Comparing STEPS nowcasts & short range NWP

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Outline

- STEPS 2km nowcast
- Fractions Skill Score
- STEPS control vs 4km & 1.5km NWP vs 1km radar
- STEPS ensemble vs 4km & 1.5km NWP vs 1km radar
- Summary

STEPS nowcast & ensemble

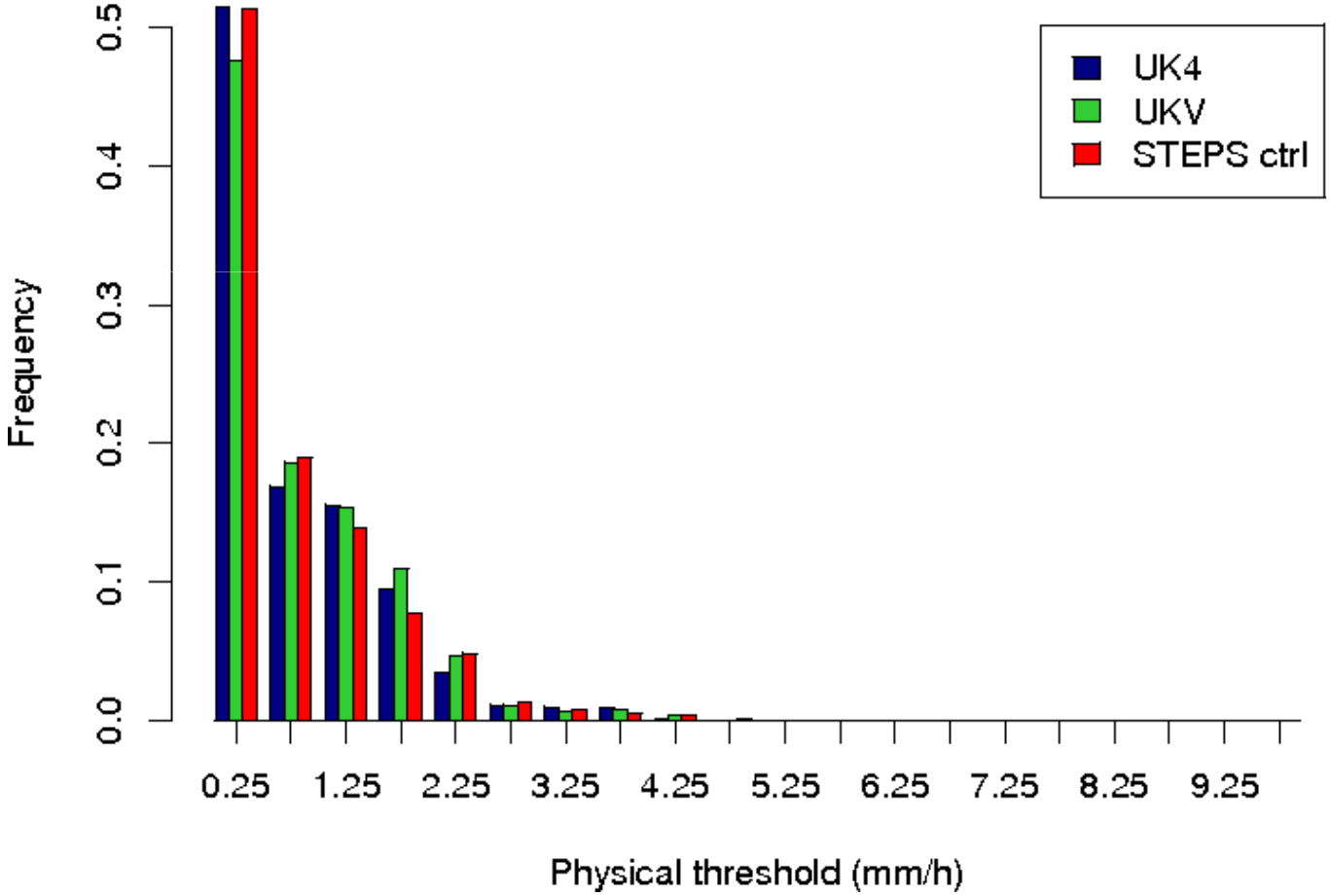
- STEPS (Bowler *et al*., 2006) exploits a multiplicative cascade model representation of precipitation fields to generate a high resolution (2 km) ensemble of precipitation nowcasts with a range of 7 hours
- These ensembles are a blend of:
  - Extrapolation of a rain analysis derived from weather radar & satellite observations using a velocity field diagnosed from two rain analyses using optical flow techniques (Bowler & Pierce, 2002)
  - Forecasts from the 4 km UK4
  - Auto-correlated noise with the space-time statistical properties of the analysis
- Ensemble perturbations are added to the extrapolation velocity field and in sampling the noise

