Remote sensing for precipitation estimation in Nepal

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Precipitation monitoring

Applications: disaster relief, river management...

Few station data available near-real-time – role for remote sensing

Satellite products: 0.25°, 3 hours, near-global

TRMM: > 1 month lag
TRMM Real Time (RT): ~12 hour lag
Daily precipitation with TRMM(RT)?

Station data: APHRODITE, 2000-2007 (26°-31° N, 79°-89° E)
Correlations improve with longer averaging period, are slightly worse for TRMMRT
Mean precipitation (2000-2007)

APHRODITE

TRMMRT

TRMM

mm/day
A probabilistic model for daily precipitation

Hyperexponential distribution:

\[ p(P|P > 0) = \mathcal{H}(a, b) = \sum_{i=1}^{N} a_i e^{-P/b_i} \]

Fit to APHRODITE distribution with \( N = 13 \):
2-stage mapping of precipitation probabilities

Precipitation occurrence: \[ p(P > 0) = \frac{1}{1 + e^{c_0 + c_1 S^* + \sum_i c_i \text{(other predictors)}}} \]

where \( S^* \) is the transformed TRMMRT value. Fit using logistic regression (LibLINEAR).

Precipitation intensity: Fit mean and standard deviation for normal transform of \( \mathcal{H}(a, b) \) using linear regression on \( S^* \) and other predictors.

Other predictors: Geographic location, season, regional circulation pattern, ...
Precipitation forecast using TRMMRT

If TRMMRT detects precipitation, this makes higher amounts more likely (but not certain)
A sample probabilistic forecast
(July 19 2014)

TRMMRT estimate (mm)

Calibrated $p(P > 10 \text{ mm})$

Calibrated $p(P > 50 \text{ mm})$
The probabilistic forecasts are reasonably well calibrated (close to the 1-1 line) over the 2000-2007 period.
Conclusions

Probabilistic daily precipitation forecasts can be generated from near-real-time remote sensing calibrated with publicly available gridded products. Improvements on existing calibration data (APHRODITE) should improve the usefulness of such forecasts for water resources applications.
Questions?

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