Remote sensing for precipitation estimation in Nepal

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Precipitation monitoring

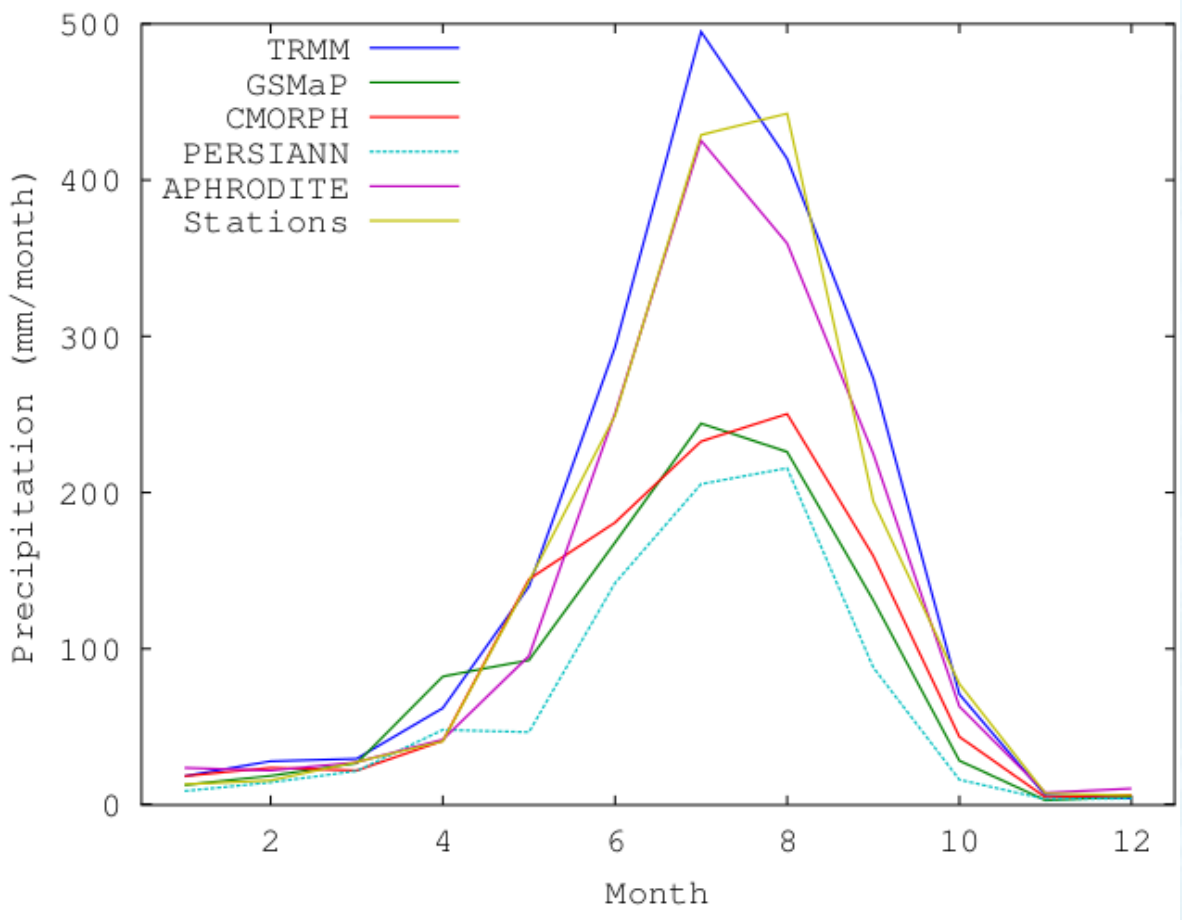
Applications: disaster relief, river management...

