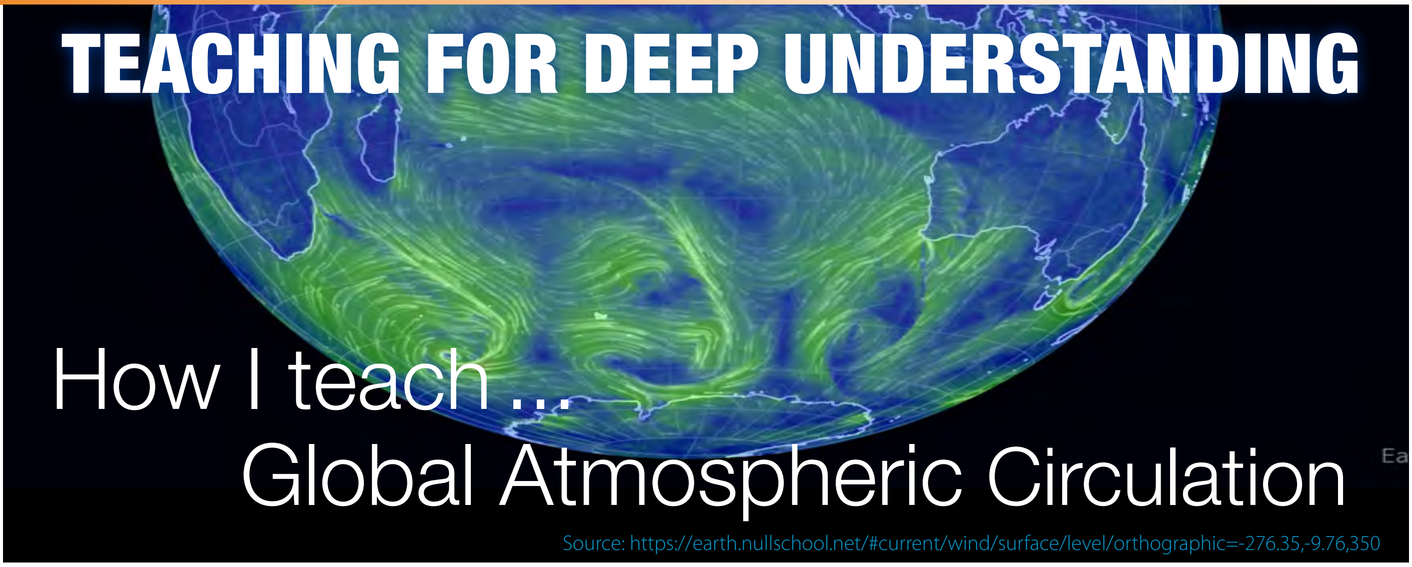


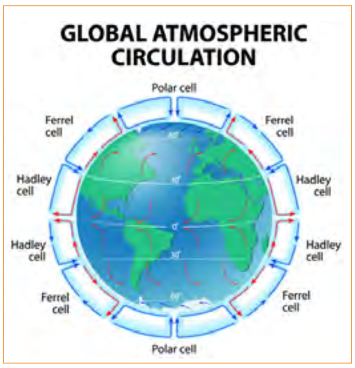
Source: https://earth.nullschool.net/#current/wind/surface/level/orthographic=-276.35,-9.76,350

"How I teach…" introducing a mini-series

Team Geography (A blog for #geographyteachers to engage and discuss all things geographical) https://teamgeography.wordpress.com/2019/11/10/how-i-teach-introducing-a-mini-series/

This is the introduction to, what I hope, will form a series of blogs into how I (and hopefully other geography teachers!) teach different elements/topics of geography. I have absolutely loved the recent shift in educational discourse towards big ideas of curriculum, so much of this narrative has helped me elevate my practice. But, I think we need to do more to demystify the lesson-level processes we utilise everyday.

As a trainee, I remember being told to go and watch teacher X because she was brilliant at teaching Y. The problem was, without the opportunity to deconstruct what I'd seen and little/no guidance on the processes behind the lesson, I got very little out of these observations… Whilst no blog will emulate planning with a colleague, watching them teach and then discussing post lesson, I hope that maybe these blogs will help us consider how we teach key geography and share some best practice. Teachers helping teachers!



