The manuscript is a non-peer reviewed preprint submitted to EarthArXiv

Toward Greater Clarity: Revisiting *The Coldest March* and Its Portrayal of the Ross Ice Shelf Atmospheric Dynamic

Mila Zinkova
Independent researcher, San Francisco, CA 94122, USA
Corresponding author: Mila Zinkova milazinkova@google.com

Keywords: Ross Ice Shelf Airstream, Susan Solomon, Misconceptions

Abstract

In the final chapters of *The Coldest March: Scott's Fatal Antarctic Expedition*, Dr. Susan Solomon analyzes the meteorological conditions surrounding the last blizzard that claimed the lives of Captain Robert Falcon Scott, Dr. Edward Wilson, and Lieutenant Henry Bowers. The book's conclusion—that the storm could not have lasted ten days and that the men may have chosen to die—warrants close scrutiny. Solomon not only argues that the blizzard was virtually impossible but even suggests that Scott may have ordered Wilson and Bowers to die alongside him, a claim resting entirely on her meteorological misinterpretation, a sensational accusation that was subsequently repeated by several major newspapers. A reassessment of the book's depiction of the behavior of the Ross Ice Shelf airstream reveals significant discrepancies with established meteorological science, satellite imagery, and historical records. Drawing on satellite observations, archival sources, and contemporary polar research, this article examines the methodological and interpretive

problems that shaped Solomon's conclusions, including oversimplifications of cyclonic incursions, and misunderstandings of barrier winds.

This is not a matter of one interpretation versus another; it is a matter of scientific evidence contradicting a narrative built on a misreading of that evidence.

Introduction

In The Coldest March: Scott's Fatal Antarctic Expedition, Solomon (2002) offers a detailed account of Captain Robert Falcon Scott's journey to the South Pole. She concludes that it is "a virtual certainty" the blizzard described by Scott (1913, p. 410)—which halted the progress of Scott, Dr. Edward Wilson, and Lieutenant Henry Bowers—did not occur as reported (Solomon, 2002, p. 319). Solomon (2002, p. 327) further argues that "the scientific constraints of modern meteorology" render such a blizzard implausible, a position she reiterated in a 2012 lecture at the Royal Society of Chemistry.

This interpretation has been widely echoed in popular media. Coverage in The New York Times (Chang, 2001), The Guardian (Glancey, 2001), and the Los Angeles Times (Hotz, 2001) reinforced Solomon's suggestion of "a desperate Scott vainly attempting to save legacies rather than lives" (The Coldest March, 2002, p. 327). These accounts helped cement a narrative of tragic heroism and questionable judgment that continues to shape public perceptions of the expedition.

Solomon (2002, p. 327) ultimately concluded that “the scientific constraints of modern meteorology […] suggest that their deaths may have been a matter of choice rather than chance.” Building on Zinkova (2025), which already presented evidence that the blizzard likely did occur and that its characteristics closely aligned with Scott’s original account, the present article shifts focus from the event itself to the assumptions underlying Solomon’s (2002, p. 327) discussion of the “constraints of modern meteorology”. A detailed reassessment shows that Solomon misrepresented the Ross Ice Shelf airstream, undermining her broader claim that Scott was dishonest in his description of the Final Blizzard. An overview map of the Ross Ice Shelf is presented in Figure 1.

Figure 1. Overview map of the Ross Ice Shelf and its surrounding terrain, including the Transantarctic Mountains to the west and Marie Byrd Land to the east. A red pointer marks Ross Island, home to McMurdo Station.

Data and Methods

This analysis uses infrared satellite imagery from NASA's Worldview platform (NASA, n/d) to evaluate Dr. Susan Solomon's (2002, 2012) meteorological findings about the nature of the Ross Ice Shelf airstream. The imagery provides clear, empirical evidence of atmospheric patterns

over the region. Bromwich et al. (1992) demonstrated that katabatic winds traversing glacier valleys in the Transantarctic Mountains often produce warm signatures on thermal satellite imagery. That is why they are easy to spot from space. Historical accounts by the Terra Nova expedition's meteorologist George Simpson (1919) and expedition member Apsley Cherry-Garrard (1922) are also incorporated.