Fractions Skill Score (FSS)

- Introduced by Roberts & Lean (2008), it is a standard spatial verification metric at the Met Office
- It enables comparison of forecasts of different resolutions against a common spatial truth (radar rainfall analyses), since high resolution forecasts are not penalised for the so-called “double penalty” problem when forecasts are not precisely matched in space / time.
- It is suitable for evaluating the incremental benefits of increasing the horizontal resolution of forecasts
- It enables “close” forecasts to receive credit, and has been used to assess the benefits of high-resolution NWP forecasts (Mittermaier *et al*., 2012).

Trial period Oct 2011 – Mar 2012
distribution of 95th percentile hourly rainfall

Trial period was unusually dry with low 95% thresholds dominating



STEPS control vs NWP
Fractions Skill Score vs neighbourhood

Direct and 6hr lagged comparisons allow for production time

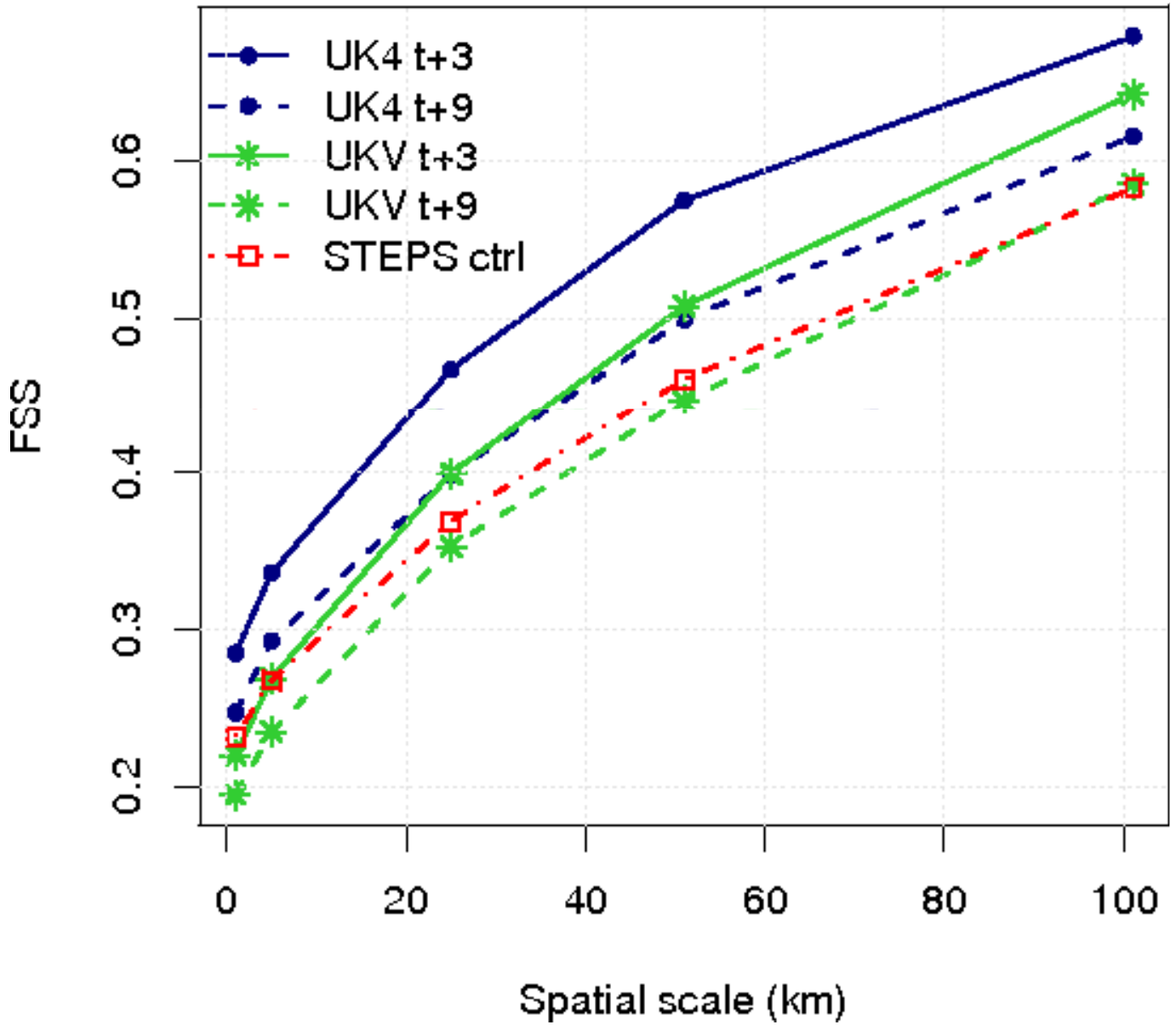
t+1h STEPS is clearly better.

