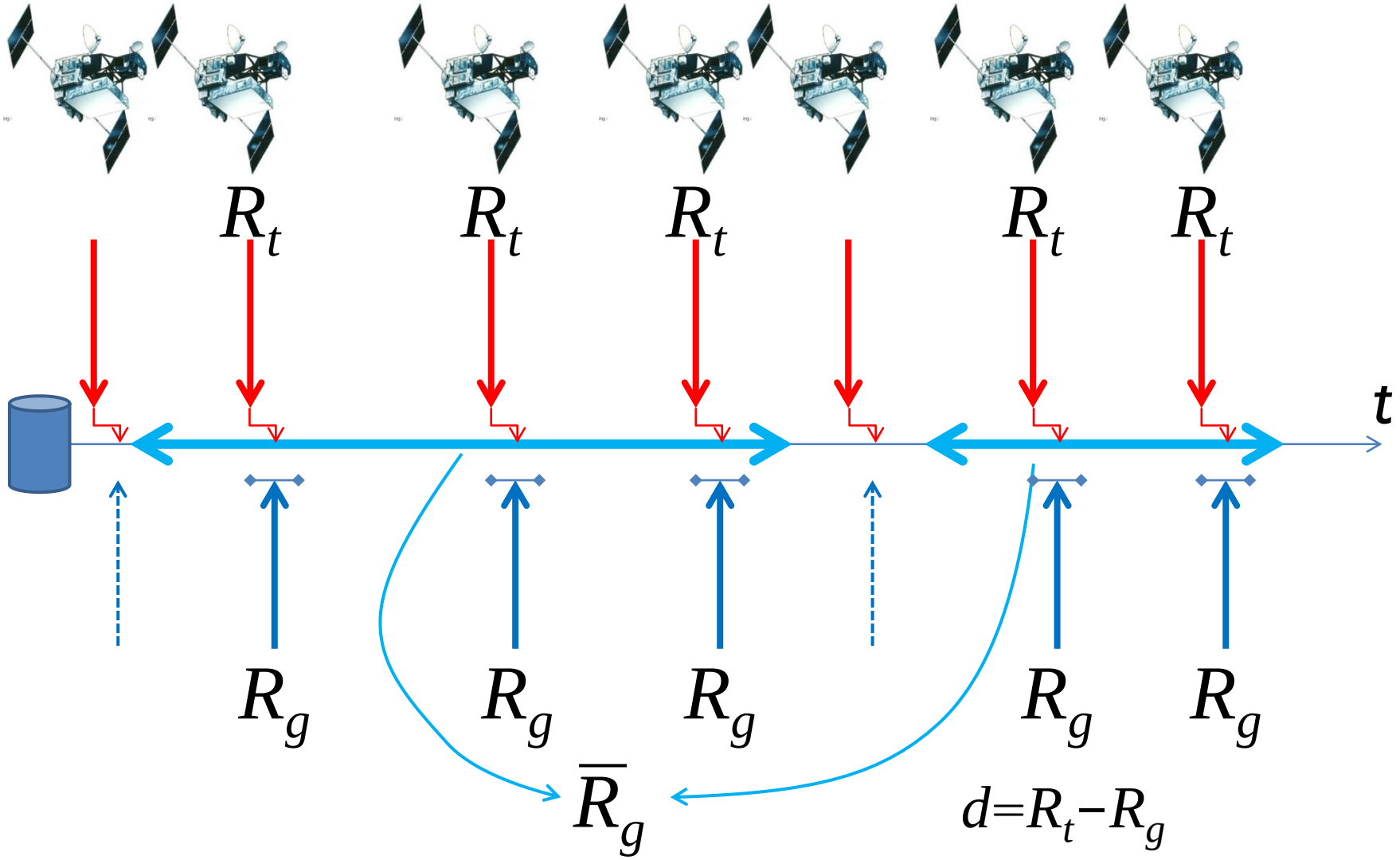
- We conducted direct TRMM validation using 37 raingauges.
- They are Installed from 2004 and continued up to now.
- We obtained 29,172 matchups including 2,245 rainy cases.



Data Availability of Raingauges



Raingauge (R_g) and TRMM (R_t)



Questions

- Q1: Somehow, draw histogram of d.
- Q2: From 1000 BootstrapSamples, Determine if 95% or 99% confidence interval of d includes 0 or not.
- Q3: Somehow, calculate 1000 Bootstrap samples (10000 is better if you can) for following cases and perform test as like Q2.
  - Midnight to Morning rain (Hour(UTC)=18 to 5)
  - Afternoon to Early Evening rain (Hour(UTC)=6 to 17)
- And more, as you like.