By comparing *The Coldest March*'s statements—drawn from the book *The Coldest March* (Solomon, 2002) and the public presentation hosted by the Royal Society of Chemistry (Solomon, 2012)—with observable satellite data, historical records and contemporary scientific literature, this study demonstrates that nearly every conclusion the book (Solomon, 2012) and the presentation (Solomon, 2012) make regarding the Final Blizzard is not supported by the available data.

Results

Let us examine the "scientific constraints of modern meteorology," which, as Solomon (2002, p. 327) contends, would have made the occurrence of the Final Blizzard virtually impossible.

Constraint #1: According to Solomon (2002, 2012), The Ross Ice Shelf is as a cyclone-free zone of pure katabatic descent , where a blizzard cannot last more than 4 days

During the 2012 presentation, Solomon (2012) was asked to clarify the assertion that blizzards on the Ross Ice Shelf cannot persist beyond four

days, if one was caused by a cyclone, for example. Solomon responded as follows:

> *I didn't mean to imply that there's no place else on the continent where you could have blizzards longer than four days long. That's, clearly not correct. There's plenty of places where you can have much longer blizzards because as you say, you can have cyclones that can last longer than that. The conditions on the barrier are pretty strongly katabatic. I mean, when you have this kind of blizzard, that's normally what you're getting, because you're shielded so well from, and from cyclones moving in from the, from the coast. So it's a very different kind of meteorology.*

The Ross Ice Shelf is not shielded from cyclones. In the vicinity of Scott's Last Camp and Corner Camp, nearly all extreme wind events—whether katabatic (Figure 2, Figure 3) or barrier (Figure 4)—are driven by passing cyclones or mesocyclones, as evidenced by infrared satellite imagery. This dynamic weather pattern was well documented by Schwerdtfeger (1984) and King and Turner (1997), long before Solomon's book appeared. Bromwich et al. (1992) showed how a large-scale cyclone could drive katabatic winds across the Ross Ice Shelf, linking storm systems directly to surface wind behavior. O'Connor et al. (1994) described two primary scenarios in which barrier winds typically develop: one involves the passage of a mesocyclone across the northwestern Ross Ice Shelf, while the other is associated with synoptic-scale cyclones approaching from the north and east, moving through the Ross Sea and Ross Ice Shelf regions (Seefeldt et al., 2007).

Interestingly, both the book (Solomon, 2002, p. 312) and the presentation (Solomon, 2012) featured a satellite image showing the propagation of katabatic winds across the Ross Ice Shelf that clearly depicts a synoptic-scale cyclone—an essential driver of the pressure gradients that enabled the katabatic flow to traverse hundreds of kilometers across the shelf.

Moreover, atmospheric conditions over the Ross Ice Shelf are not governed solely by katabatic winds. Rather, the region's wind regime reflects a dynamic interplay among barrier winds—driven by the topographic blocking by the Transantarctic Mountains—gravity-driven katabatic flows, and synoptic and mesoscale winds associated with cyclones and mesocyclones traversing the Ross Sea and Ross Ice Shelf (Seefeldt et al., 2007).

