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Climate Change through the eyes of radioisotopes

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SNT2019, Hofburg, Vienna, 9h45, T1.1-O4, 25 June 2019

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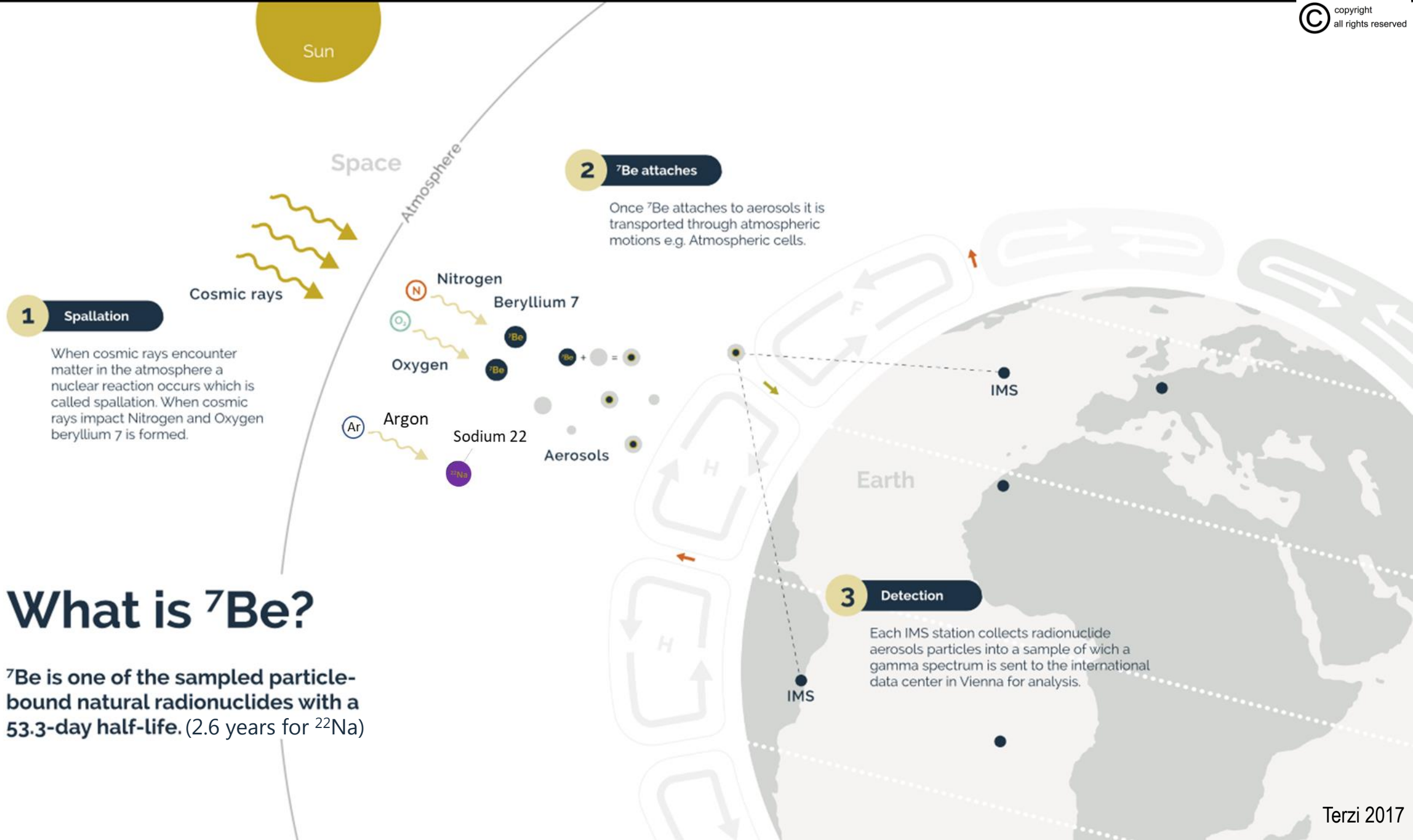


What is ^{7}Be?

^{7}Be is one of the sampled particle-bound natural radionuclides with a 53.3-day half-life. (2.6 years for ^{22}Na)

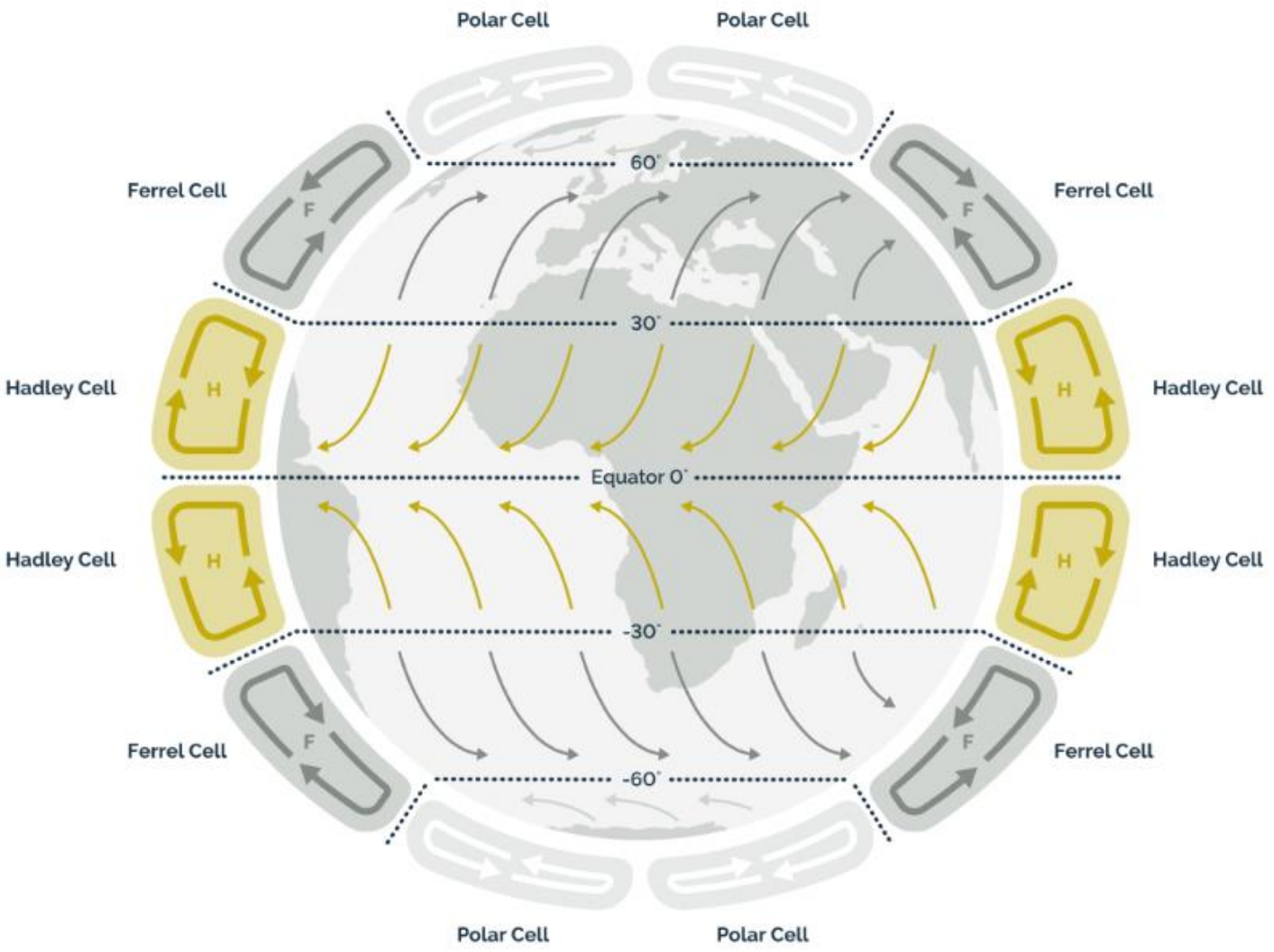
Terzi 2017

Atmospheric cells

There are three atmospheric cells in the northern and southern hemisphere.