Source 1: Image accessed via– https://www.internetgeography.net/topics/what-is-global-atmospheric-circulation/ (Sunday 10th November, 2019)

Tom Highnet

How I teach…
Global Atmospheric Circulation Model

SOURCE: Team Geography (A blog for #geographyteachers to engage and discuss all things geographical) https://teamgeography.wordpress.com/2019/11/10/how-i-teach-global-atmospheric-circulation-model/

NOTE: This does not reflect an hour, or any other convenient package of learning, but is instead an overview of how I would go about unfolding this concept.

A recurring theme within the #geographyteacher community on Twitter is about how to teach the global atmospheric circulation model. The model seems to strike fear into the hearts of teacher, and students, alike. I confess, I felt exactly the same the first time I taught it. Now, it is right up there as one of my absolute favourite topics to teach.

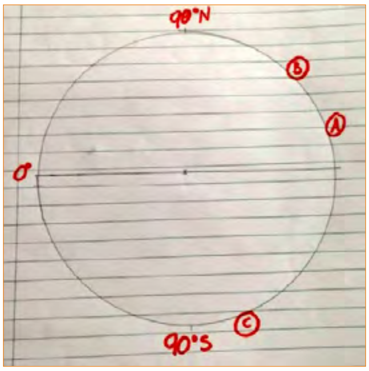
At first glance, it looks intense. I certainly don't begin with the image you see above. There is just too much going on and students quickly become overwhelmed by it all.

In teaching about this, I want my students to be able to:

- Confidently define latitude and identify how it changes, this will help them too…
- Understand the process of differential heating, which will inform their understanding of…
- The difference between high and low air pressure, when they know this they can…
- Explain the weather conditions associated with different types of air pressure, which will mean they can determine
- How the circulation of air changes around the world – taking the form of cells

Key idea – Understanding latitude

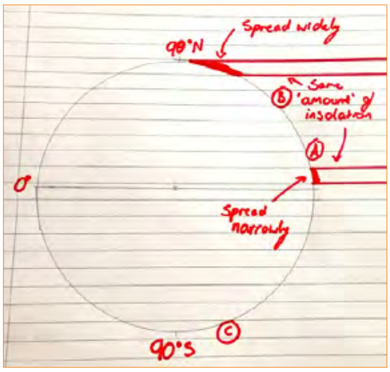
To begin with, we recap what is meant by latitude. This takes the form of me working at the whiteboard (don't have a visualiser :() and sketching an outline of the Earth. I discuss with students that the Equator is at 0 degrees – dividing the world into two equal hemispheres, Southern and Northern. As we go away (North or South) from the equator, the latitude increases. This concept can prove tricky for some and I will do some quick questions to check we're all clear.



Source 2: Gradually introduce questions to check: Which letter is at the highest latitude? A or B? Explain why. Which letter is at the highest latitude? B or C? Explain why. How do you know A is at a low latitude?

Key idea – Differential heating

Assuming I am happy with students understanding of latitude at this point, we would now move onto consider the impacts of uneven insolation across the surface of the Earth. Addressing my class, I would explain that the sun's rays do not heat the surface of the Earth evenly, resulting in **differential heating**. This is due to the **curvature** of the Earth. I would model this to students on the diagram:



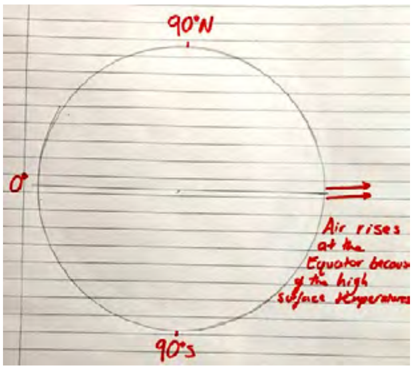
Source 3: Advantages of a lined pad – makes sure my sun's rays are equal. Students can see the impact of the Earth's curve on the spread of insolation.