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

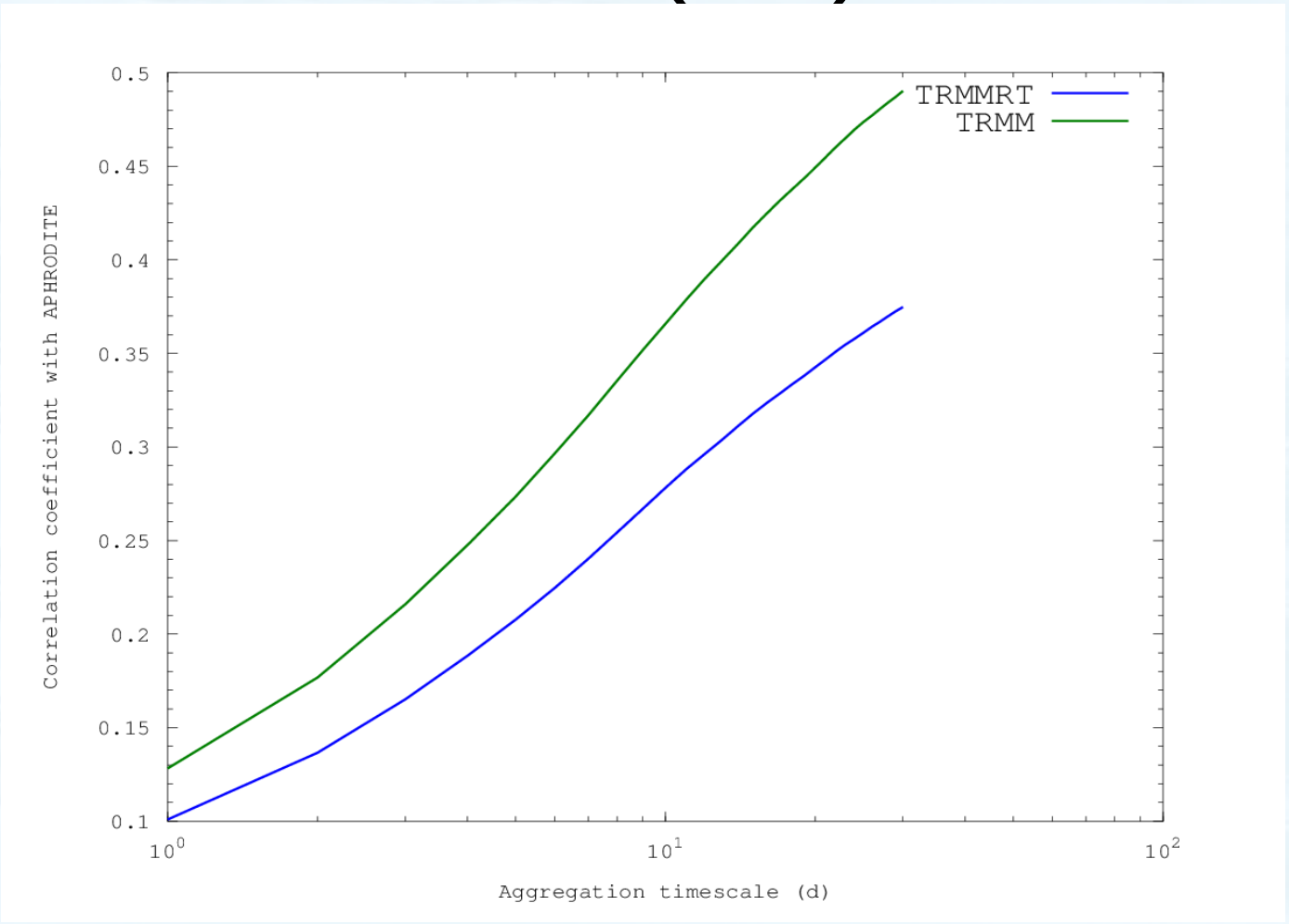
Satellite products: 0.25°, 3 hours, near-global

- TRMM: > 1 month lag
- TRMM Real Time (RT): ~12 hour lag

Monthly precipitation with TRMM (Krakauer et al. *Remote Sensing*, 2013)



Daily precipitation with TRMM(RT)?