- **Polar cell**
- **Ferrel cell**
- **Hadley cell**

There are 3 atmospheric cells in the northern hemisphere and 3 in the southern hemisphere.



^{7}Be an indicator for atmospheric cell convergence zone position

Terzi and Kalinowski, (2017) J. Env. Rad.

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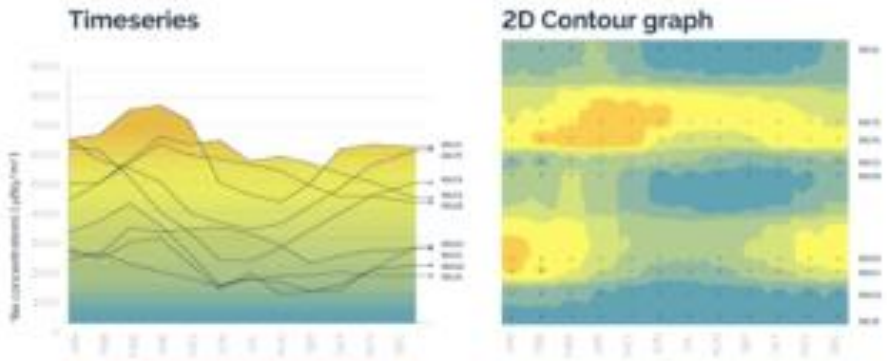

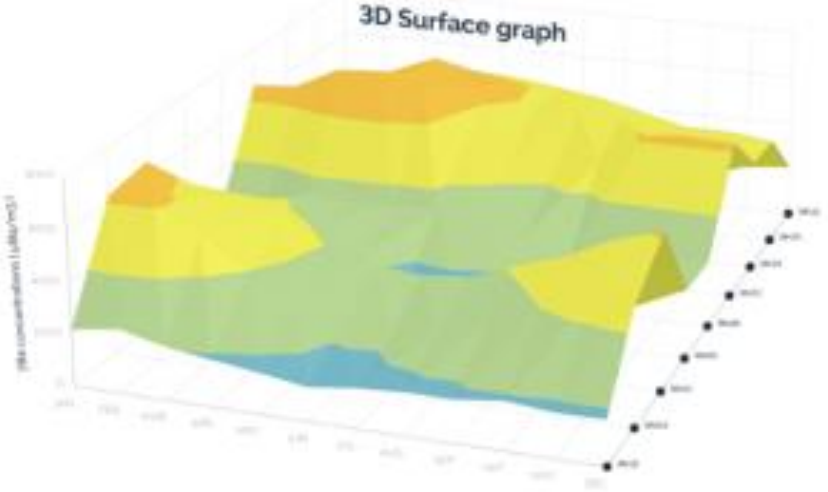

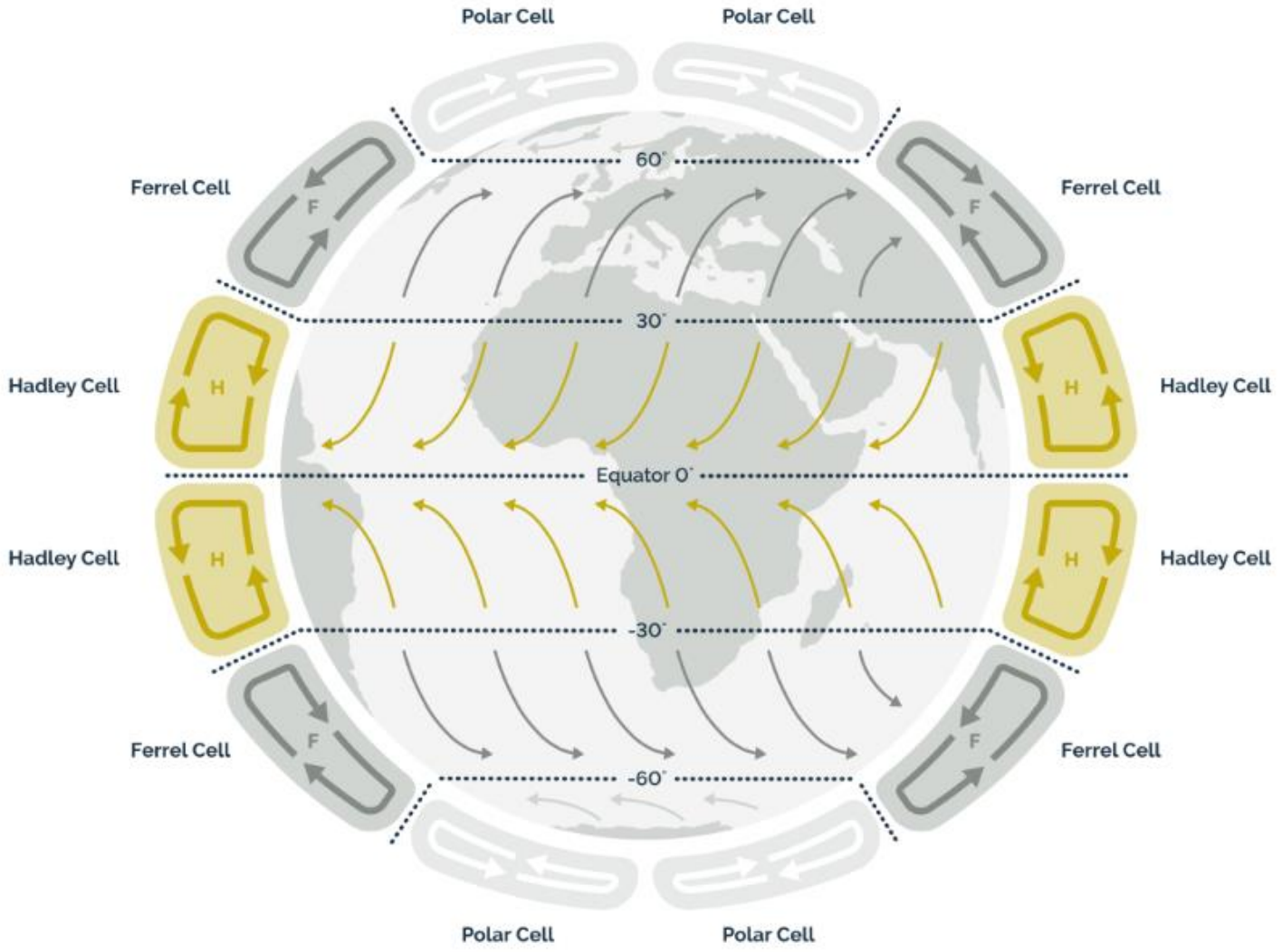

Terzi 2017

^{7}Be indicator to predict seasonal weather and monsoons triggered by atmospheric cell convergence zone position