Now that we have an understanding of latitude and differential heating, I pose a question to my class; 'At the equator, where the insolation is most concentrated, what happens to the air?'. The key here is ensuring I make my answer and explanation clear and concise: At the equator, where the sun's rays are most concentrated air is warmed because of the higher surface temperatures and begins to rise, as it is less dense than the surrounding air. In reviewing this statement, I may ask a series of probing follow up Q's – e.g. just remind me why is the insolation most concentrated at the equator? OR Why would the surface temperature be higher at the equator than at higher latitudes? – Ensuring we plan these follow up questions is a really important in consolidating our students understanding, don't neglect them.

Now that we are happy, we have a) an understanding of latitude, b) an understanding of differential heating across the Earth and c) an emerging familiarity with the notion of rising air at the equator, we can continue.

Key idea – Air pressure

I may now re-purpose my diagram to allow me to add the rising air at the equator. I explain that the rising air is made up of large amounts of water vapour, because evaporation over the oceans is high at the equator – remember differential heating.



Source 4: Have modified/added a new diagram to reduce distraction and allow students to focus on air pressure and movement.

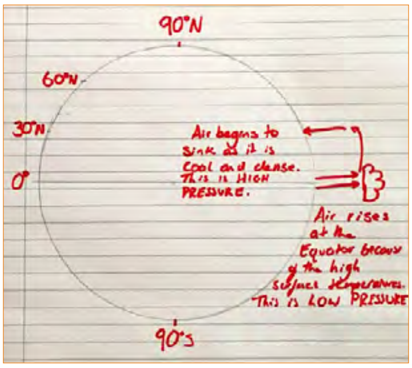
As the air rises, I explain that it begins to cool because it is no longer heated by its contact with the warm Earth's surface. As it cools, the water vapour in the air begins to condense (some students have a comfortable understanding of what is meant by condensation and others do not). Condensation results in the formation of large clouds over the equator which, in turn, results in high levels of rainfall at the equator (link to rainforests, depending on your curriculum sequence!).

I teach students that this rising air is known as low pressure. I explain that we measure the 'amount' of air at the surface (in millibars) as it is a useful indicator of wider weather conditions. When teaching air pressure, it is well worth investing the time in getting students clear on the differences – low pressure = rising air, there is less air at the surface and high pressure = sinking air, there is more air at the surface. This can often be a stumbling block for many students. Use what's out the window here too – if it's raining, ask students about air pressure – help them see it.

Key idea – Hadley Cell

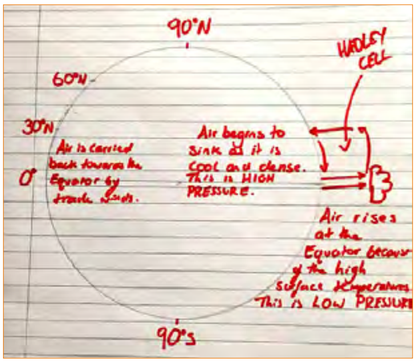
As the air rises, it eventually reaches the atmosphere, forcing air to spread North and South of the equator, unable to return to the equator because of rising air. This is our first introduction to the idea of 'circulation' – with the air moving away from the equator and circulating round to higher latitudes.

As the air moves both North and South, high above the surface, I explain that it is cooling and begins to sink. This sinking takes place because the process of cooling has made the air more dense. Back to the diagram, I add on arrows to show the air sinking at ~30 degrees N+S.



Source 5: Building up the diagram – note the additions of cloud and extra annotations.

Depending on curriculum, the visualisation of high pressure at 30~ degrees N+S is an opportunity to recap on deserts. I would finalise this first cell with the knowledge that trade winds carry the sinking air back towards the equator, allowing me to draw an arrow from 30 degrees N/S back towards the equator. This gives students their first completed cell; the Hadley cell.

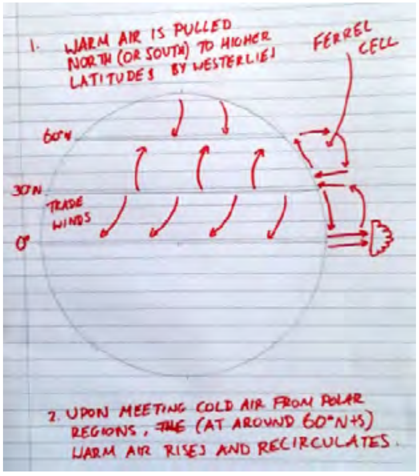


Source 6: I have my first fully completed cell – if I had more space, I would label rising air as low pressure and sinking air as high pressure.