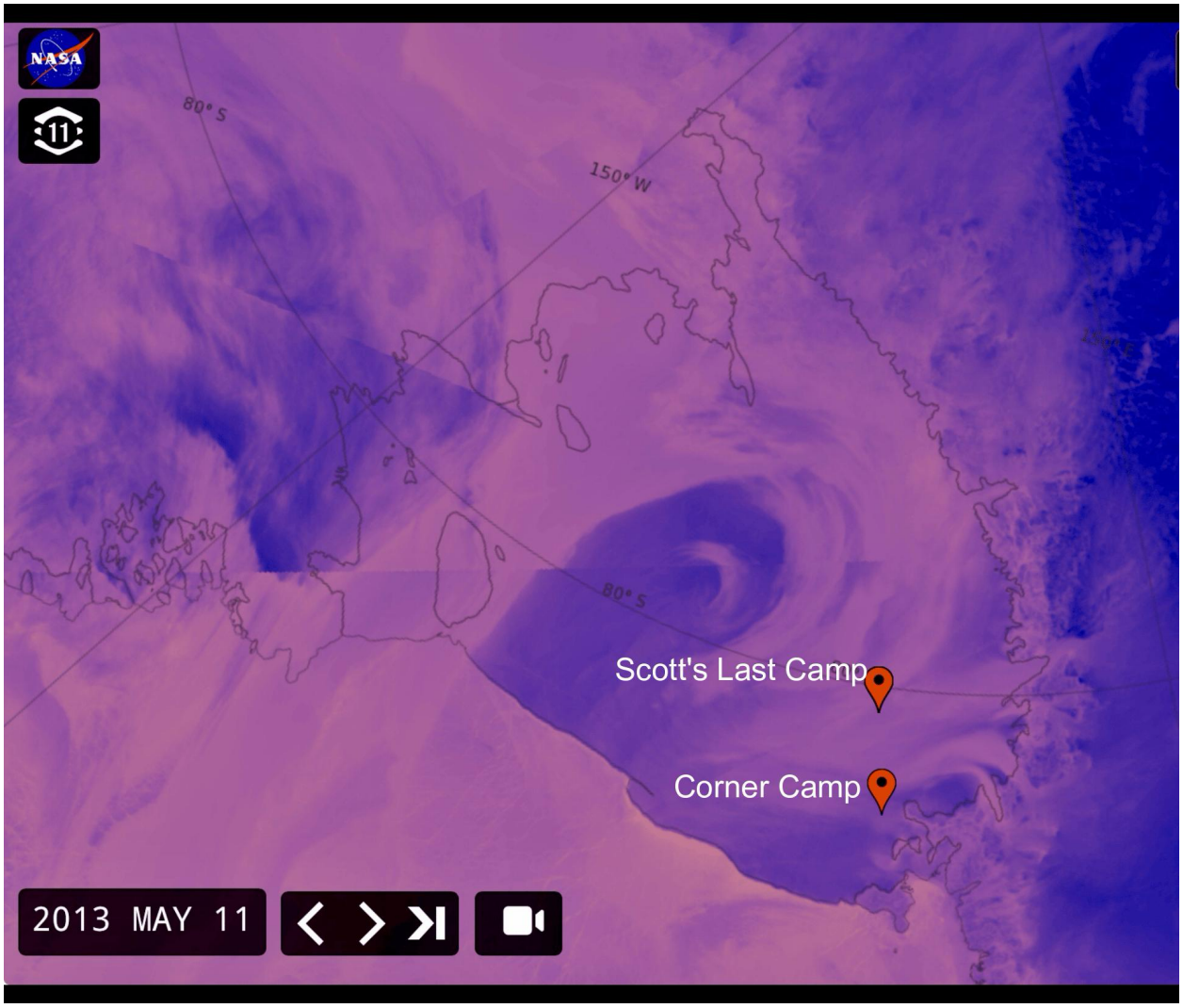

Figure 2. The NASA Earthdata (n.d.) satellite infrared image shows a large cyclonic storm swirling over the Ross Ice Shelf in Antarctica on May 11, 2013. Two locations, Scott's Last Camp and Corner Camp, are marked. The image also reveals subtle signatures of katabatic winds. These appear as lighter (warmer), linear features flowing off the Transantarctic Mountains.

