

# Modelling indices of UK extreme rainfall using inter-annual variability of large scale circulation

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STARDEX: STATistical and Regional dynamical  
Downscaling of EXtremes for European regions

# Outline

- Objectives
- Data
  - Predictands
  - Predictors
- Modelling scheme
  - Pre-screening predictors
  - Modelling the predictands
- Results

# Objectives

- STARDEX: statistical downscaling of extremes
- Relate local extremes of rainfall to large scale circulation
  - Model daily rainfall to daily circulation and examine extremes
  - **Model seasonal indices of extremes to seasonal mean circulation**

# Data: predictands

- Seasonal indices of extreme rainfall
- 1958-2000
- 28 stations in SE England
- 15 stations in NW England

pav	Mean daily rainfall
pq90	90th percentile of rainday amounts (mm/day)
px5d	Greatest 5-day total rainfall
pint	Simple Daily Intensity (rain per rainday)
pxcdd	Max no. consecutive dry days
pfl90	% of total rainfall from events > long-term P90
pnl90	No. of events > long-term 90th percentile of raindays

# Data: “predictors”

- NCEP reanalyses
- 1958-2000 seasonal averages
- 20W to 15E and 35N to 70N
  - MSLP
  - Upper level obs at 850, 700 and 500hPa
    - Geopotential height
    - Temperature
    - Relative humidity
    - Specific humidity



# Data: pre-screening predictors

- For each predictor (NCEP variable)
  - For each predictand (extreme index)
    - For each year in 1958-2000
      - Remove that year
      - Use Canonical Correlation Analysis (CCA) to relate predictor and predictand across all stations
      - Hindcast missing year
    - Calculate Spearman correlation between observed and hindcasted indices then average across all stations
  - Average across all predictands
- → Average skill of each predictor

# Model...

- Canonical Correlation Analysis (CCA)
  - Seeks to find coupled modes of variability that maximise the correlation
  - Performed using SVD of cross-covariance matrix of the PCs of the two fields
  - Pre-filters the data by retaining only significant PCs
  - No. of significant PCs selected for each predictor and predictand by 1000 PC analyses randomly resampling the data and comparing eigenvalues to observed series