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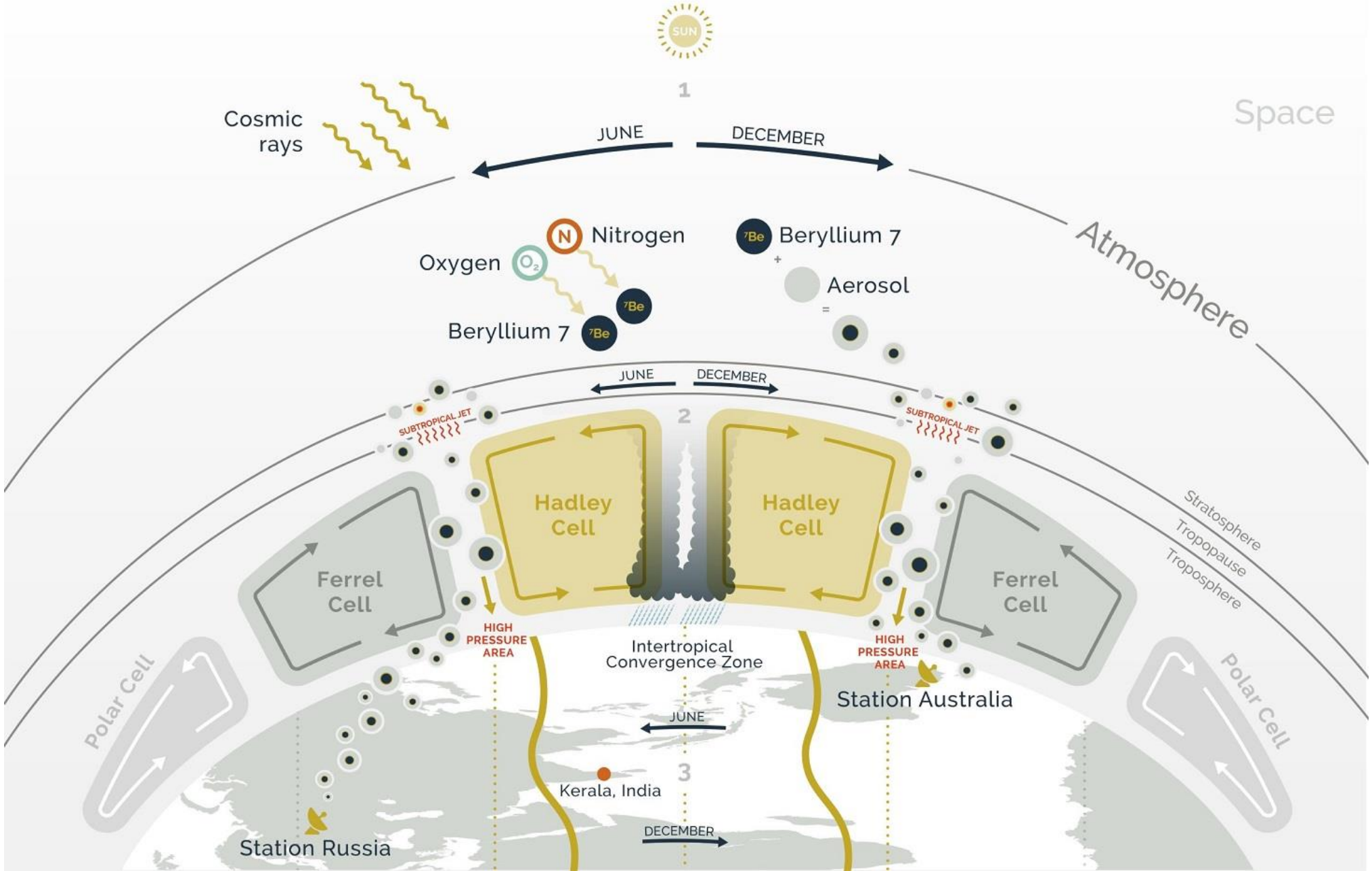
Terzi et al (2019) Scientific Reports

Seasonal Weather and Monsoon prediction



Exploratory work: cosmogenic radionuclide as possible indicator for Climate change?