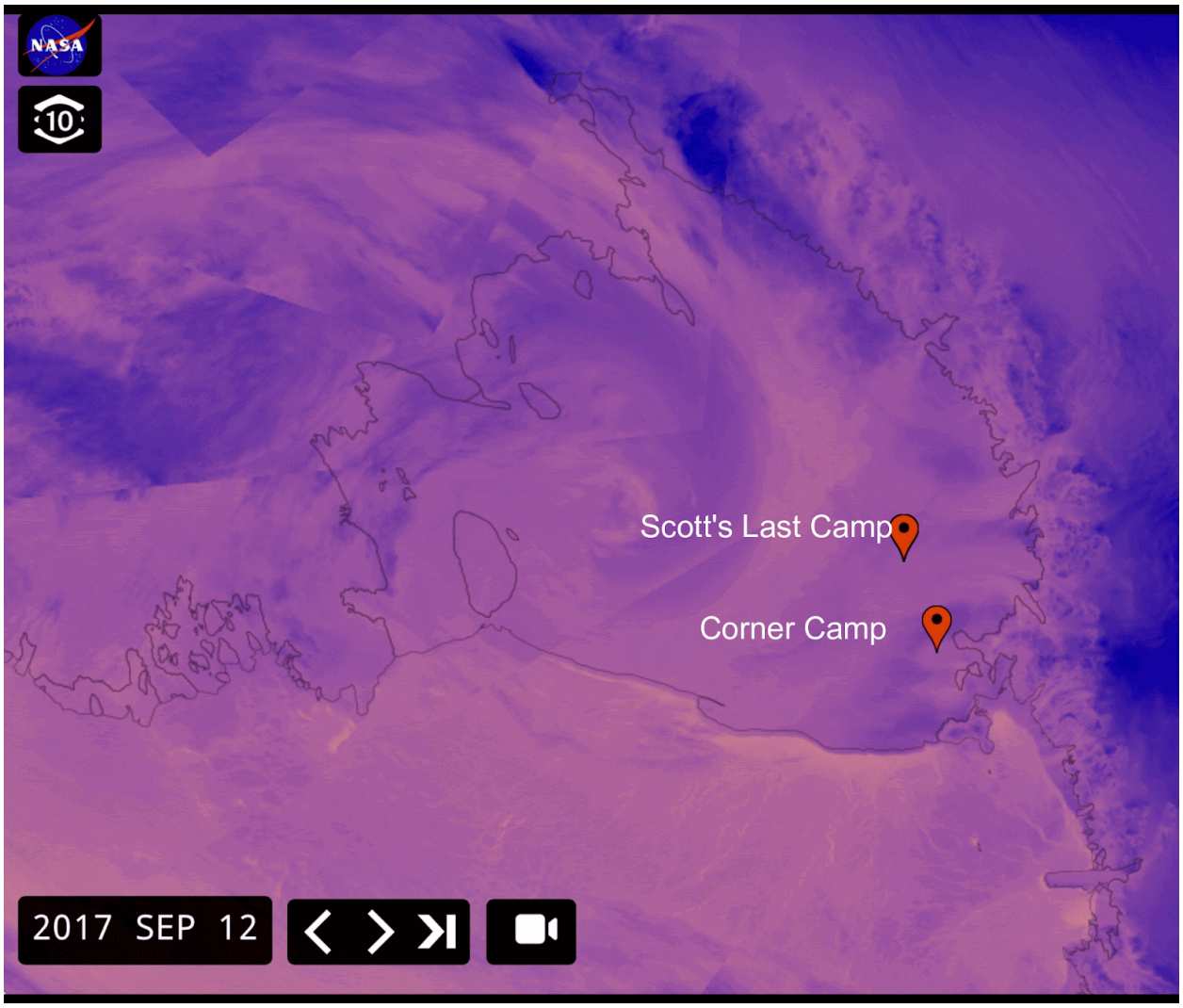

Figure 3. NASA Earthdata (n.d.) satellite infrared image shows a large cyclonic storm swirling over the Ross Ice Shelf in Antarctica on September 12, 2017. Two locations, Scott's Last Camp and Corner Camp, are marked. The image also reveals subtle signatures of katabatic winds. These appear as lighter (warmer), linear features flowing off the Transantarctic Mountains.