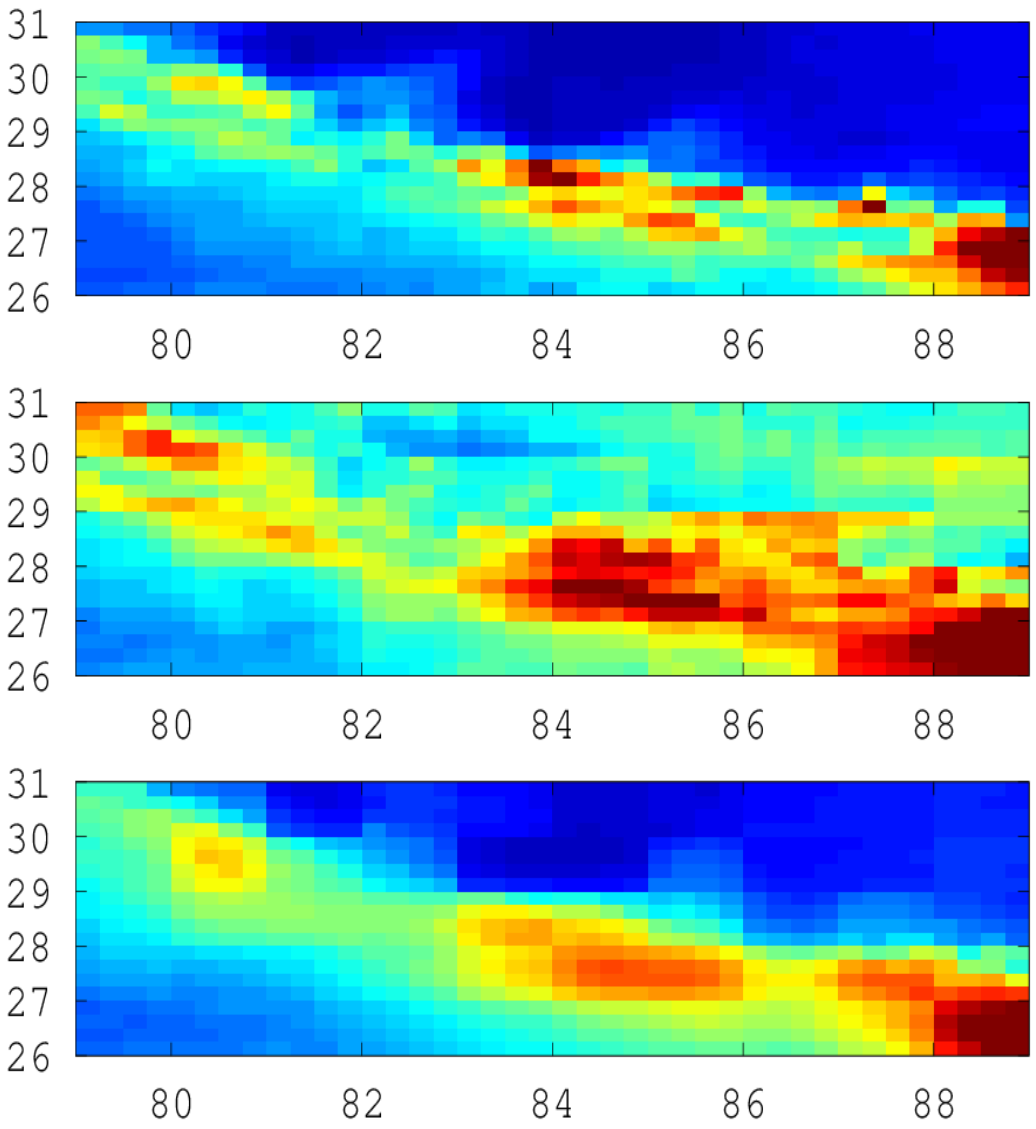
Station data: APHRODITE, 2000-2007 (26°-31° N, 79°-89° E)
Correlations improve with longer averaging period, are slightly worse for TRMMRT