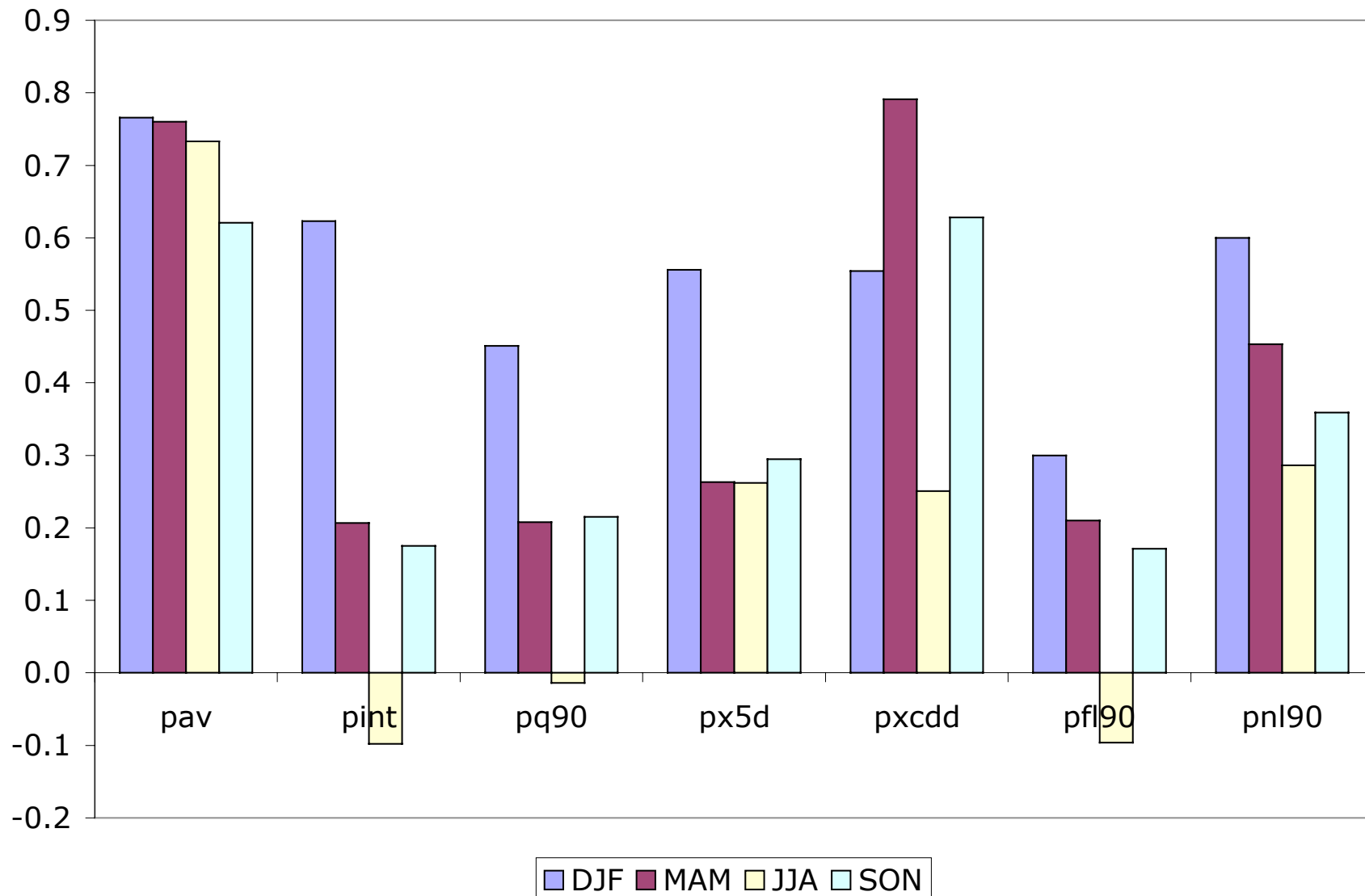
## ...Model

- Two predictor sets
  - MSLP only
  - MSLP, T700, RH700 and SH700.
    - Best set chosen by testing each combination ( $2^4-1$ ) and x-validating to maximise Spearman (rank) correlation of observed and downscaled indices averaged across all stations
    - Predictor set varies between regions, predictands and seasons
- Model developed and trained using years 1958-78 and 1994-2000
- Validated using 1979-1993