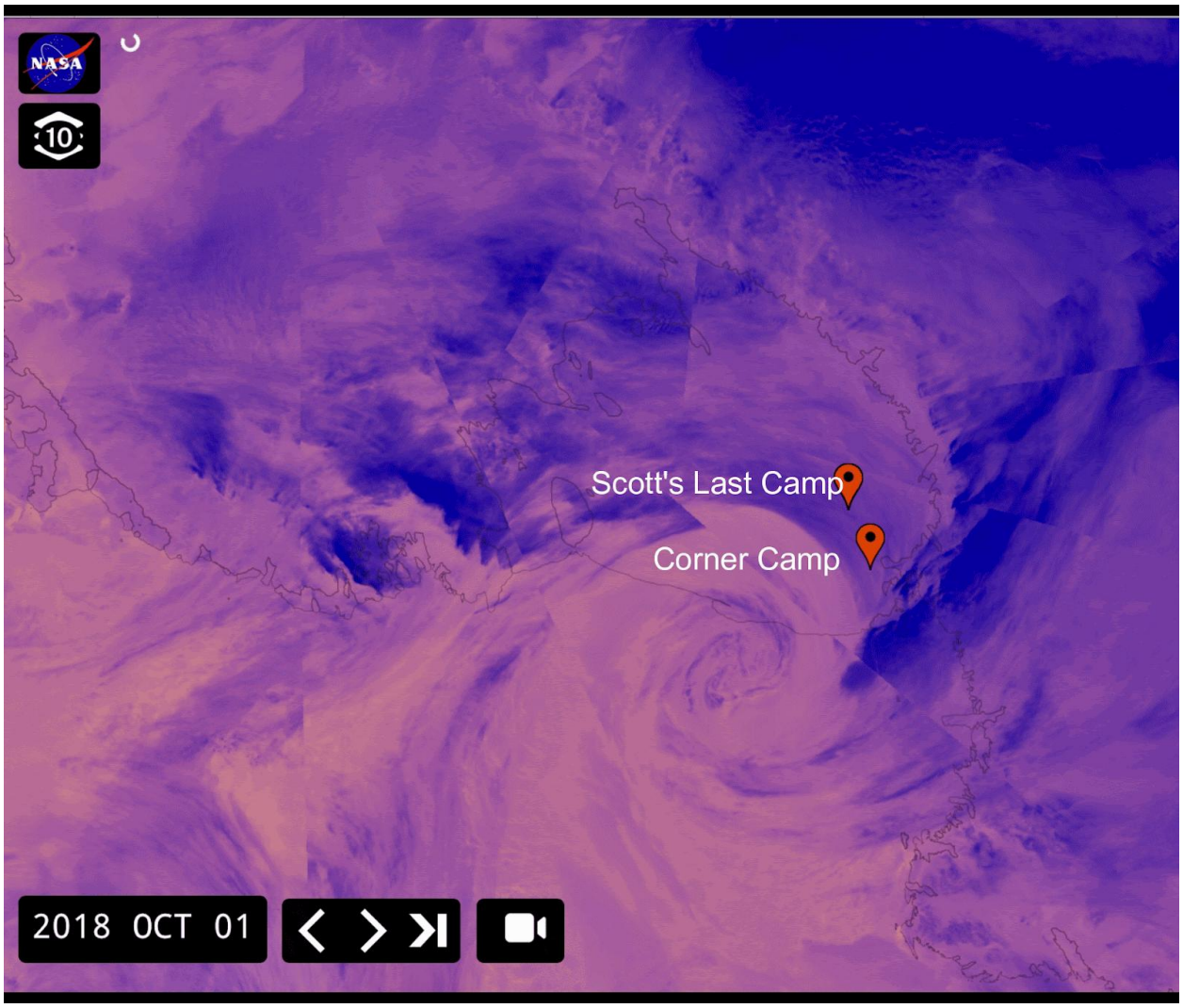

Figure 4. The NASA Earthdata (n.d.) satellite infrared image shows a large cyclonic storm swirling over Ross Sea and the Ross Ice Shelf in Antarctica on September 12, 2017. Two locations, Scott's Last Camp and Corner Camp, are marked. This cyclone resulted in the barrier wind.

While speaking about the records of the longest blizzards, it's worth noting George Simpson's (1919, p. 13) account from Cape Evans about the longest recorded blizzard in June 1912—less than three months after Scott and his companions perished on the Ross Ice Shelf.