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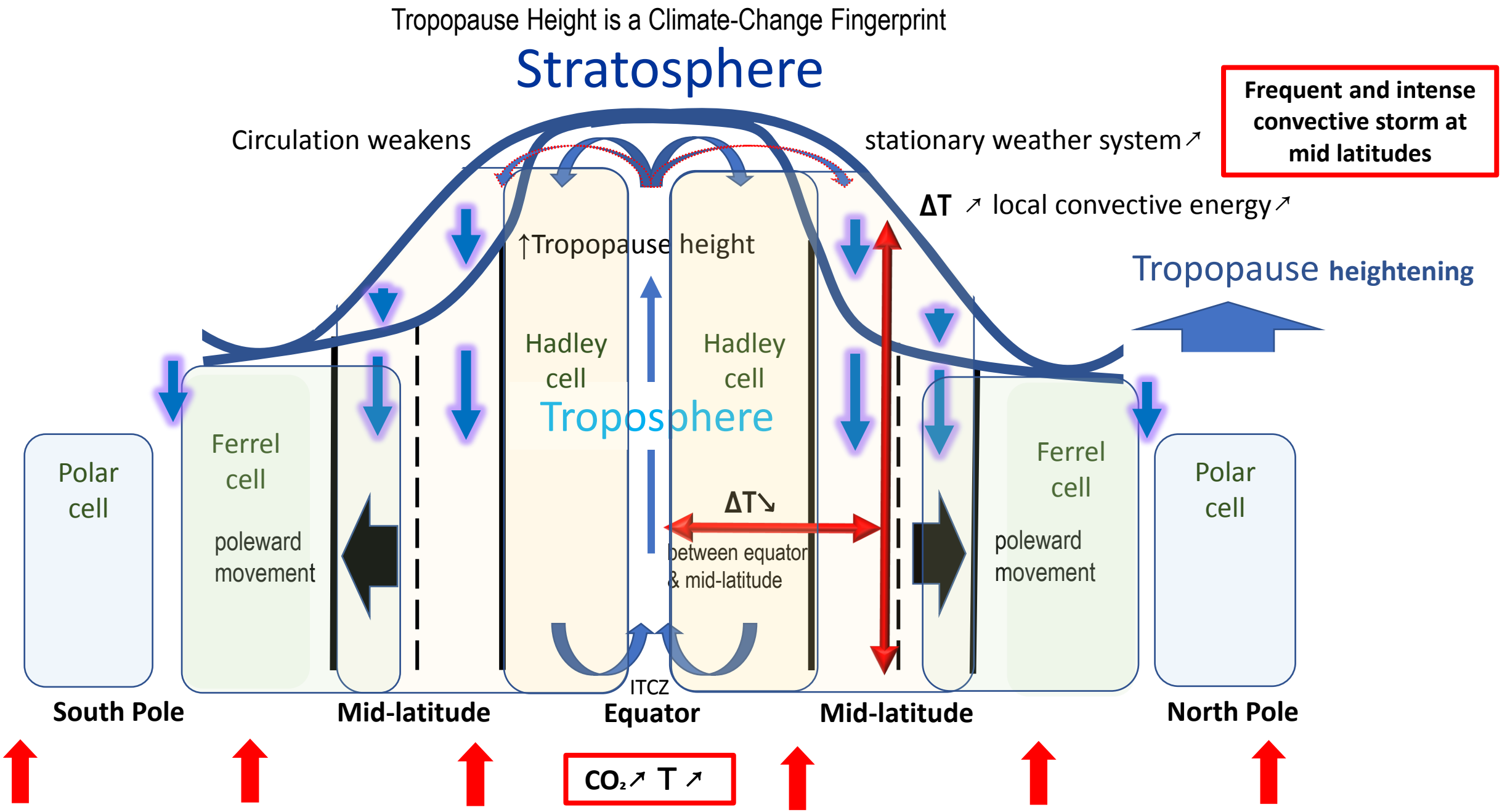
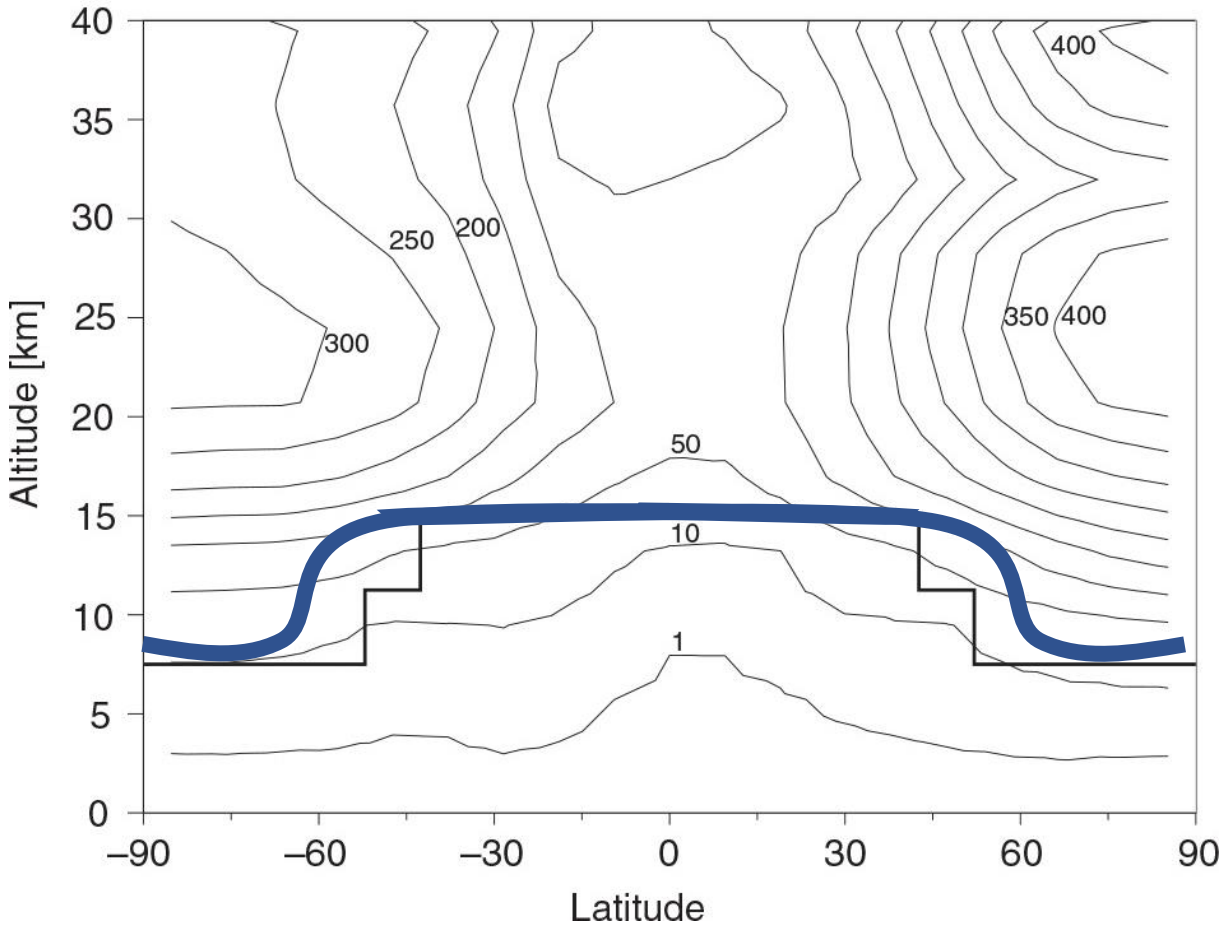


Link between Beryllium 7 concentration and Tropopause profile



Simulated concentration of Be-7 in the atmosphere, in 10^4 per m^3. the thick line represent the tropopause in the model. Deleygue et al 2015.

The higher the tropopause the higher the ^{7}Be concentrations

1. ^{7}Be a proxy for tropopause height variation

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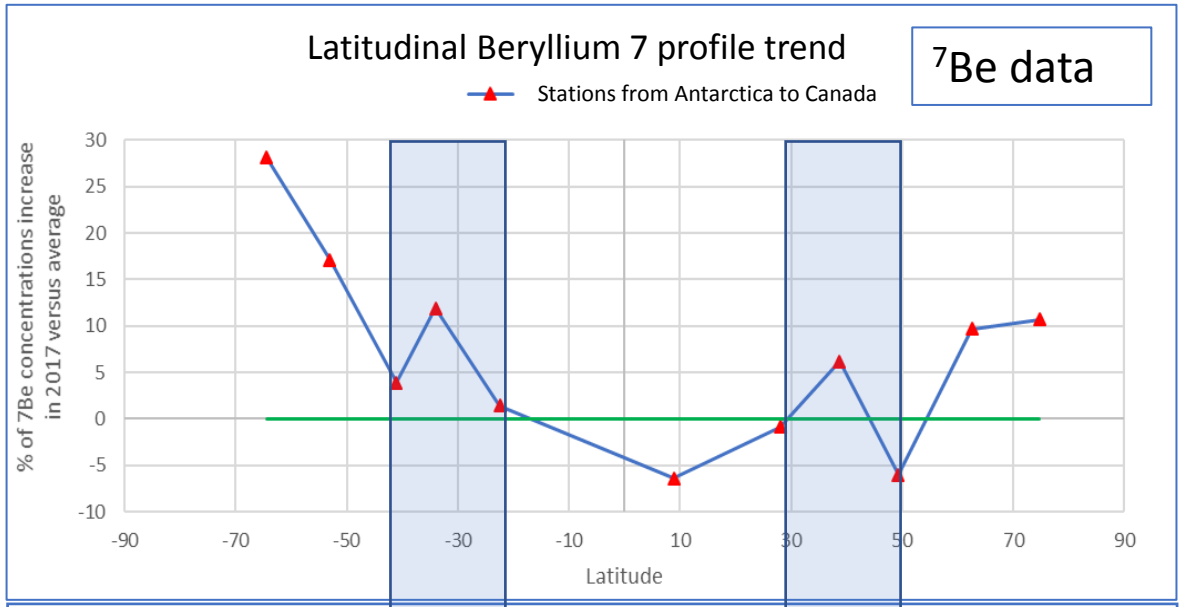
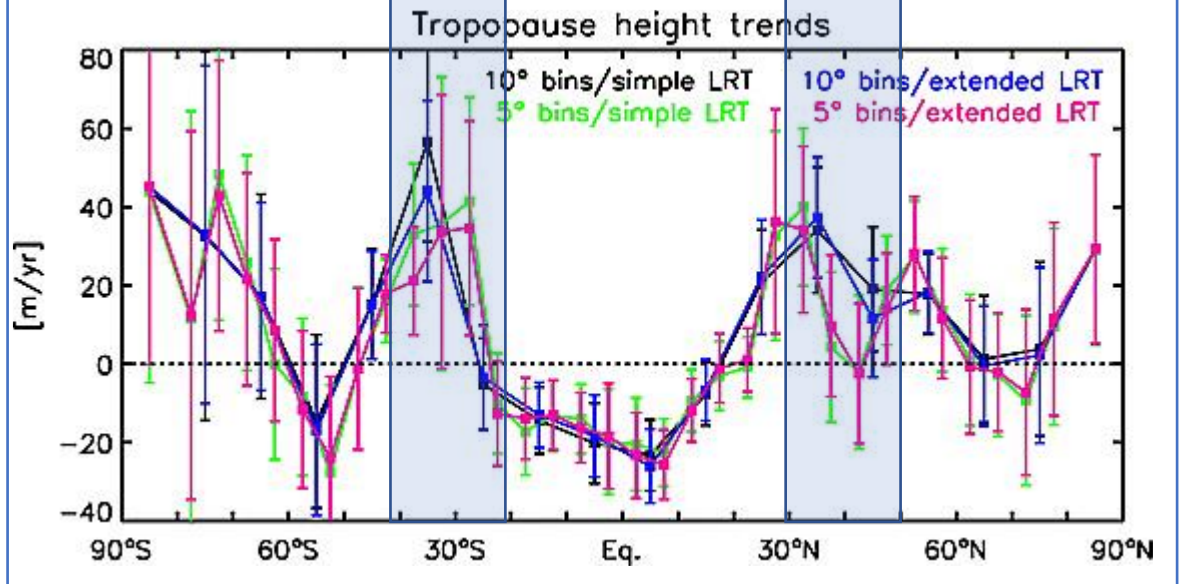
Terzi et all. (2019) draft



