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Discussions

Interactive comment on "Uncertainties in Forecasts of Winter Storm Losses" *by* Tobias Pardowitz et al.

Anonymous Referee #1

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Overall quality of the discussion paper ("general comments"): This study focuses on the meteorological and damage uncertainties and how quantification of these can derive probabilistic forecasts of winter storm damage over Germany. Model forecast uncertainties are verified with and compared to observation data on insurance losses. Statistical techniques are used to estimate damage uncertainties with appropriate verification methodologies being used to analyse forecast skill.

Forecasting losses from winter storms is extremely difficult, this paper makes good strides in how to address these difficulties in a novel way and provides a good methodology for quantifying uncertainties in the factors which make loss forecasts so complex. The insurance data provides a unique dataset which is rarely seen in these kinds of studies.

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[Discussion paper]

Sections 2 and 3 (Data and Methodology) have good content and explanations. Assumptions are outlined well and scientifically backed with appropriate evidence. The investigation analysing the influence in different uncertainty types, four in total plus one dressed ensemble post-processing approach) and their interactions is well thought out and a good method for this kind of analysis.

Overall an interesting paper which should be published after some minor corrections (see below). Clarification is required in some areas to make the paper more easily understandable along with numerous technical corrections.

Individual scientific question/issues ("specific comments")

Title: Could better reflect the study for example 'An Analysis of Uncertainties in Forecasts of Winter Storm Losses'.

Page 1 line 12 (abstract): 'Deterministic assessment of damages' please clarify, is this prior to the event? Even knowing local vulnerabilities would not allow for a yes/no damage assessment until after the event when the damage is done.

Page 3 lines 8-11: It is stated that 'hail induced damaged cannot be separated...this poses another uncertainty that needs to be reflected in the relationship between local winds and resulting damages' however this is not mention again in the paper. How this could be done and what it may show?

Page 5 line 12: How can post-processing help adjust the spread of an ensemble? Can this be made more explicit/clearer?

Page 5 line 20: Can the size of the Gaussian kernel be specified?

Page 8 line 10: Clarify what 'low forecasted gusts' are.

Page 8 line 20: Clarify this sentence, how is a doubling shown? The sentence and Figure don't appear to correlate.

Results section: Over-forecasting is not mentioned. On page 9 lines 8 and 9 '10-20%

probability using full uncertainty in most of the affected areas' is stated. I understand the nature of probabilities however it would be good to have a comparison between forecast probabilities for the loss ratios and in the areas where damage was observed i.e. how often is 10-20% forecast and damaged observed?

Page 9 line 10: What is meant by 'objective verification'?

Page 10 lines 8-14: Could anything else be said about Fig 5? Perhaps correlate BSS to orography? Comment why the BSS in some areas is so low at -10? Could Fig 5 be related to the forecasts in Fig 3?

Page 10 line 5: Don't agree with the last part of this last sentence, it depends on the meteorological situation.

Page 10 line 15: Clarify 'this effect'

Page 10 line 25: Could 'how these findings could potentially be used in risk based warning systems' be expanded? More explicitly how could forecasters use this approach to improve forecasts and warnings?

Technical corrections

Generally:

Define when talking about mean wind speeds and wind gust speeds. For wind impacts and studies using wind data knowing the difference is important.

Ensure paragraphs aren't one sentence long.

Keep consistent phrasing e.g. 'damage uncertainty' not 'impact model uncertainty' (e.g. page 2 line 14); 6-hourly (page 4 line 1) and 6 hourly (page 3 line 16).

Be consistent in the use of 'damage modelling uncertainty', 'meteorological uncertainty' and 'full uncertainty/both uncertainties' e.g. Page 9 line 1 it's referred to as 'damage occurrence uncertainty' and page 9 line 5 vs Figure 3 and Figure 4.

Ensure consistency of Brier Score and Brier Skill Score capitalisation or define then use BS and BSS don't mix.

Consistency needed for 'winter storm Britta' references including removing capitalisations.

Change all references of 1d, 3d and 9d to 1 day, 3 days and 9 days respectively including in figures.