The longest blizzard occurred in June 1912 when from 20 hours on the 7th until 11 hours on the 14th , i.e. , for 6 days and 14 hours , the anemometer recorded more than 20 miles in every hour and the mean velocity during the period was 48 miles an hour

Simpson clearly described a barrier blizzard not a katabatic blizzard. How do we know that Simpson's (1919) blizzard was a barrier blizzard? We know this because Weber et al. (2016) concluded that all extreme wind events at Ross Island included in their study were caused by the barrier wind regime. Therefore, the blizzards Solomon experienced herself (probably at McMurdo Station, Ross Island), were all most likely barrier, not katabatic, blizzards.

While considering the potential duration of a blizzard on the Ross Ice Shelf, it is important to recognize that a barrier blizzard can and often does transition into a katabatic blizzard with little or no interruption in some places, including the Last Camp. This seamless shift can substantially extend the total duration of blizzard conditions at certain locations. For instance, the barrier blizzard at Cape Evans described by Simpson lasted nearly seven days. Based on the dynamics of a regime shift, this event would likely have manifested as a 10-11-day barrier–katabatic blizzard at Scott's Last Camp. Initially, both sites would have been affected simultaneously by the barrier regime. However, as the cyclone shifted southeast and reoriented, the katabatic component would have continued to impact Scott's camp alone (Zinkova, 2025).

Constraint # 2. According to Solomon (2002, 2012), katabatic winds follow the direction of the flow, and thus the absence of a blizzard at Corner Camp implies none occurred at Scott's Last Camp.

An additional proposed "constraint of modern meteorology" appears to stem from *The Coldest March*'s interpretation of katabatic wind behavior over the Ross Ice Shelf. In the 2012 presentation, Solomon (2012) stated:

> *The barrier [the Ross Ice Shelf] is just this big flat ice shelf, so to a large extent the wind can only follow the direction of the flow, there's nothing to break it up.*

And therefore

> *If there had been a blizzard upstream here in the middle of the barrier, I find it hard to see how there could not have been one at Corner Camp.*

In essence, *The Coldest March* is concluding that katabatic winds can "only follow the direction of the flow," which leads the book to argue that the absence of a katabatic blizzard at 78°3'S, 168°59'E (Corner Camp) necessarily implies its absence at 79°40'S, 169°30'E (Scott's Last Camp) as well. Far from being merely inaccurate, this interpretation does not reflect the observed behavior of katabatic winds and leads to a misleading characterization of their dynamics. Katabatic winds are primarily gravity-driven, with their trajectories influenced by several factors, most of all the evolving pressure gradients associated with passing cyclones. Infrared satellite imagery (Figure 5, Figure 6, Figure 7, and Figure 8) and numerous studies (Bromwich et al, 1992) (Seefeldt et al, 2007), (Zinkova, 2025)

reveal a far more intricate pattern of katabatic propagation across the Ross Ice Shelf characterized by lateral shifts and localized surges that contradict Solomon's (2012) depiction.

Also interesting is Solomon's (2012) description of the origin of katabatic winds:

> *Why does a blizzard happen? The main reason is because of the katabatic winds of Antarctica. On the high plateau, temperatures drop and very, very cold air pools. What can happen is that there's a front come through, and it literally will push the cold air off the plateau. It comes roaring down the glaciers.*

However, as evidences shows (Turner, 1996) unlike the Ross Ice Shelf, the plateau is not a thoroughfare for frontal systems and katabatic winds do not require a frontal "push" to descend; they are gravity-driven flows of dense, radiatively cooled air that naturally spill downslope from the Polar Plateau (Parish and Cassano, 2003). It is only when katabatic winds reach the lower elevations of the Ross Ice Shelf that cyclonic activity may assist in their further propagation (Seefeldt and Cassano, 2012).

