Table 2

Comparison between predicted road surface temperatures and observed road surface temperatures for the validation (unseen) dataset for varied configurations of hidden layers: root mean square error (RMSE), mean absolute error (MAE) and correlation coefficient (R^2).

Number of neurons in hidden layer(s)	MAE (degC)	RMSE (degC)	R^2
5	1.48	2.23	0.938
5, 5	1.58	2.34	0.931
5, 4	1.54	2.31	0.933
5, 3	1.56	2.33	0.932

amplitude of the diurnal cycle over winter, it is also useful since road state forecasts are especially important over winter, when they are used to determine whether a particular road surface is likely to be icy and require treatment.

A sensitivity study of the Met Office's physics-based model determined that if initial road surface temperature estimates were within 5 degC of observed road surface temperature values, then model output converged within a single one-hour timestep. Therefore, we would ideally like to be able to use a machine learning model to generate initial road surface temperature estimates within this threshold. With the best-performing model (consisting of a single hidden layer containing five neu-

rons), across all unseen locations and times, 96.0% of predictions were within 5 degC of observed values.

Conclusion

In this article, we have explored whether machine learning methods may allow us to generate accurate estimates of initial road surface temperatures, thus enabling us to reduce the spin-up time of our physics-based surface-exchange-scheme model. We find that neural network models provide a promising solution, quickly translating readily available atmospheric forecast information from the Met Office UKV model into road surface temperature predictions. In particular, we find that here the optimum configuration of neural network model consists of a single hidden layer containing five neurons. With this model configuration, we find that, across all unseen locations and times, the mean absolute error of the predicted road surface temperatures compared to observations is 1.54 degC and the root mean square error is 2.23 degC. Additionally, we find that 96.0% of predictions are within 5 degC of observed values. Since this is the threshold of error within which our physics-based model converges within one timestep, we conclude that we are able to use these estimates to initialise our physics-based model without requiring a spin-up period. We have therefore developed a hybrid approach for forecasting at new locations, combining a tradi-

tional physics-based model with a machine learning technique allowing us to rapidly generate initial conditions.

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Spotlight on the Youth and Early Career Special Interest Group

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Over recent years, there has been a growing focus on engaging young people in meteorology and climate science. Recent United Nations Climate Change Conference of the Parties (COP) events in Glasgow (2021) and Sharm El-Sheikh (2022) have highlighted the need to bring the leaders of tomorrow into today's discussions so that progress can be made towards securing their futures.

The United Kingdom (UK) is a world leader in weather and climate science and its trans-

lation into policy, so it is essential that we also lead the way in engagement with today's youth. As the UK's Professional and Learned Society for weather and climate, the Royal Meteorological Society (RMetS) is rising to meet this challenge. This engagement must be a reciprocal relationship, with the Society supporting and championing young scientists in their work, whilst also allowing them to help shape the direction of the Society.

What does 'youth and early career' mean?

There are countless different definitions for both 'youth' and 'early career'. For the purposes of the RMetS Special Interest Group (SIG), we consolidate two existing defini-

tions from the United Nations[1] and the European Geosciences Union.[2] Under 18s fall under the remit of the Society's education strategy, so we consider 'youth and early career' to include anyone over the age of 18 who is either a student or who graduated from their highest degree within the past seven years (accounting for any career breaks).

The Youth and Early Career SIG

The RMetS Youth and Early Career SIG was founded in October 2022 by RMetS Science Engagement Manager Hannah Mallinson

[1]https://www.un.org/en/global-issues/youth (accessed 4 May 2023).
[2]https://www.egu.eu/ecs/ (accessed 4 May 2023).

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and Science Engagement Fellow Daniel Skinner. At the time of writing (May 2023), the group consists of 21 members, including representatives from nine universities (eight from the UK and one from the USA), multiple public and private sector organisations (e.g. Met Office, British Antarctic Survey), journalists (e.g. Carbon Brief) and freelancers. These members range in experience from undergraduate students to postdocs and graduates in industry, covering the whole of our 'youth and early career' definition. Between them, the group's members bring a wealth of different skills and expertise from different sectors to create a diverse team.

The mission of the SIG is twofold:

- To sustain, encourage and progress the Society's engagement with and provisions for youth and early careers.
- To champion youth and early careers in the Society's activities.

To realise these goals, the SIG will work both as an independent body to create content and resources, and as an advisory panel to the Society's internal committees. In this way, the SIG can create value for both early career members of the Society and the youth and early career community as a whole.

The SIG meets every 4 months to discuss ongoing group projects, share new ideas and provide input to Society initiatives.

SIG activities

The SIG is currently working on a number of projects that aim to support youth and early careers. These projects can be divided, in line with our mission, into independent and Society-based projects.

Independent projects

Within the SIG, we have a number of science communication experts who have come together to create two new communication videos for early career members. Due to be launched this summer, the videos will offer guidance on sharing weather and climate science, both with traditional media and new media, so that members can better engage the public with their work.

Society-based projects

One way in which the Society engages with early careers in academia is through the Student Ambassador scheme. Ambassadors form a link between the Society and universities/research institutions, raising the profile of the Society whilst helping to support the needs of each early career community. This year, we are working with current Student Ambassadors and the Society's membership team to reinvigorate the scheme, providing greater support for the Student Ambassadors and widening their reach across the UK. Our hope is that these changes can be put in place ready for the start of the 2023/2024 academic year.

The SIG is also working with the Society to ensure that early careers receive relevant and targeted support, and that this is consistent across the Society. We have commissioned a review into the Society's definitions of youth and early career and of the various groups they encompass. Our priority is to find a robust set of definitions that can be used throughout the Society and SIG's activities, which is inclusive, and reflects the needs of the Society's membership.

Future plans

The Early Career and Student Conference is a highlight in the RMetS events calendar and is growing year-on-year. Due to the popularity of the conference, we hope to run a SIG-hosted session in 2024 with opportunities for networking and careers support. The format is still to be decided, but our goal is to complement the existing conference and build on its success.

More initiatives are in the pipeline to support youth and early careers, but we always welcome new ideas. Please email youthearlycareer@rmets.org if you would like to share. We will be making announcements in the coming months about specific projects and releases.

Finally, we will continue to work with the Society to champion early careers throughout its activities. We have regular dialogue with the Society's internal committees (some of which include a SIG representative) to ensure that we make the most of every opportunity and can provide the best support to youth and early career individuals.

Find out more

The RMetS offers a range of resources for early careers. The RMetS careers website[3] provides advice on where to study meteorology and how the society can support you in your career. The MetLink website[4] contains a wealth of information for teachers and parents to bring weather and climate to a younger audience. Further information about the SIG can be found online.[5]

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[3]https://www.rmets.org/careers (accessed 4 May 2023).
[4]http://www.metlink.org/ (accessed 4 May 2023).
[5]https://www.rmets.org/special-interest-groups/youth-and-early-career (accessed 4 May 2023).

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