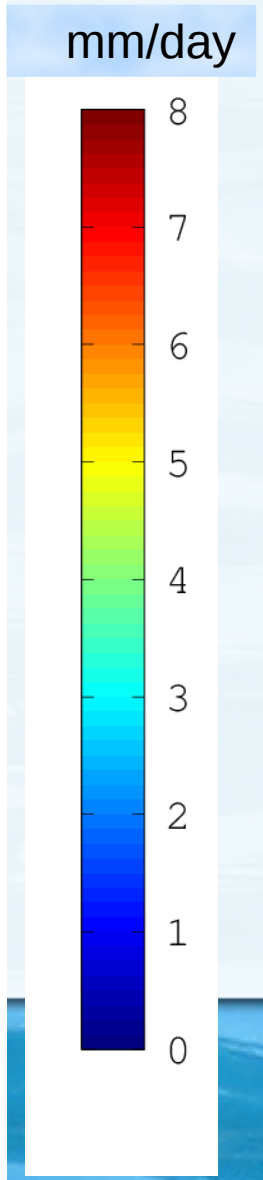
Mean precipitation (2000-2007)

APHRODITE

TRMMRT

TRMM



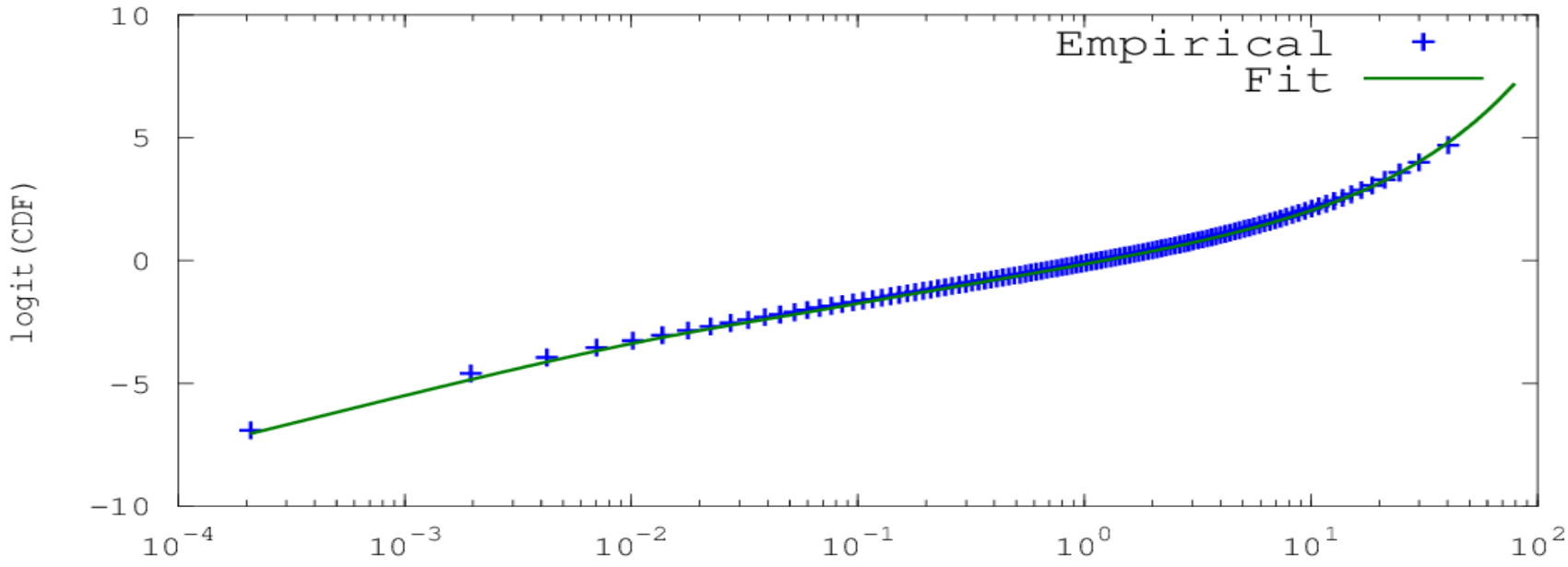


A probabilistic model for daily precipitation

Hyperexponential distribution:

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

Fit to APHRODITE distribution with *N* = 13:



2-stage mapping of precipitation probabilities

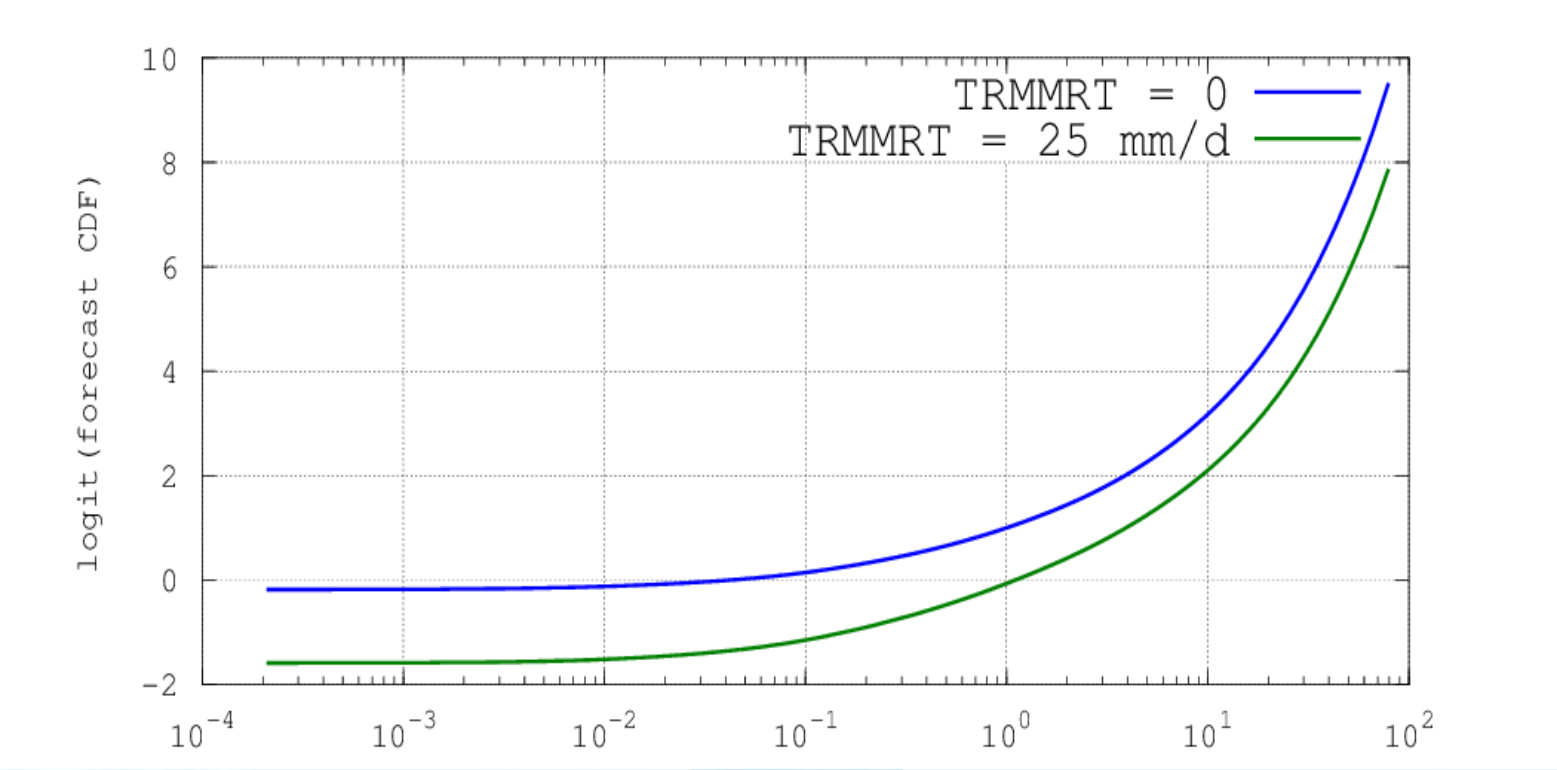
Precipitation occurrence: $$p(P > 0) = \frac{1}{1 + e^{c_0 + c_1 S^* + \sum_i c_i (\text{other predictors})}}$$

where *S** is the transformed TRMMRT value.
Fit using logistic regression (LIBLINEAR).

