Historical precipitation data rescue to investigate the long-term variability of the Asian monsoon

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“Historical precipitation data rescue” in Japan

Overall target:

“Long-term variability of the Asian Monsoon”

- Long time series of daily precipitation
The WMO’s Data Rescue project, a component of the World Climate Data and Monitoring Program (WCDMP), helps countries manage and preserve climate data and transfer observations from paper records to digital form. The WMO (in WCDMP Report No. 49) defines data rescue as “an ongoing process of preserving all data at risk of being lost due to deterioration of the medium, and the digitizing of current and past data into computer-compatible form for easy access,” and adds that

1) data should be stored as image files onto media that can be regularly renewed (cartridges, CDs, DVDs, etc.);
2) data already in computer-compatible media should be constantly migrated to storage facilities that conform to changing technologies; and,
3) data should be key-entered in a form that can be used for analyses.

BAMS (2004)
Page et al. (2004)

Fig. 1. For each country, the number of stations that have historical daily precipitation data available in paper format (filled circles) and in digital format (open circles), as sampled for the first day of every decade, from 1 Jan 1900 through 1 Jan 2000, and for each country. Increases or decreases in the number of stations during the following 10 yr to 1 Jan of the following decade have not been counted.
“Historical precipitation data rescue” in Japan

Overall target: Long-term variability of the Asian Monsoon
- daily precipitation
- since the late-19th century
  - previous project focused on the 20th century

Today’s presentation: seasonal rainfall characteristics and monsoon variability by comparing the first half and the second half of the 20th century

1. Indonesia
2. Philippines
3. China
4. Indochina (mainly Vietnam)
5. Japan
1. Indonesia

- “Regen waarnemingen in Nederlandsch-Indie”
- Daily precipitation
- 1901-1916
  - Data for pre-1901 were digitized by KNMI and BMKG

Stations recorded in “Regen waarnemingen in Nederlandsch-Indie” during the 19th century
1. Indonesia
1. Indonesia

Annual rainfall variability for 1901-1916

- **Medan**
  - $\tau = 0.216$
  - Ave. = 2,049mm

- **Bandjamasin**
  - $\tau = -0.1$
  - Ave. = 2,449mm

- **Ambon**
  - $\tau = 0.1$
  - Ave. = 3,250mm

- **Batavia**
  - $\tau = -0.016$
  - Ave. = 1,832mm

- **Makassar**
  - $\tau = -0.05$
  - Ave. = 2,705mm
1. Indonesia
Annual rainfall variability for 1975-1990

- **Medan**
  - $\tau = -0.4$
  - Ave. = 1,884mm

- **Bandjarmasin**
  - $\tau = -0.6$
  - Ave. = 1,882mm

- **Ambon**
  - $\tau = 0.166$
  - Ave. = 2,731mm

- **Jakarta**
  - $\tau = -0.3$
  - Ave. = 1,908mm

- **Panakukan**
  - $\tau = 0.0$
  - Ave. = 2,876mm

Courtesy of Dr. Hamada
1. Indonesia
Annual rainfall: 1901-1916 vs 1975-1990

1901-1906

- Medan: $\tau = 0.216$, Ave. = 2,049mm
- Bandjarmasin: $\tau = -0.1$, Ave. = 2,449mm
- Ambon: $\tau = 0.1$, Ave. = 3,250mm

1975-1990

- Medan: $\tau = -0.4$, Ave. = 1,884mm
- Bandjarmasin: $\tau = -0.6$, Ave. = 1,882mm
- Ambon: $\tau = 0.166$, Ave. = 2,731mm
1. Indonesia

Seasonal rainfall variability (derived from 1901-1916 data)
1. Indonesia
Seasonal rainfall variability (derived from 1975-1990 data)
1. Indonesia