t+2h STEPS & NWP have similar skill

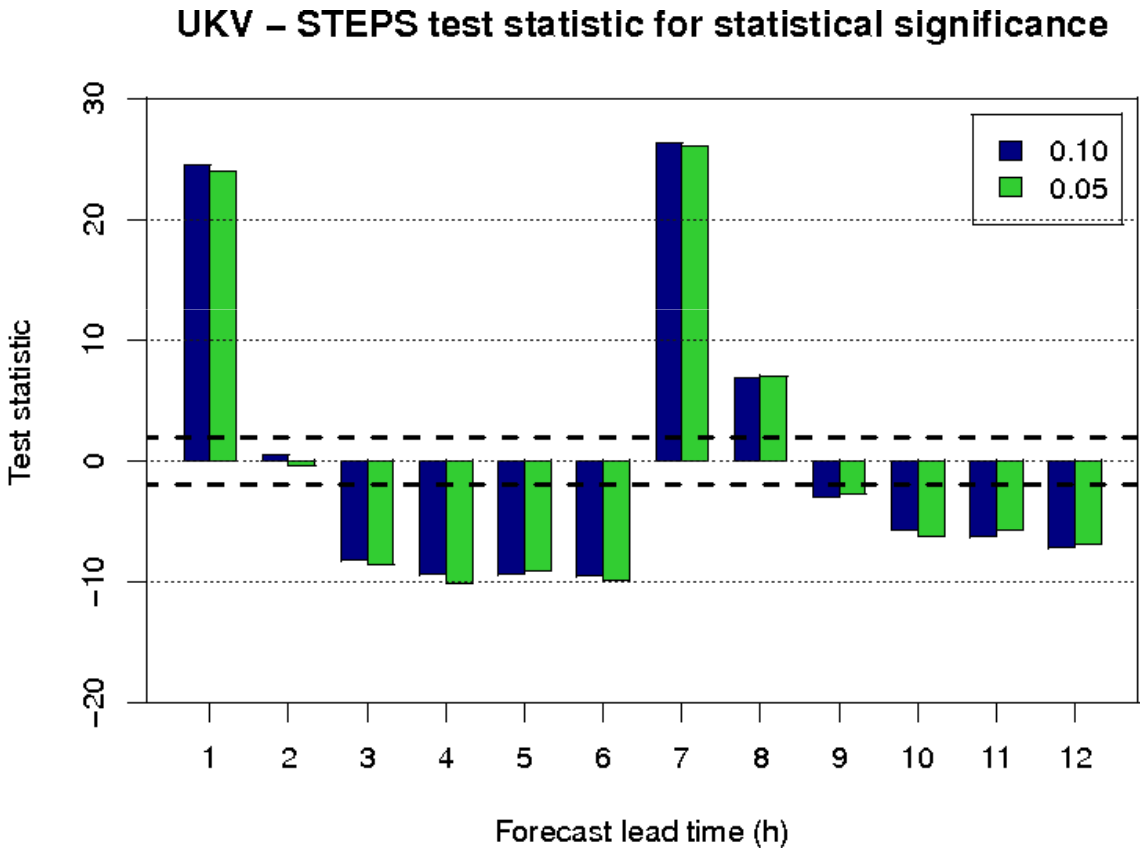
t+8h NWP remains inferior

From t+3h/t+9h there is no difference in skill

STEPS merging should ensure skill does not drop below NWP on average



Significance of differences



- t+1h STEPS nowcast *significantly* better than t+1h & t+7h UKV forecasts
- t+2h differences not significant, but T+8h STEPS *significantly* better than UKV
- At longer lead times both direct & lagged UKV forecasts *significantly* better than STEPS