Schmidt et al. 2008

GPS radio occultation data



Ground based continuously operated radionuclide measurement systems

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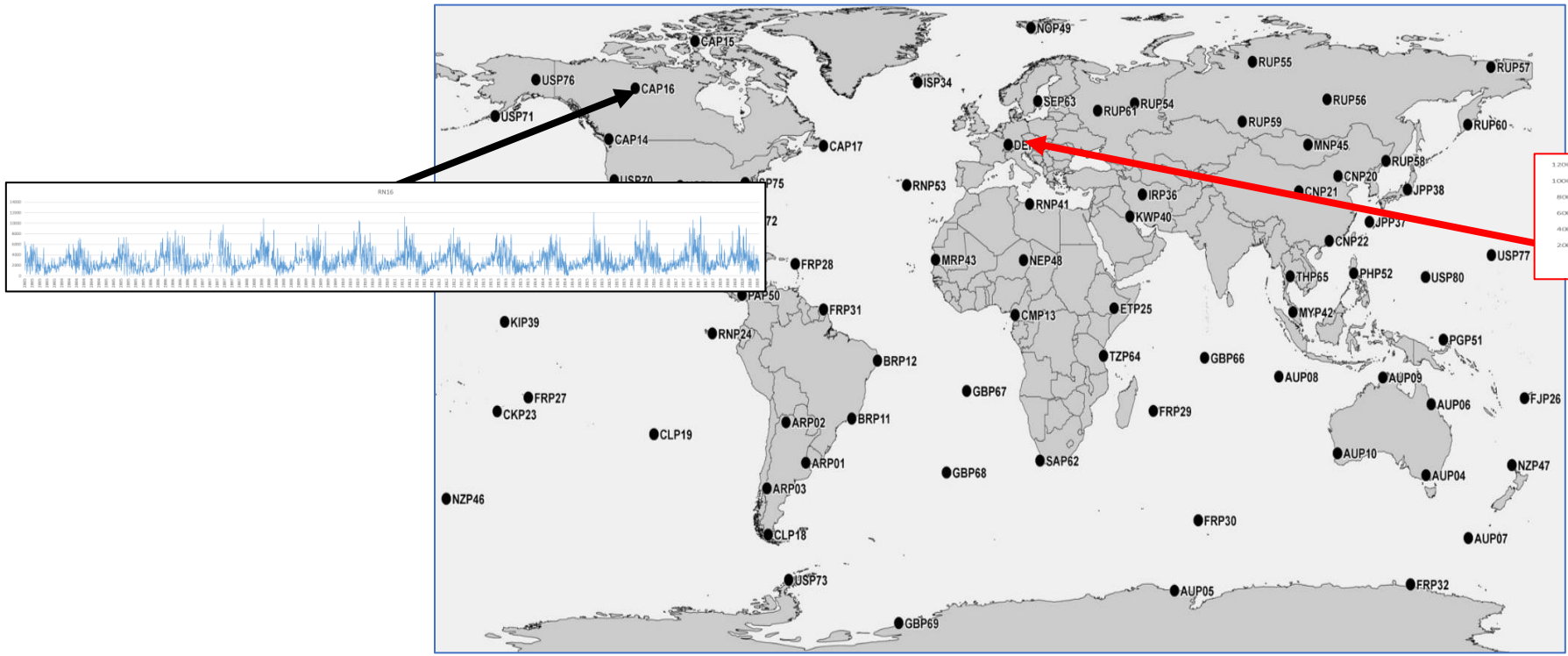
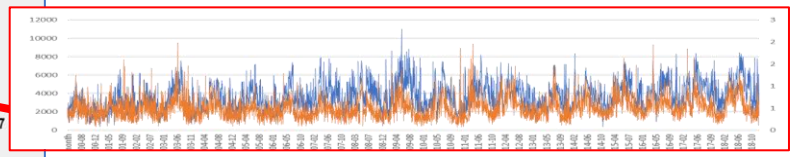
International Monitoring system (IMS) Radionuclide Network (80)





HVS stations BAG Switzerland (5)

https://www.ctbto.org/specials/vdec/

2. ^{7}Be a proxy for tropopause height variation and 3. poleward movement of Hadley cell

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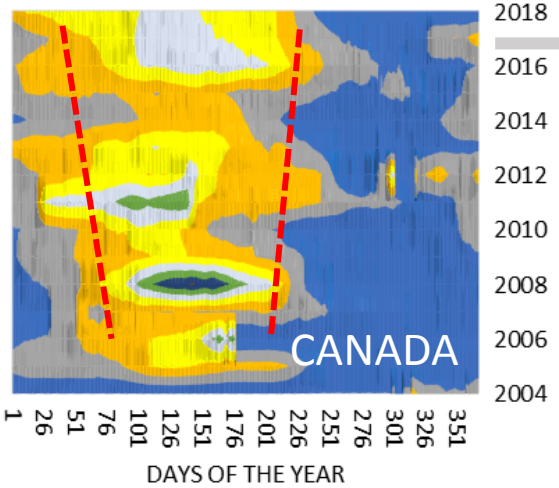
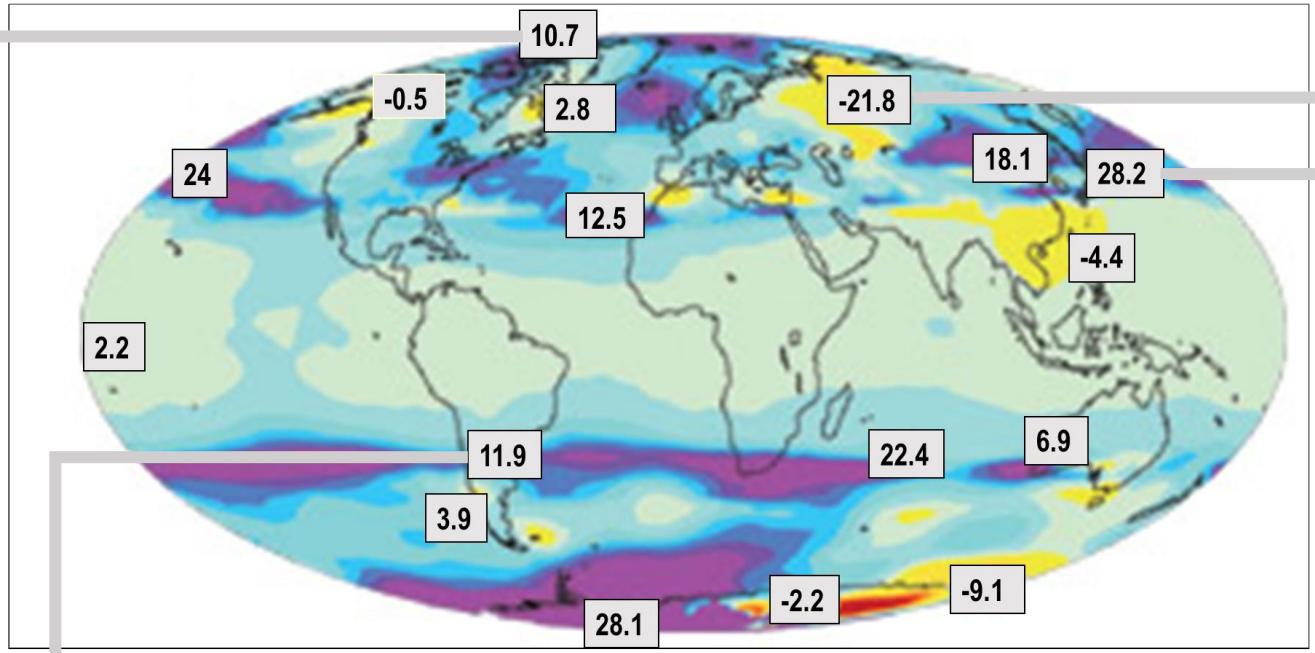
Terzi et all. (2019) draft

