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Machine learning emulation of gravity wave drag in numerical weather forecasting

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We assess the value of machine learning as an accelerator for a kernel of an operational weather forecasting system, specifically the parameterisation of non-orographic gravity wave drag. Emulators of this scheme can be trained that produce stable and accurate results up to seasonal forecasting timescales. By training on an increased complexity version of the parameterisation scheme we build emulators that produce more accurate forecasts than the existing parameterisation scheme. Leveraging the differentiability of neural networks we generate tangent linear and adjoint versions of our parameterisation, key components in 4D-var data-assimilation. We test our tangent linear and adjoint codes within an operational-like 4D-var setup and find no degradation in skill vs hand-written tangent-linear and adjoint codes.