Contemporary Ocean Warming Dissociates Cascadia Margin Gas Hydrates
Online Supplementary Materials

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1. Warming trend sensitivity study

We explored the effect of several alternate choices of methodology in computing the warming trend (Table S1). In most cases, we feel that our decisions, such as using water depth rather than longitude, accounting for the seasonal cycle, and excluding Juan de Fuca canyon data, should improve the accuracy of the estimate. However, the large difference in the estimated warming trend between CTD-only and combined CTD, glider and float data sets warrants more explanation. At the time of our download, there was no CTD data available in the NODC archive in this region for 2010-2013. As seen in Fig. 2a, three-year regional averages are low relative to surrounding years during 2009-2011 when they rely heavily on float and glider data (Fig. 2a). Thus when the trend is estimated using CTD data only, it increases substantially. However, CTD data from our August 2013 cruise to gas hydrate vent sites is included in the data set, and its average value is significantly lower than the three-year regional-average data point shown in Fig. 2a for 2012. Also, the PDO index at sampling times was consistently negative during this period (Fig. 2b). Thus rather than an instrumental bias, we hypothesize decadal variability, particularly as it impacts the offshore region sampled by the glider/float data (see the difference between slope- and deep-water data in Fig. 2a) as the responsible factor for the relatively low three-year regional-averages from 2009-2011. Finally, we note that the CTD-only and "best" estimates agree within their error bars, as do all other runs in this sensitivity study.

Best estimate	*0.0068 ± 0.0009*
Alternate Methodological Choice	**°C per year**
Longitude used rather than water depth for offshore coordinate	0.0070 ± 0.0009
Quadratic terms allowed	0.0068 ± 0.0009
Seasonal cycle not removed	0.0070 ± 0.0009
Juan de Fuca canyon data not excluded	0.0067 ± 0.0009
Exclude glider and float data	0.0080 ± 0.0011
Temperature converted from ITS-68 to ITS-90 for data prior to 1990	0.0068 ± 0.0009
Data restricted to the slope, taken as 200-1000 m water depth	0.0077 ± 0.0018
Data restricted to the upper slope, taken as 200-600 m water depth	0.0067 ± 0.0038
Data restricted to 1977 and later	0.0076 ± 0.0012
Data restricted to 1980 and later	0.0069 ± 0.0013
Regression using ENSO MEI* rather than PDO index	0.0061 ± 0.0008

Table S1. Summary of the warming trend at 480 m and its 95% confidence level error bars under variations in several assumptions of the regression calculation. *Multivariate ENSO Index, Wolter, K. and M. S. Timlin (1998), Measuring the strength of ENSO events – how does 1997/98 rank? *Weather* **53**: 315-324, data downloaded from ESRL website.

2. Additional modeling information and figures

We confirmed our estimates of the *in situ* thermal diffusivity with measured for the Washington margin that were obtained during our GeoPRISM cruise in August, 2013 at water depths of 552 and 1029 m (Homola, K. L, H. P. Johnson and C. K. Hearn, Measurements of *In Situ* Thermal Diffusivity of Cascadia Margin Marine Sediments, *Elementa*, in press). This data is available on-line at

https://catalyst.uw.edu/workspace/paulj/17643/