RN15 0/-120 days average
normalized over all avaialble years

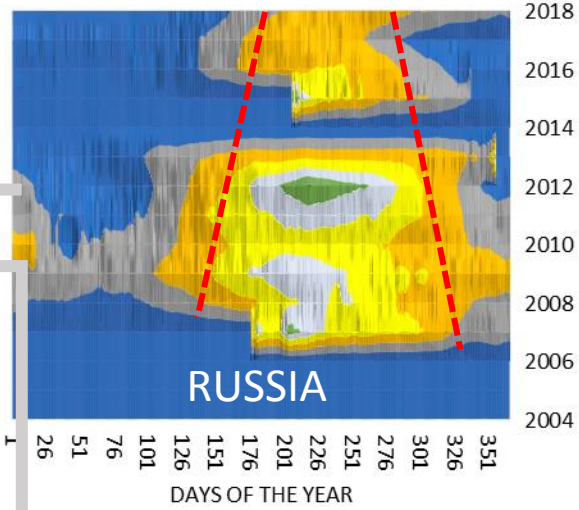


Beryllium 7 data (2004-2018)
overlaying gsp radio-sonde data (1979-1999)

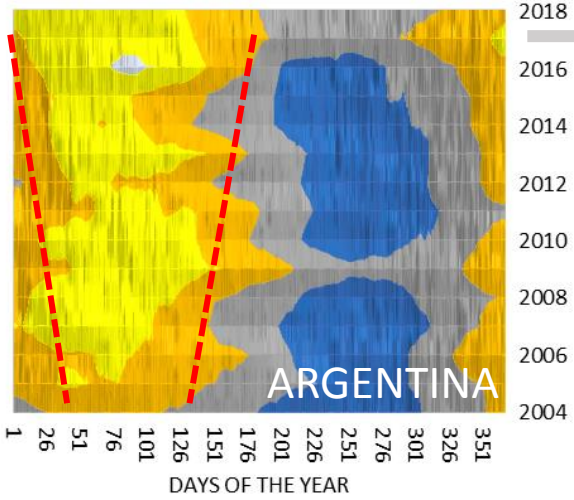


Map from Santer et al. 2004

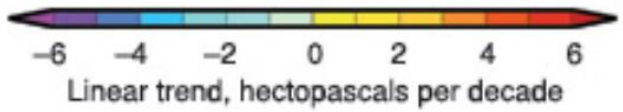
RN59 0/-120 days average
normalized over all avaialble years



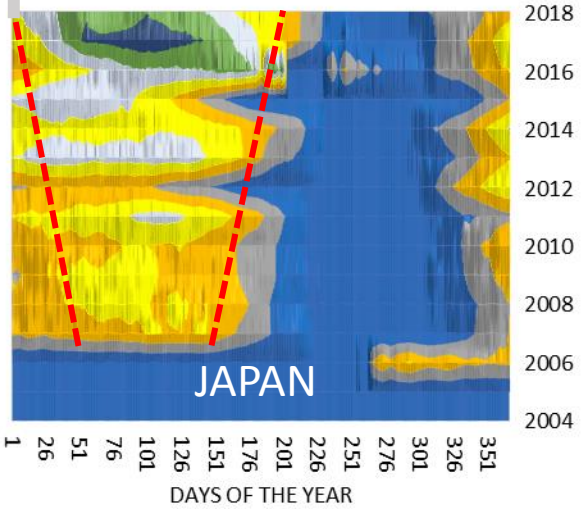
RN01 0/-120 days average
normalized over all avaialble years



^{7}Be % of growth



RN37 0/-120 days average
normalized over all avaialble years



The cone shape Hp: the longer the warm air, the higher the tropopause, the more extended is the period of ^{7}Be growth.