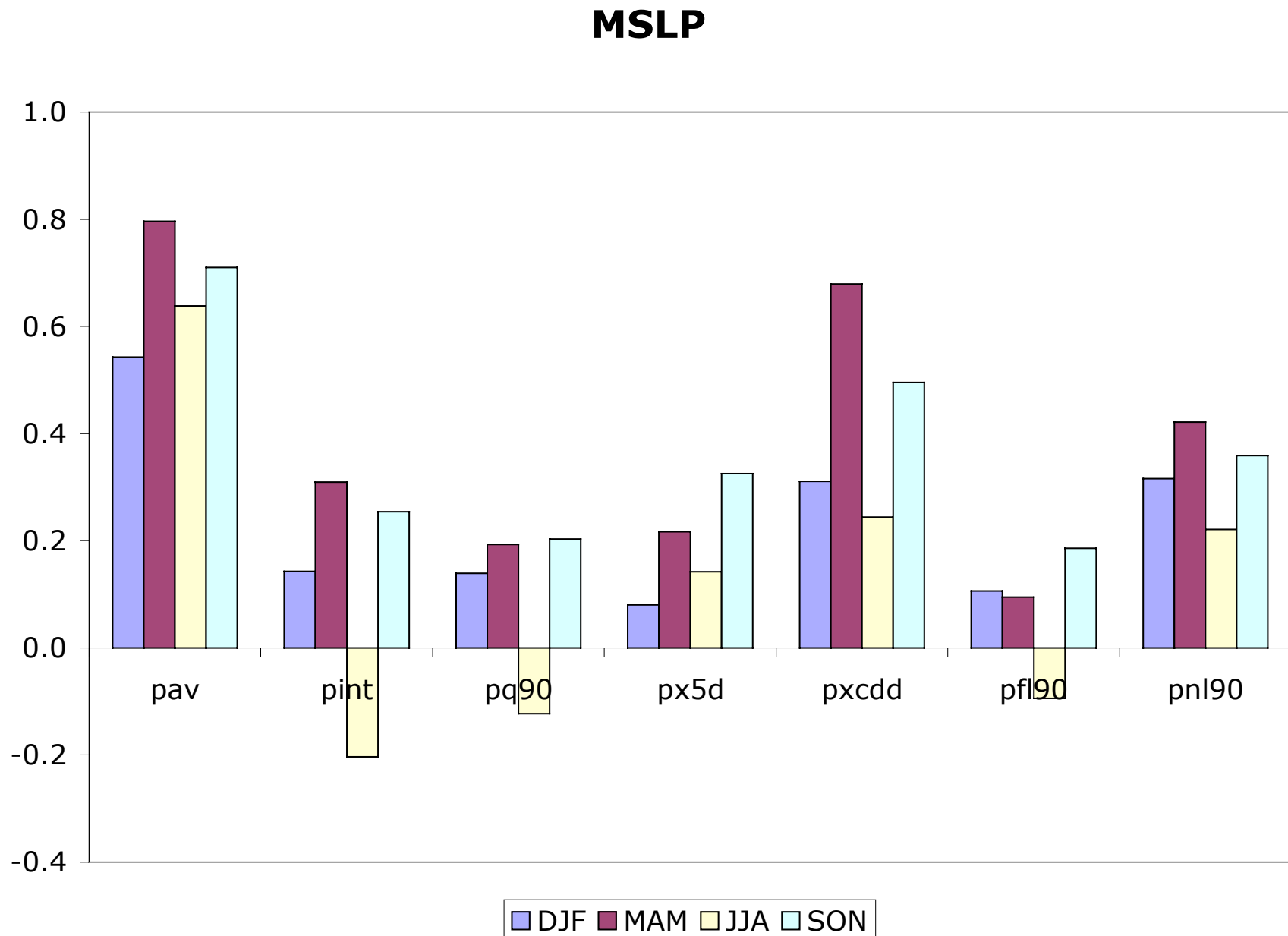


# SE England average correlation

## MSLP

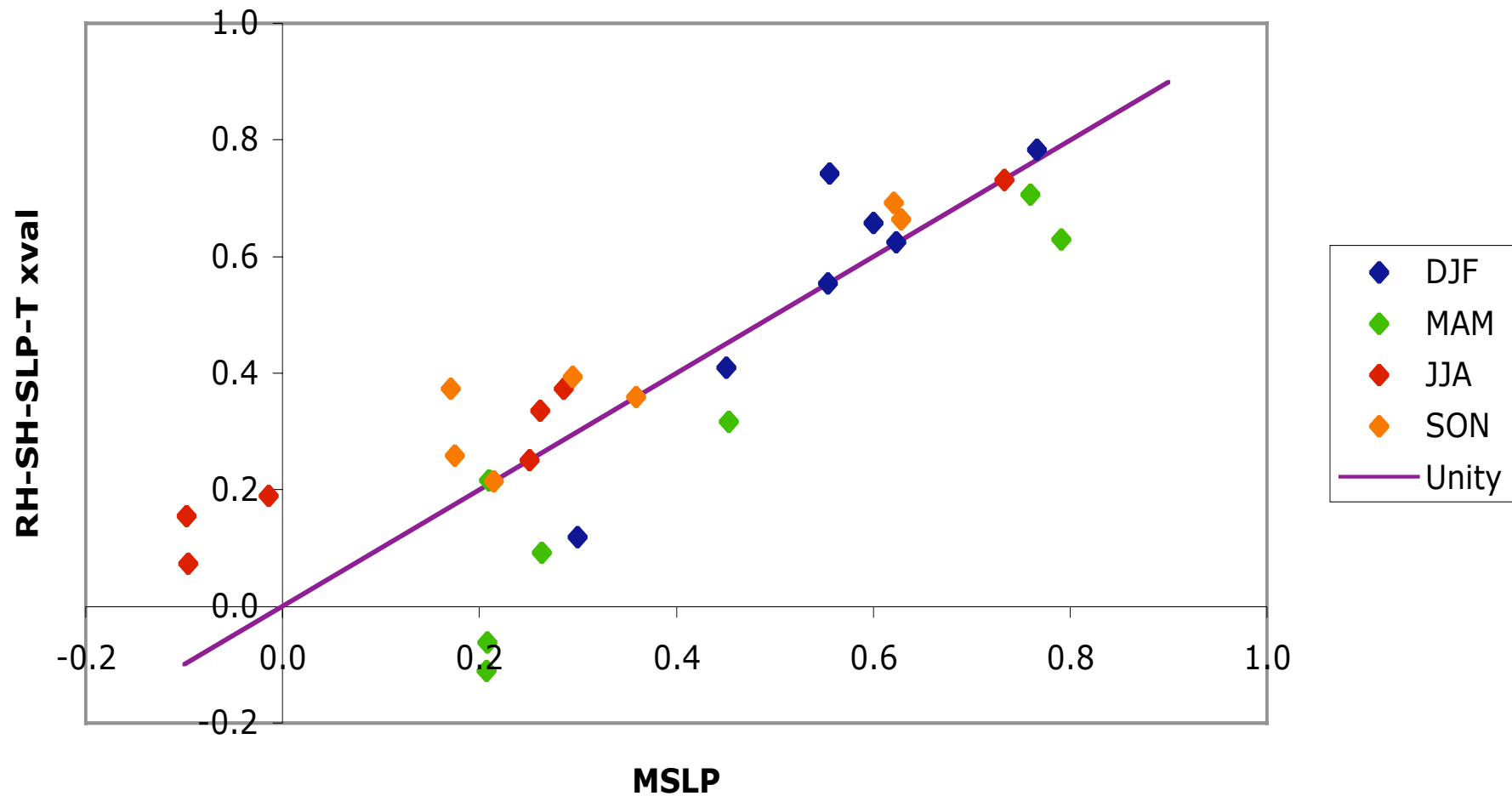


# NW England average correlation



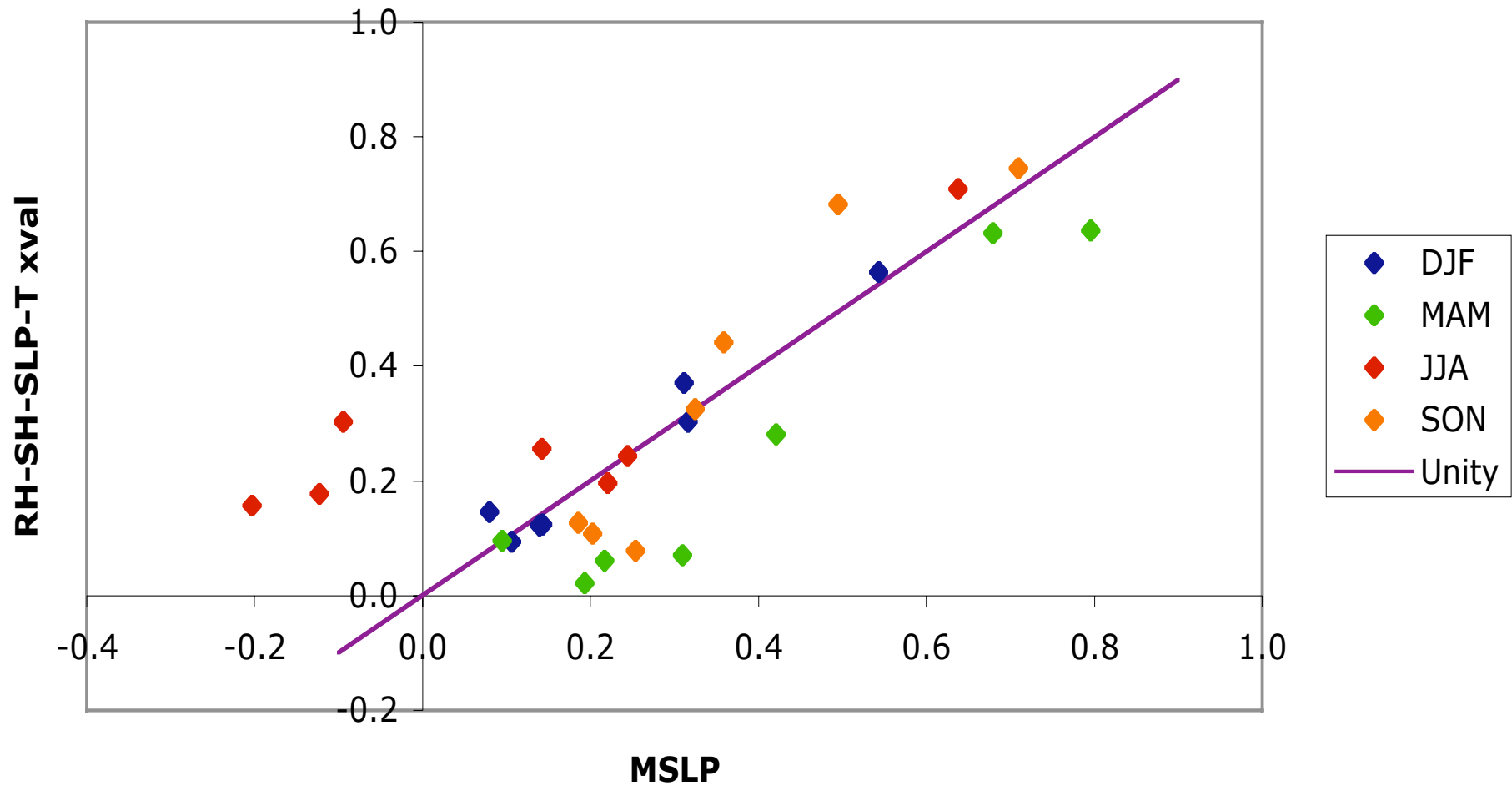
# SE England Model Comparison

## Hindcast MSLP vs RH-SH-SLP-T xval



# NW England Model Comparison

## Hindcast MSLP vs RH-SH-SLP-T xval



# 491-station European analysis

