Environmental Variables Mia extracted.

Data from Australian Antarctic Division by Ben Raymond.

Link: https://data.aad.gov.au/metadata/records/Polar\_Environmental\_Data

Citation to data: Raymond, B. (2012, updated 2018) Polar Environmental Data Layers Australian Antarctic Data Centre - CAASM Metadata (<https://data.aad.gov.au/metadata/records/Polar_Environmental_Data>)

Distance to canyon  
File: distance\_to\_canyon  
Distance to the axis of the nearest canyon (Antarctic only)  
Source data: O'Brien and Post (2010) seafloor geomorphic feature dataset, expanded from O'Brien et al. (2009). Mapping based on GEBCO contours, ETOPO2, seismic lines.  
Processing steps: Distances to nearest canyon axis calculated in km using the Haversine formula on a spherical earth of radius 6378.137km.  
NOTE: source data extend only as far north as 45S. Do not rely on this layer near or north of 45S.  
Reference: O'Brien, P.E., Post, A.L., and Romeyn, R. (2009) Antarctic-wide geomorphology as an aid to habitat mapping and locating vulnerable marine ecosystems. CCAMLR VME Workshop 2009. Document WS-VME-09/10  
  
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Distance to polynya  
File: distance\_to\_polynya  
Distance to the nearest polynya area (Antarctic only)  
Source data: AMSR-E satellite estimates of daily sea ice concentration at 6.25km resolution  
Processing steps: The seaice\_gt\_85 layer (see below) was used. Pixels which were (on average) covered by sea ice for less than 35% of the year were identified. The distance from each grid point on the 0.1-degree grid to the nearest such polynya pixel was calculated in km using the Haversine formula on a spherical earth of radius 6378.137km. (NB the threshold of 35% was chosen to give a good empirical match to the polynya locations identified by Arrigo and van Dijken (2003), although the results were not particularly sensitive to the choice of threshold.  
Reference: Arrigo KR, van Dijken GL (2003) Phytoplankton dynamics within 37 Antarctic coastal polynya systems. Journal of Geophysical Research, 108, 3271. <http://dx.doi.org/10.1029/2002JC001739>

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Distance to upper slope (Antarctic only)  
File: distance\_upper\_slope  
Distance to the "upper slope" geomorphic feature from the Geoscience Australia geomorphology data set. This is probably a better indication of the distance to the Antarctic continental shelf break than the "distance to shelf break" data (above).  
Source data: O'Brien and Post (2010) seafloor geomorphic feature dataset, expanded from O'Brien et al. (2009). Mapping based on GEBCO contours, ETOPO2, seismic lines.  
Processing steps: Distances calculated in km using the Haversine formula on a spherical earth of radius 6378.137km. Points inside of an "upper slope" polygon were assigned negative distances.  
Reference: O'Brien, P.E., Post, A.L., and Romeyn, R. (2009) Antarctic-wide geomorphology as an aid to habitat mapping and locating vulnerable marine ecosystems. CCAMLR VME Workshop 2009. Document WS-VME-09/10

Terrain ruggedness Index:

See ideas in <https://www.tandfonline.com/doi/full/10.1080/01490410701295962>

tri calculated from the bathy\_avg5km layer in FastIceCovars already using the “terrain” function in library “raster”. For more details see *?terrain* in R after loading *library(raster)*