I would start to get students to move away from attending my notes/teaching and would start to get them applying their own understanding. At this point, this primarily takes the form of a blank diagram of the Earth (with lines of latitude at 30, 60 and 90 added in). I would walk students through what we have learnt thus far – the uneven concentration of insolation across the Earth and the implications of this for air pressure. Whilst I am doing this recap, I would expect students to be adding to their own diagrams – providing a list of key term/prompts on the whiteboard to support. We would now proceed to add in the remaining cells.

Key idea – Ferrell Cell

Bringing the class back together, I revisit my diagram, with the Hadley cell on it, and explain that, at 30 degrees N+S, air is pulled in two directions – some back to the equator, and some northwards by winds known as **Westerlies.** These Westerlies carry the warm air from 30 degrees up to ~60 degrees North or South. It is at this point, this warm air meets cold polar air, moving to lower latitudes under the influence of **polar easterlies.** Where these two bodies of air meet – the warm air from 30 degrees N+S and the cold air from the poles – there is a mix, forcing the air to rise (as it is warm and thus less dense). This creates an area of low pressure known as the **subpolar low.** When we have identified this, as shown below, I ask students to add the **Polar cell** (the final cell of the tri-cellular model) using all we have covered.



Source 7– Note: I have only completed cells for the Northern hemisphere, deliberately leaving out the polar cell for students to finish/ add air pressure.

Conclusion

Like all complicated concepts and ideas, nailing down your explanations and the way you will sequence knowledge, is crucial. Also, plan your questions and how you'll check for understanding – these elements are essential if students are to overcome misconceptions.

A word of advice, as tempting as it is to use a completed diagram/videos, I would strongly urge you to avoid these until students have pieced together the full idea – diagrams and videos make perfect sense to us, as the teacher, as we have a fully developed understanding of the topic. For students, this is much less the case. Finally, (here comes the controversy) I'd cut the gimmicks – 3D models, balloons, paper plates – they all may have a place but first time in, I'd be planning high quality diagrams and precise, concise explanations – don't overload your students.

This has been a bit of whistle stop tour of 'How I teach…' as the GACM is **BIG**. But I hope you've had a bit of a peek behind the resources/PowerPoints we often see bandied around and seen into the bigger idea of lesson planning.

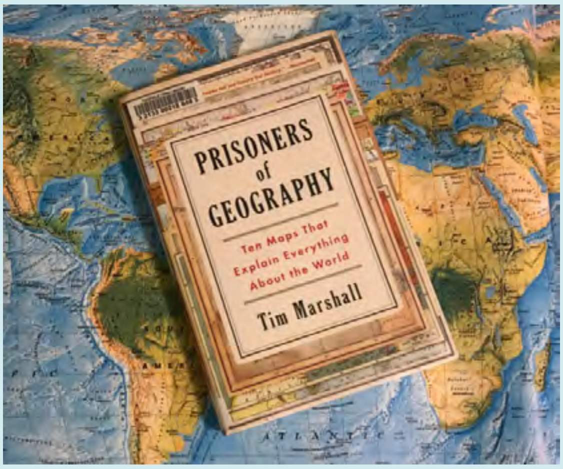
EDITORIAL COMMENT

Team Geography is a blog for #geographyteachers to engage and discuss all things geographical.

The blog has some very useful posts for developing teaching skills and thinking about how geography can be taught.

Where's the Geography?

https://teamgeography.wordpress.com/2018/02/20/wheres-the-geography/



The following are 'GUEST POSTS' for Year 11 Global Challenges:

Political geography

How I teach… Russia, using Prisoners of Geography @ missbytheway

https://teamgeography.wordpress.com/2020/06/15/guest-post-how-i-teach-russia-using-prisoners-of-geography-missbytheway/

Note: link to some good resources.

Development geography

How I teach… The development gap @RobboGeog

https://teamgeography.wordpress.com/2020/06/07/guest-post-how-i-teach-the-development-gap-robbogeog/

Skills activities linked to Biophysical Interactions and Ecosystems at Risk are included in the Stage 6 Skills section