

# Scientists simulate the climate of Game of Thrones

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## The world of Game of Thrones @ClimateSamwell



The world of Game of Thrones, showing the positions of the continents over the globe. Light blue represents the ocean, and the colour scale over the continents shows the height of the mountains and hills. This information is needed by the climate model because the surface characteristics such as height and reflectivity have a strong influence on atmospheric winds and temperature. Credit: Dan Lunt, University of Bristol

Winter is coming... as anyone who watches the hit TV series, Game of Thrones, knows.

Some even have their own theories for what causes the strange extended seasons in that world of dragons, kings, queens, and magic.

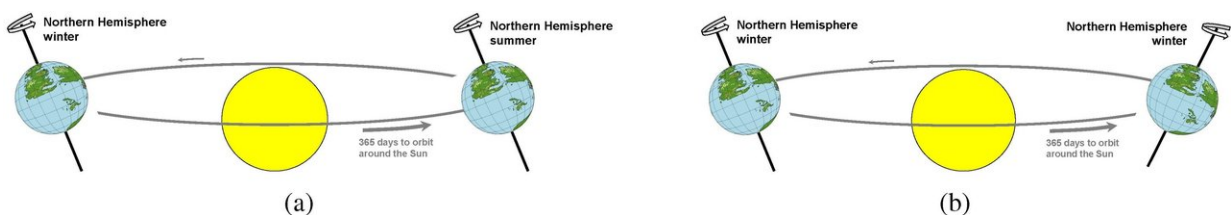
But scientists from the Universities of Bristol, Cardiff, and Southampton have gone one stage further, by using a Climate Model to simulate and explore the [climate](#) of the world of Game of Thrones.

The results show that The Wall, where the land of Westeros is guarded from the White Walkers, has a climate in winter similar to that of Lapland, whereas Casterly Rock, the stronghold of the scheming Lannisters, has a climate similar to that of Houston, Texas, and Changsha in China.

The wind speeds and directions predicted by the climate model explain phenomena such as the dominance of the seas by the Iron Fleet, the likely attack plans of invading dragon hordes from Essos, and the trading routes between Westeros and the Free cities across the Narrow Sea.

The temperatures predicted by the climate [model](#) indicate the likely hibernation zones of White Walkers in summer.

The full results are published in a mock journal article (also available in Dothraki and High Valyrian), written by Samwell Tarly, who is studying to become a "Maester" in the Citadel in Oldtown in Westeros.



(a) shows how the "real" Earth orbits the Sun, with a constant angle of the tilt of the spinning axis, giving the familiar four seasons per year. (b) shows how the planet of the Game of Thrones may orbit the sun, giving extended seasons as the planet "tumbles" on its spinning axis, resulting in the same Hemisphere pointing towards the Sun throughout the year. Credit: Dan Lunt, University of Bristol

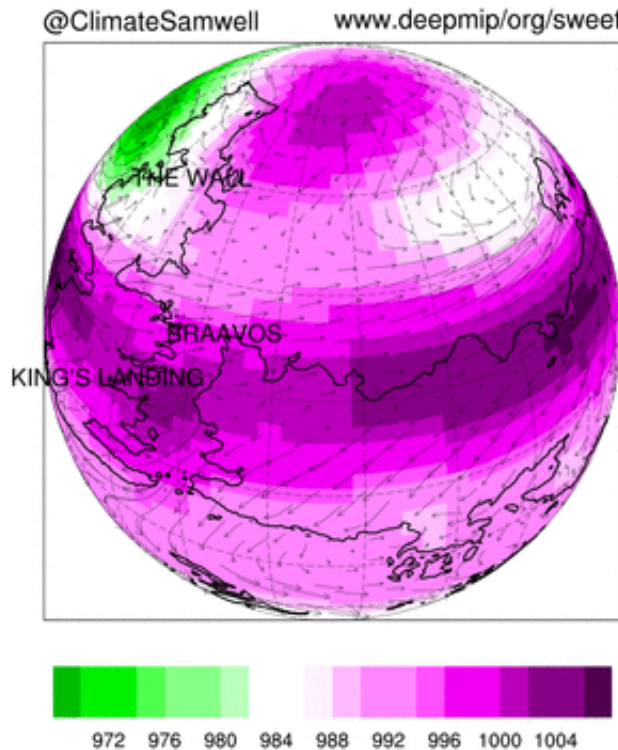
Samwell shows that the extended seasons can be explained by a 'tumbling' of the tilt of the spinning axis of the planet as it orbits the Sun, in such a way that the same Hemisphere always tilts towards the Sun.

He also models the global warming that would occur if concentrations of greenhouse gases in the atmosphere were to be doubled (due to increases in carbon dioxide and methane emissions from dragons and the excessive use of wildfire).

His estimate of 2.1oC [global warming](#) for a doubling of carbon dioxide (the "Climate Sensitivity" of the world of Game of Thrones) is within the range predicted by the Intergovernmental Panel on Climate Change for the 'real' Earth, of 1.5 to 4.5oC.

Professor Dan Lunt, from the School of Geographical Sciences and Cabot Institute at the University of Bristol said: "Because [climate models](#) are based on fundamental scientific processes, they are able not only to simulate the climate of the modern Earth, but can also be easily adapted to simulate any planet, real or imagined, so long as the underlying continental positions and heights, and ocean depths are known."

## Pressure (mbar) and winds (NH Winter)



Surface air temperature predicted by the climate model for winter in the Northern Hemisphere. The colour scale shows the temperature in degrees Celsius. The super-cold temperatures (less than -20oC) north of The Wall are similar to those of Lapland in Sweden/Finland. Credit: Dan Lunt, University of Bristol

Professor Carrie Lear from Cardiff University added: "This work is a bit of fun, but it does have a serious side. Climate models simulate real physical processes which operate in both cooling and warming climates. Scientists working on the [SWEET project](#) are using exciting novel techniques to reconstruct the climate of super-warm states of Earth's past.

"They are using this information to test state-of-the-art climate models

under conditions of high atmospheric [carbon dioxide](#) concentrations, similar to those expected by the end of this century."

Professor Gavin Foster, from the University of Southampton, said: "The Intergovernmental Panel on Climate Change have shown that climate models can successfully simulate climates from the freezing world of the last Ice Age, to the intense warmth of the 'Eocene greenhouse', 50 million years ago. These same models are then used to simulate the future climate of our planet."

**More information:** The Climate of the world of Game of Thrones: [www.paleo.bristol.ac.uk/~ggdjl ... game thrones 1.0.pdf](http://www.paleo.bristol.ac.uk/~ggdjl...game_thrones_1.0.pdf)

Provided by University of Bristol

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