Seasonal rainfall variability (derived from 1975-1990 data)
2. Philippines

- “Monthly Bulletins of Philippines Weather Bureau”
- Daily precipitation (+ pressure data, typhoon truck)
  - 1901 - : digitization finished
  - 1891 – 1900 : ongoing
  - over 300 stations
- 1891 – 1940
- Images contributed from Univ. Hawaii
  - Japan Meteorological Agency
  - KNMI etc.

by Dr. H. Kubota (JAMSTEC)
2. Philippines

- Stations recorded in “Monthly Bulletins of Philippines Weather Bureau” since 1901
  - for pre-1901: about 10 stations

by Dr. I. Akasaka (Tokyo Metropolitan University: TMU)
2. Philippines  1907-1940 vs. 1961-2002

- Distribution of annual rainfall

by Dr. I. Akasaka (TMU)
2. Philippines 1907-1940 vs. 1961-2002

Mean seasonal progression of rainfall in the west Luzon Island

by Dr. I. Akasaka (TMU)
2. Philippines  **1907-1940 vs. 1961-2002**

- Inter-annual variability of Monsoon onset/withdrawal.

by Dr. I. Akasaka (TMU)
3. China

- “Bulletin des Observations”
- Zi-Ka-Wei (Shanghai observatory funded by Jesuit)
- Daily precipitation
  - 40 - 200 stations
- 1873 – 1939
- only 6 locations were digitized
  - Amoy, Hong-Kong, Ning-po (Chin-hai), Pei-yu-chan, Wen-cheou
- 1901 - : finished
- 1873 – 1900 : ongoing
- available from JMA library
3. China
3. China

- Long-term trend
  - Annual rainfall
  - Number of days with daily precipitation above 50mm

by Dr. J. Hirano (TMU)

- Seasonal variability of rainfall (half-pentad) at Wen-cheou

by Dr. J. Hirano (TMU)
4. Indochina (mainly Vietnam)

- “Bulletin Pluviometrique”
- 1906-1928
  - Daily precipitation
  - only monthly total precipitation for 1906-1909
- JMA library and NOAA website
  - Météo France
  - Vietnam Weather Bureau
4. Indochina

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**Moy de Mars 1910**

**TABLEAU MÉTÉOROLOGIQUE**

**BULLETIN PLUVIOMETRIQUE**

**ANNEE**

1910

**GOUVERNEMENT GÉNÉRAL DE L'INDOCHINE**

**OBSERVATOIRE CENTRAL DE L'INDOCHINE**

**SERVICE MÉTÉOROLOGIQUE**

**ANNUEL**

**ET**

**CARTE**

**1911**

**Moy de Mars 1910**

**Gouvemment général de l'Indochine**

**Observatoire central de l'Indochine**

**Service météorologique**

**Bulletin pluviométrique**

publié par G. Le Cadet

Directeur

**Tableaux mensuels, annuels et carte**

**Année**

1910

**Direction de l'Observatoire central**

**Préfet**
4. Indochina

- Long-term trend of **annual** rainfall at Hanoi
- No significant trend detected

by Dr. J. Hirano (TMU)
4. Indochina

- Long-term trend of **seasonal** rainfall at Hanoi

  No significant trend
  
  Increasing trend \( (p < 0.05) \)

by Dr. J. Hirano (TMU)
4. Indochina 1906 – 1943 vs. 1956 - 2008

- Seasonal variability of rainfall (half-pentad) at Hanoi

![Graph showing seasonal variability of rainfall (half-pentad) at Hanoi](image)

by Dr. J. Hirano (TMU)
Conclusions

- Seasonal rainfall characteristics and monsoon variability are discussed by comparing the first half and the second half of the 20th century.

- Between the two periods, differences in the timing of the monsoon peak season and the seasonal progression of monsoon rainfall are detected in several Asian countries.

Questions

- Mechanism
- Quality of the data
Future plans

- Data rescue
  - Digitization extending back to the 19th century
  - Additional countries
    - Ex. Myanmar, Nepal
- Data management
  - Guidelines for **quality control**
- Overall climatic analysis
  - **Long-term variability** of Monsoon characteristics over SE/E Asia

Thank you very much for your attention.