0.6-0.8 0.8-1 1-1.2 1.2-1.4 1.4-1.6 1.6-1.8 1.8

3. ^{7}Be indicator for progression speed of Atmospheric cell convergence zone

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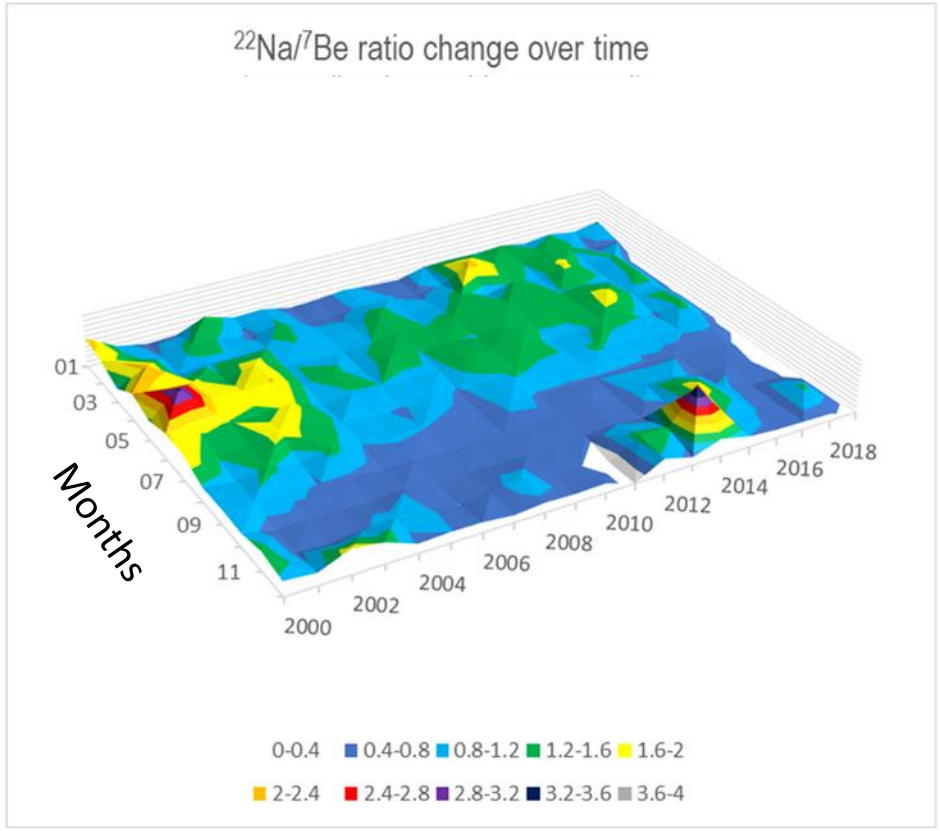
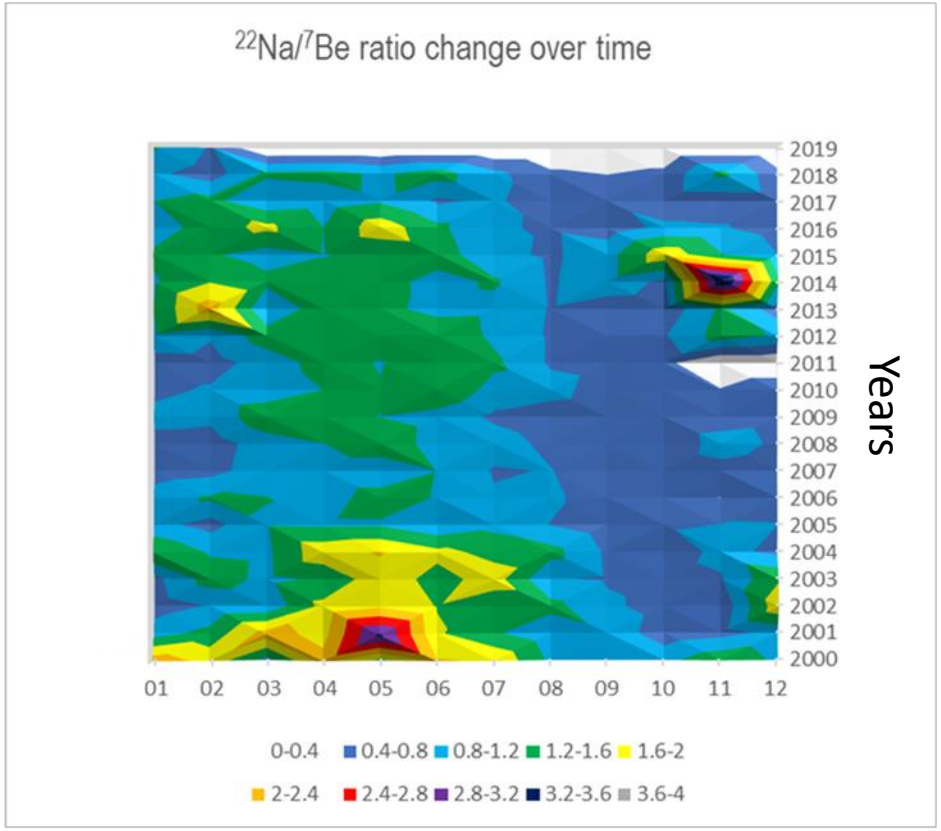
Change of atmospheric cells progression visible through isotopic ratio change over time





4. ^{7}Be indicator of fixed weather pattern

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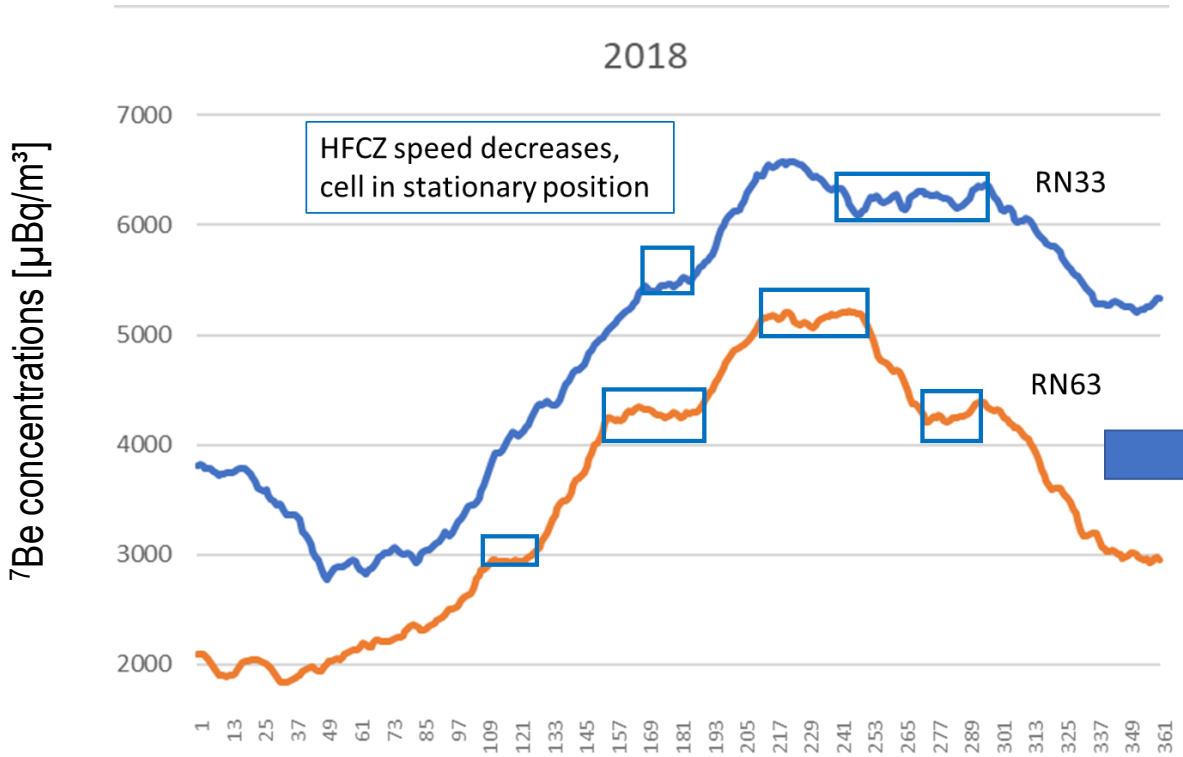
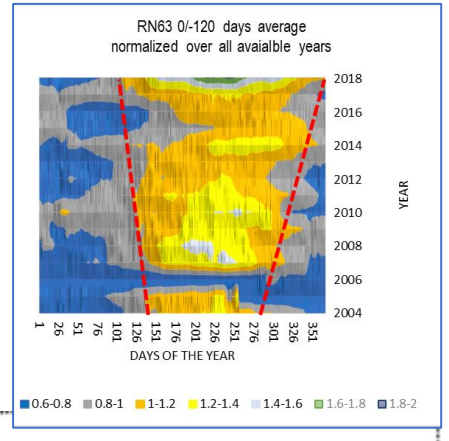
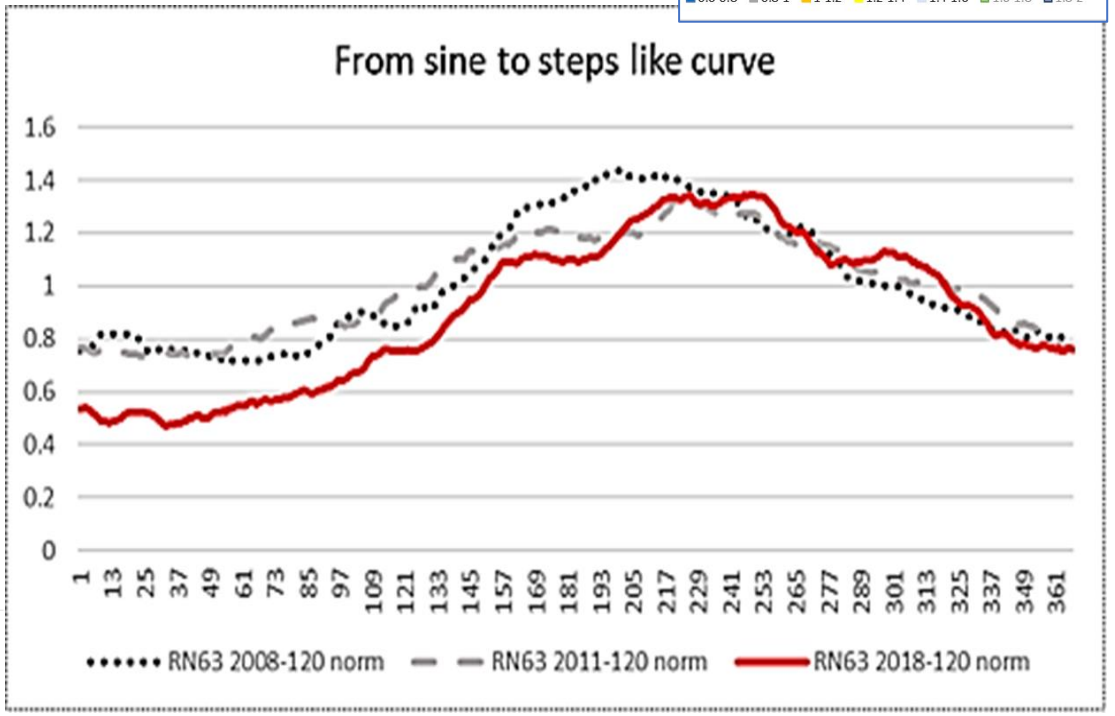
Fixed weather pattern in Northern Central Europe may be related to the slowing down of Hadley cell circulation