Keep 'low' and 'high' threshold wording consistent, 'lower' and 'higher' thresholds are referred to on page 9.

Check references in particular comma placements and journal titles.

Page 1 line 14: clarify what are the 'two individual contributions'

Page 1 line 15: 'forecast skill' of what?

Page 1 line 17: define 'district level'

Page 2 line 8: source 'of' uncertainty not 'for'

Page 2 line 17: approach 'when' predicting

Page 2 line 26: comprise 'of' daily data

Page 3 line 2: 'insurers' not 'insurances'?

Page 3 line 15: define DWD

Page 3 line 16: 10 meter's' above 'the' ground

Page 3 line 18/19: 'hourly 10m wind gusts' instead of 'hourly wind gusts in 10m height'

Page 3 line 20: 'maximum 10m wind gusts' instead of 'maxima of wind gusts in 10m height'

Page 3 line 22: ECMWF 'has' operationally 'run' its

Page 3 line 24: can remove 'the'

Page 3 line 25: check sentence structure and TL use

Page 3 line 28: 'In' December or re-arrange sentence

Page 4 line 1: remove space between 10 and m

Page 4 line 11: 436,905 not 436.905; comma needed after 'equation'

Page 4 line 15: TL not TL

Page 4 line 18: maximum 10m 'wind' gusts

Page 5 lines 6 and 7: Makes very little sense, please revise

Page 5 line 11: 'Post-processing' no 'A' needed.

Page 5 line 12: 'what is meant in the study by the term « calibration »'? please revise

Page 5 line 13: depending 'on' the, not 'of'

Page 5 line 25: What are CDF's?

Page 5 line 26: PDF already defined

Page 6 line 6: move comma to after district and remove from after derived

Page 6 line 18: no 'the' needed before Sec. 3.3

Page 8 line 8: 'range is only between'

Page 8 line 15: 'previously' not 'above'

Page 8 line 20: Don't need 'Considering' at the beginning of the sentence.

Page 8 line 28: add 'observed' to make 'the observed loss ratio'

Page 8 line 30: add 'only' after 'uncertainty' and clarify/reword the sentence.

Page 9 line 1: 'uncertainty only for winter storm Britta' or 'uncertainty in the case of

winter storm Britta'

Page 9 lines 2-4: reorder to refer to both uncertainties then dressed ensembles, this fits better with the order of Figure 3.

Page 9 line 9: 'forecasts' not 'forecast'

Page 9 line 13: 'When averaged over' not 'In average over'

Page 9 line 19: '3.5), with the climatology as a reference forecast, it is confirmed that'

Page 9 line 23: 'For a lead time'

Page 9 line 30: define 'high impact events'

Page 9 line 30: 'Even for a lead time'

Page 10 lines 4 and 5 and Page 11 lines 8 and 17: not sure 'stronger' and 'strong' are the correct words, please revise

Page 10 line 6: 'in the case'

Page 10 line 16: 'winter storms' instead of 'severe winds'

Page 10 line 24: 'In forecasting'

Page 10 line 30: 'too little ensemble'

Page 10 line 2: 'for short lead times'

Page 10 line 3: no comma needed after 'fact'; 'uncertainties are smaller at' no need for 'obviously'.

Page 10 line 7: 'situations'

Page 10 line 8: 'improvement in forecast'

Page 10 line 16: 'large lead times'

Page 10 line 23: 'Overall, this study shows, for this particular case study, that'

Figure 3: Units on right hand side, referred to in % in text but decimals in figure.

Figure 4: Make scales the same so easier to compare. Caption could say ' Lead time dependent Brier Skill Score (BSS; employing climatology as the reference forecast) for events with loss ratio exceeding low threshold (0.0001o/oo) (left) and loss events with loss ratio exceeding high threshold (0.001o/oo) (right). Shown in black symbols are verification results for the four different set-ups, red triangles show verification results using the ensemble dressing post processing system.'

Figure 5: 'for loss ratio exceeding low threshold (0.0001o/oo)'