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

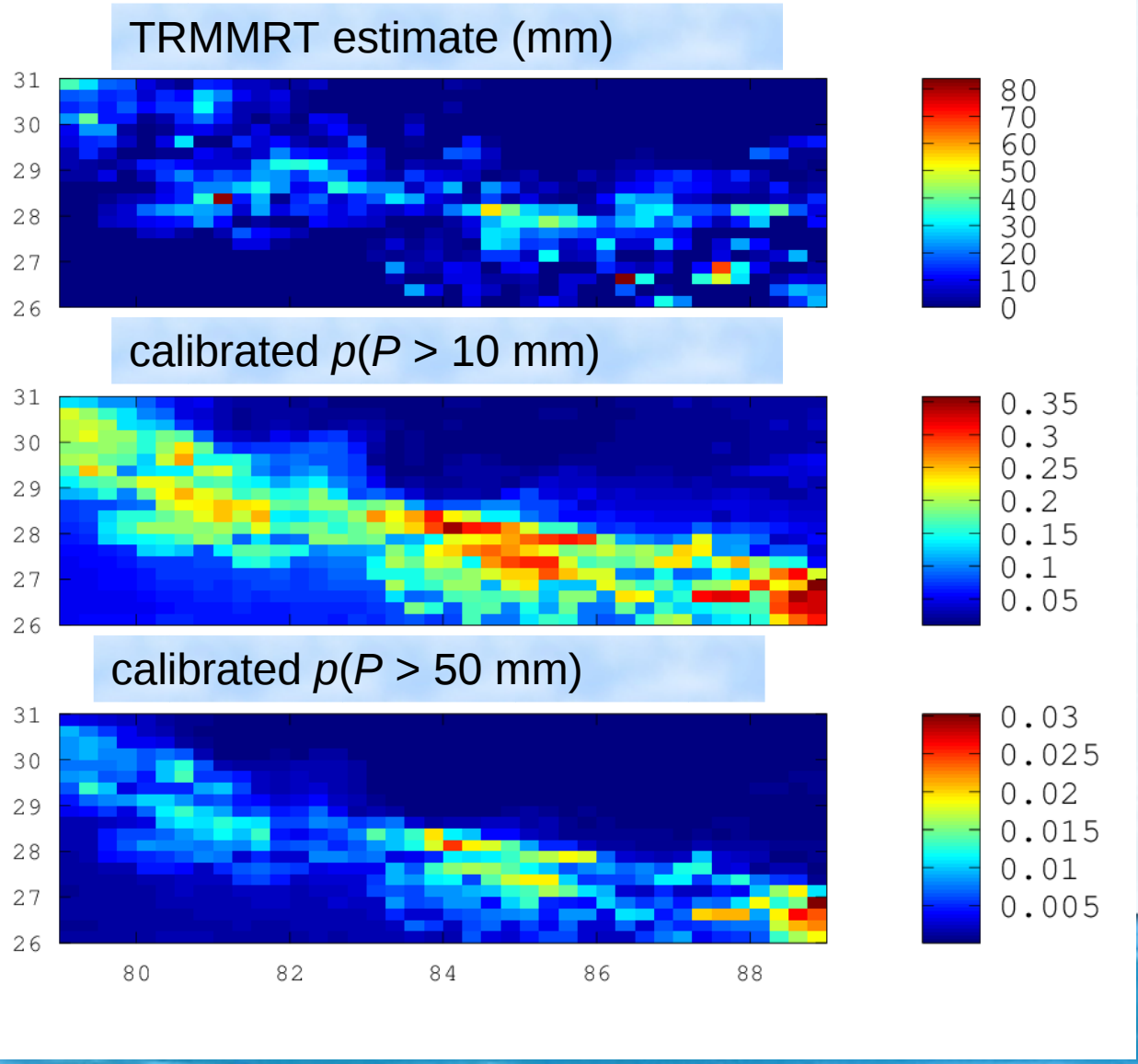
Other predictors: Geographic location, season, regional circulation pattern, ...

