

Chapter 10 lecture questions

Q1: What is the threat score for the tornado forecast model?

Answer: 0.369.

Solution:

The tornado forecast model has $a = 41$, $b = 31$, $c = 39$ and $d = 1002$. The threat score $TS = a/(a + b + c) = 41/(41 + 31 + 39) = 41/111 = 0.369$. Thus TS is much less than $FC = 0.937$. In this problem, the high FC is misleading since $d \gg a, b$ and c . $TS = 0.369$ means the model is not that good.

Q2: For continuous variables, the root mean squared error (RMSE) between forecasted and observed values is commonly used to evaluate a forecast model. If model 1 has RMSE of 0.0395, model 2 has RMSE of 0.0374 and the RMSE of a standard model is 0.0389. What are the RMSE skill scores for model 1 and model 2 with the standard model as reference?

Answer: RMSE skill score = -0.015 for model 1 and 0.039 for model 2.

Solution:

Skill score $SS = (A - A_{\text{ref}})/(A_{\text{perfect}} - A_{\text{ref}})$. With $A = \text{RMSE}$, and for the perfect model $\text{RMSE} = 0$, we have:

$$\text{RMSE SS} = (\text{RMSE} - \text{RMSE}_{\text{ref}})/(0 - \text{RMSE}_{\text{ref}}) = 1 - (\text{RMSE}/\text{RMSE}_{\text{ref}}).$$

For model 1, $\text{RMSE SS} = 1 - (0.0395/0.0389) = 1 - 1.015 = -0.015$, i.e. model 1 is of lower skill than the reference model by 1.5%.

For model 2, $\text{RMSE SS} = 1 - (0.0374/0.0389) = 1 - 0.961 = 0.039$, i.e. model 2 is of higher skill than the reference model by 3.9%.