(weakening of trade winds due to smaller temperature difference between Equator and mid latitudes)







Exploratory work, in summary:

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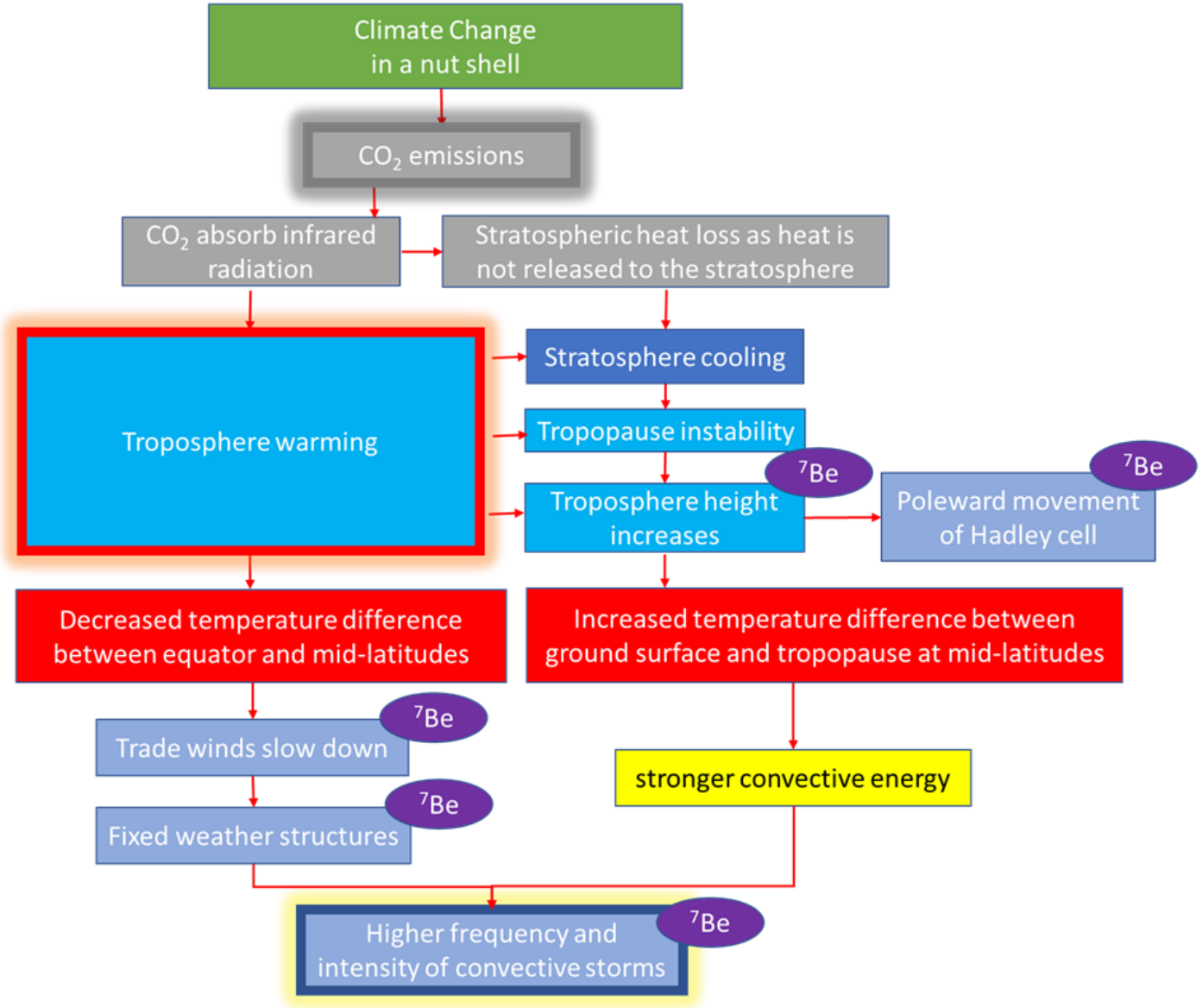
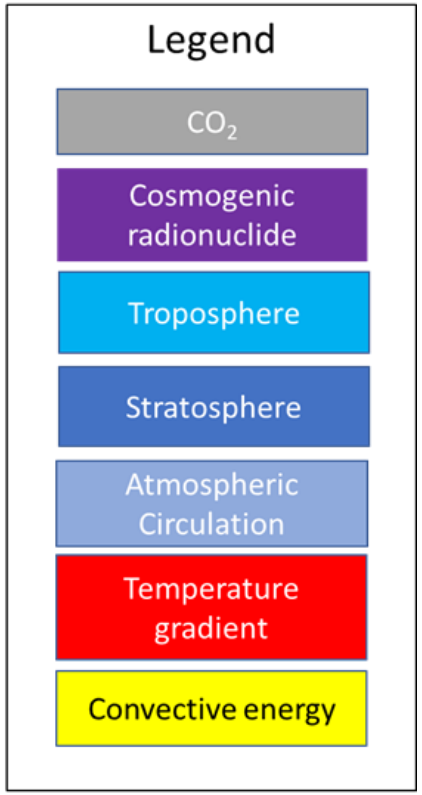
Cosmogenic radionuclide as possible indicator for Climate change





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Studying meteorological phenomena with ^{7}Be

Thank you