Supplementary Table S3 *Information-theoretic comparison of models fitted using Maximum Likelihood on a single dataset of 659918 records (1357 individuals) for milk yield and 77178 records (1212 individuals) for fat and protein content (521 models per milk trait – see Supplementary Table S2 for the full set of models compared; only the best models for each weather element and milk trait are shown here)*

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Milk yield** | **Fat content** | **Protein content** |
|  | Rank | Unique term in best model | AIC | ∆ AIC between metrics | Rank | Unique term in best model | AIC | ∆ AIC between metrics | Equal support | Rank | Unique term in best model | AIC | ∆ AIC between metrics  | Equal support |
| Ts | a | TD^3,^3 | 3800106 | 62 | a | WM^3,^3 | 95879 | 28.0 | -- | e | TD^3,^3 | -35434 | 2.45 | TD-1^3,^3; WM^3,^3; 3dM^3,^3 |
| THI2 | b | WM^3,^3 | 3801136 | 960 | b | WM^3,^3 | 95995 | 76.2 | -- | cd | 3dM^2,^1 | -35445 | 0.2 | TD^2; TD^2,^1; TD-1^2,^2; 3dM^1; WM^3,^3 |
| Tdb | c | WM^3,^3 | 3801468 | 41 | b | WM^3,^3 | 96000 | 48.9 | -- | d | TD^1 | -35442 | 1.7 | TD^2,^1; 3dM^2,^1;TD-1^2,^2; 3dM^1,^1 |
| THI1 | d | WM^3,^3 | 3801770 | 821 | b | WM^3,^3 | 96001 | 74.4 | -- | de | TD^2 | -35438 | 2.0 | TD^2,^1; 3dM^3,^1 |
| Twb | e | WM^3,^3 | 3802204 | 721 | c | WM^3,^3 | 96013 | 70.6 | -- | e | TD^3 | -35432 | 0.2 | TD^3,^3 |
| Tg | f | WN^3,^3 | 3803581 | 498 | d | WN^3,^3 | 96088 | 69.9 | -- | c | 3dN^2,^1 | -35450 | 14.3 | -- |
| sun | g | WX^3,^3 | 3804014 | 241 | e | WN^2,^2 | 96199 | 2.2 | WM^2,^1; TD^3,^2 | b | WX^2,^2 | -35472 | <0.1 | WX^2 |
| RH | h | WM^3,^3 | 3804469 | 287 | e | TD^3,^3 | 96199 | 6.5 | WM^3,^3 | c | WM^3,^2 | -35450 | 5.15 | 3dM^3,^1 |
| vis | i | WM^1,^1 | 3804803 | 194 | f | WM^1,^1 | 96209 | 9.4 | -- | g | WM^1,^1 | -35391 | 19.3 | -- |
| WS | j | WM^3,^3 | 3804832 | 230 | g | TD^3 | 96229 | 1.9 | TD^3,^1 | a | WM^3,^3 | -35704 | 13.9 | -- |
| PMSL | k | WM^3,^3 | 3804974 | 59 | gh | WM^3,^3 | 96230 | 4.3 | TD-1^3,^3 | f | 3dM^3,^2 | -35405 | 2.8 | WM^3,^3; 3dM^3;WM^2; TD-1^3 |
| ppt | l | WX^1,^1 | 3805063 | 25 | hi | 3dX^1,^1 | 96234 | 5.0 | WM^1,^1; TD-1^1,^1 | g | WM^1,^1 | -35391 | 3.21 | 3dN^1,^1; WX^1,^1 |
| snow | m | WM^1,^1 | 3805146 | 17 | i | TD p/a | 96237a | 0.3 | TD p/a^1,^1; WX^1,^1; WM^1,^1;WX^1; TD^1 | h | TD-1 p/a | -35370b | 1.21 | TD-1p/a^1; TD-1p/a^1,^1;WM^1; WX^1;3dM^1 |

Models are ranked from best to worst (lowest to highest AIC) for each weather element or index; ‘a’ represents the highest rank, and different lower case letters indicate meaningful differences (≥7 AIC units). Models are based on Equation 3 and differ from each other in a single weather metric, weather metric × management interaction or order of polynomial term. Linear terms (^1) only were compared for visibility (vis), precipitation (ppt) and snow; first, second (2) and third (^3) order polynomial terms were compared for soil temperature (Ts), dry bulb temperature (Tdb), wet bulb temperature (Twb), grass temperature (Tg), wind speed (WS), air pressure at mean sea level (PMSL), relative humidity (RH) and THI. ‘^1’, ‘^2’ and ‘^3’ indicate the highest order term fitted in a given model for a given weather metric (indicated before the comma) and for the weather metric interacted with management (after the comma). AIC scores are provided for the highest ranked model for each weather element or index. ∆ AIC between metrics is the difference in AIC units between the best model and the next best model within each weather element or index. Models <7 AIC units of the best model are listed under Equal support. For milk yield, no model differing in metrics or the presence / absence of the interaction term was <7 AIC units of the best model for any weather element. For simplicity we do not provide ∆ AIC for models differing only in polynomial terms for the same metric nor list these under Equal support. Metrics: TD (test day) is the day that the cow was milked; TD-1 is the day before milking; p/a indicates a binary occurrence score of presence versus absence; WM is weekly running mean; WX is weekly maximum; WN is weekly minimum; 3dM is the running mean over 3 days, 3dX is the maximum over 3 days and 3dN is the minimum over 3 days.

a18 out of 20 models considering the effects of snow on fat content had equal support (i.e. all but WN snow depth models); only the top 6 are shown.

bAll 20 models considering the effects of snow on protein content had equal support; only the top 6 are shown