STEPS ensemble vs NWP

- The ST
enseml
- The FS
STEPS
shown
scores
membe
- At t+1h
NWP m
- By t+3h
within t
FSS ma
- By T+6
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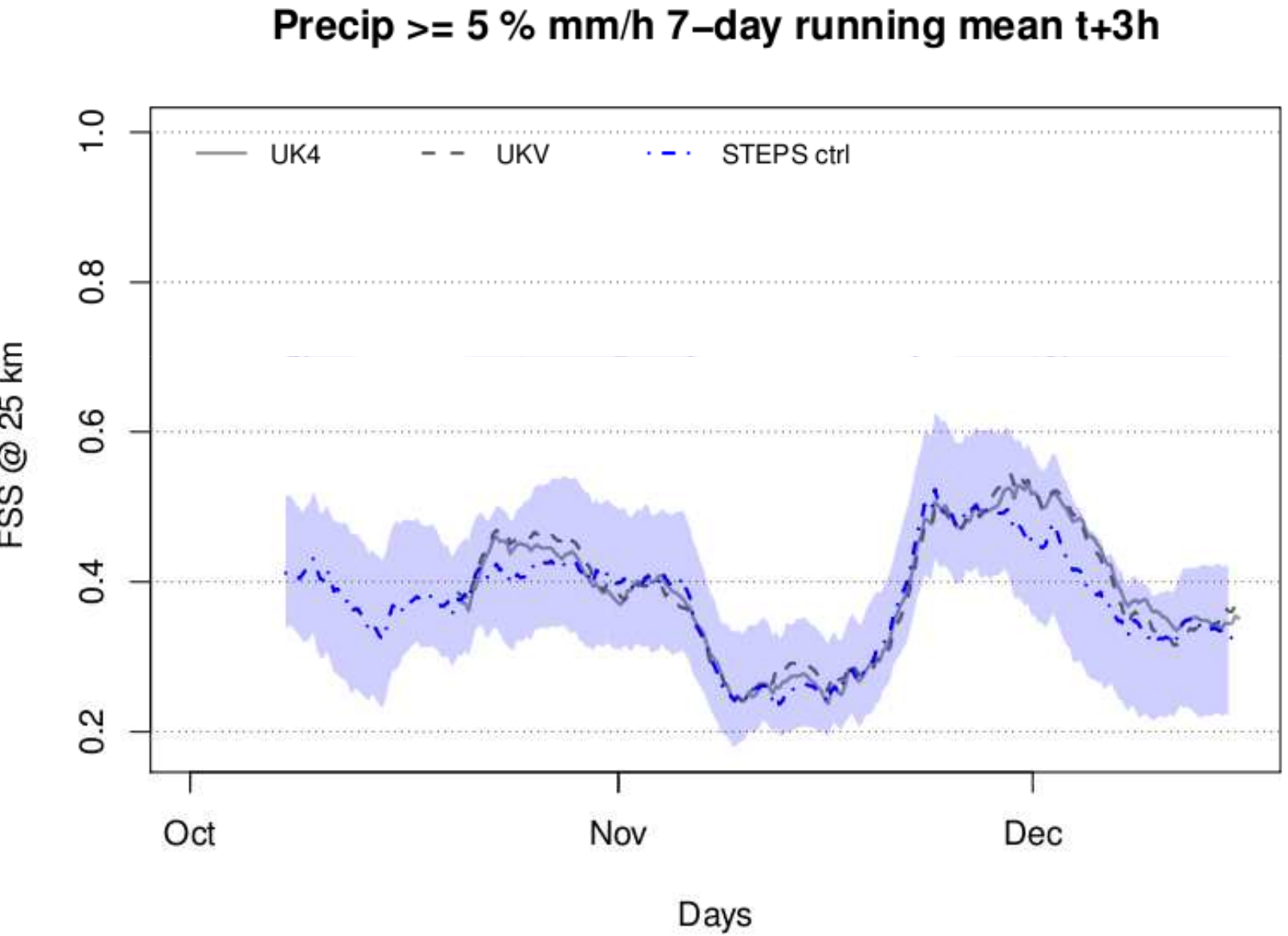

Summary

- FSS statistics show t+1h STEPS control is significantly more skilful than t+1h & t+7h UK4 / UKV
- Cross-over point for STEPS control lies between t+2h & t+3h
- Careful use of the STEPS ensemble could extend cross-over to longer lead times
- Hourly cycling & better DA will improve the NWP score & are being trialled in London 2012
- Careful use of an NWP ensemble will improve the NWP score & is also being trialled in London 2012

Note: STEPS is both initialised & verified with radar data. This should be an advantage, but only if radar quality is stable. Even subtle observation biases can lead to incorrect conclusions.

Questions?