Precipitation forecast using TRMMRT



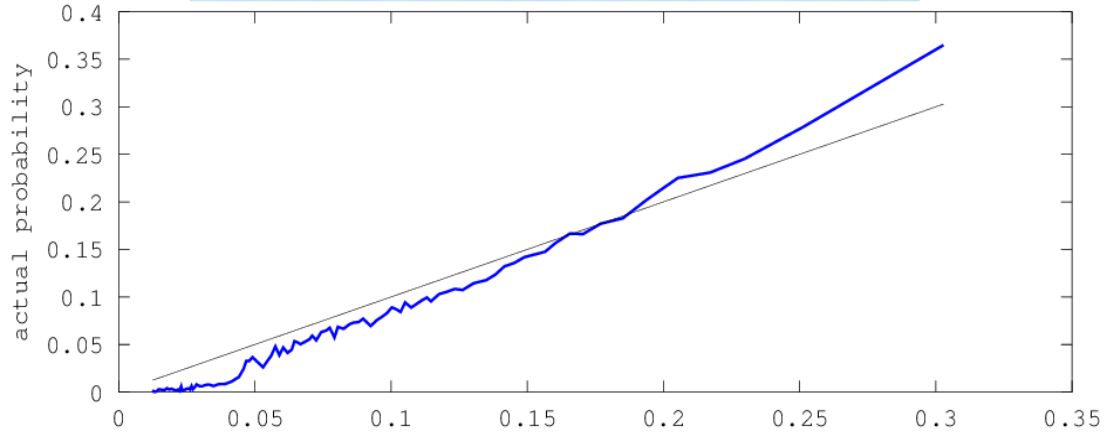
If TRMMRT detects precipitation, this makes higher amounts more likely (but not certain)

A sample probabilistic forecast
(July 19 2014)

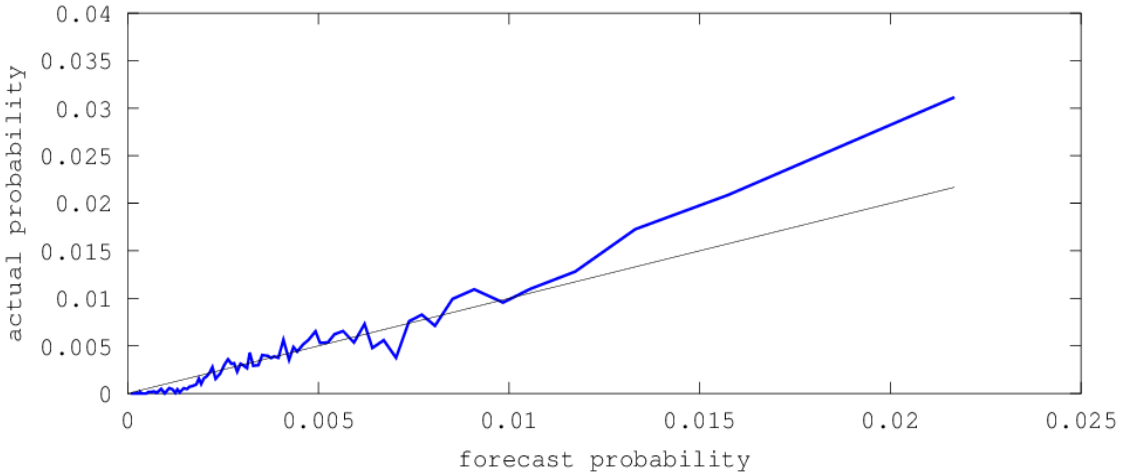


Probabilistic forecast quality

p(*P* > 10 mm)



p(*P* > 50 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 based on 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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