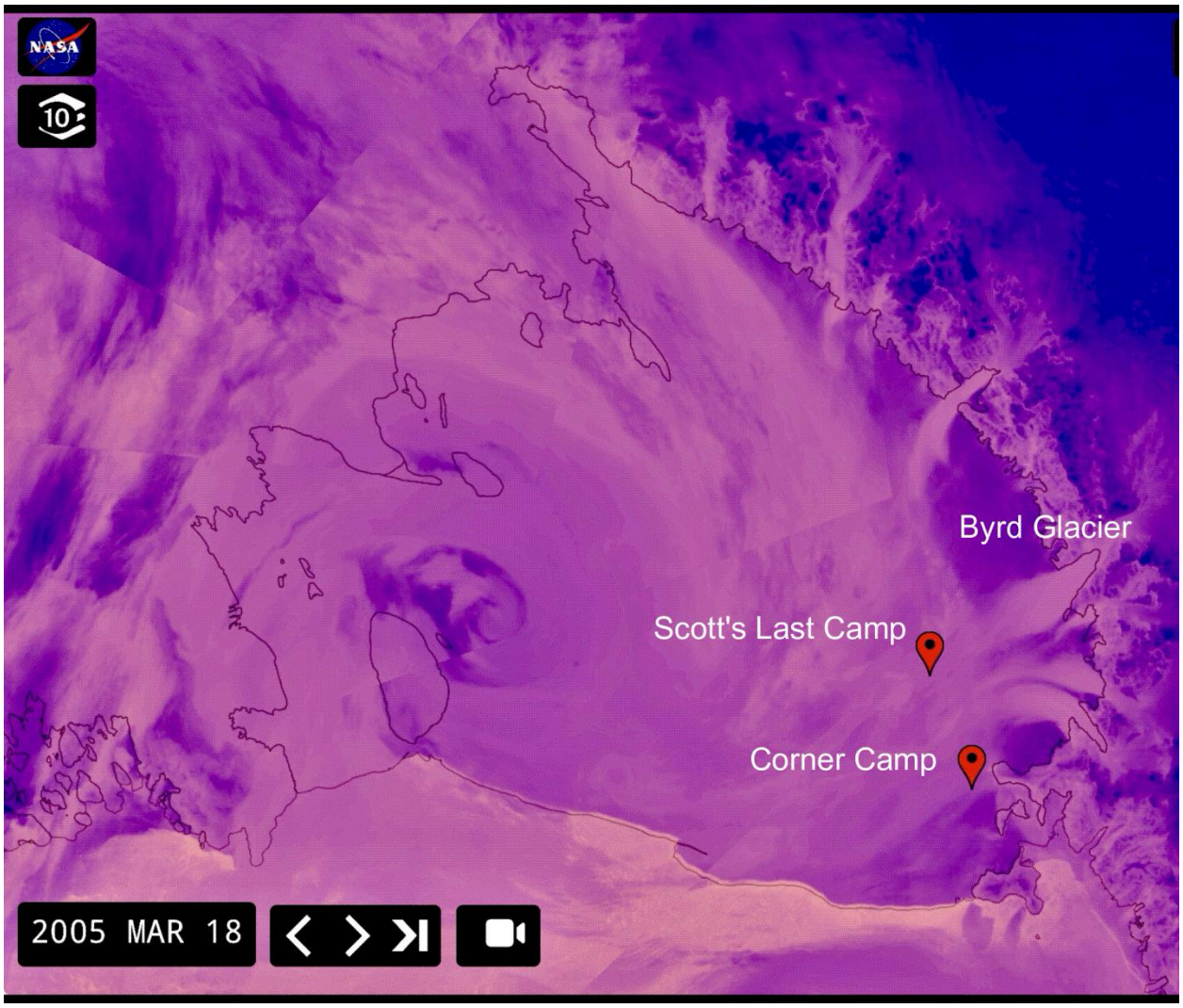

Figure 5. NASA Earthdata (n.d.) satellite infrared image shows a large cyclone swirling over the Ross Ice Shelf in Antarctica on March 18, 2005. Two locations, Scott's Last Camp and Corner Camp, are marked. The image also reveals warm signatures of katabatic winds. These appear as lighter (warmer), linear features flowing off the Transantarctic Mountains. A katabatic blizzard is occurring in the vicinity of Scott's Last Camp, driven by a surge descending from Byrd Glacier. In contrast, conditions at Corner Camp remain calm.

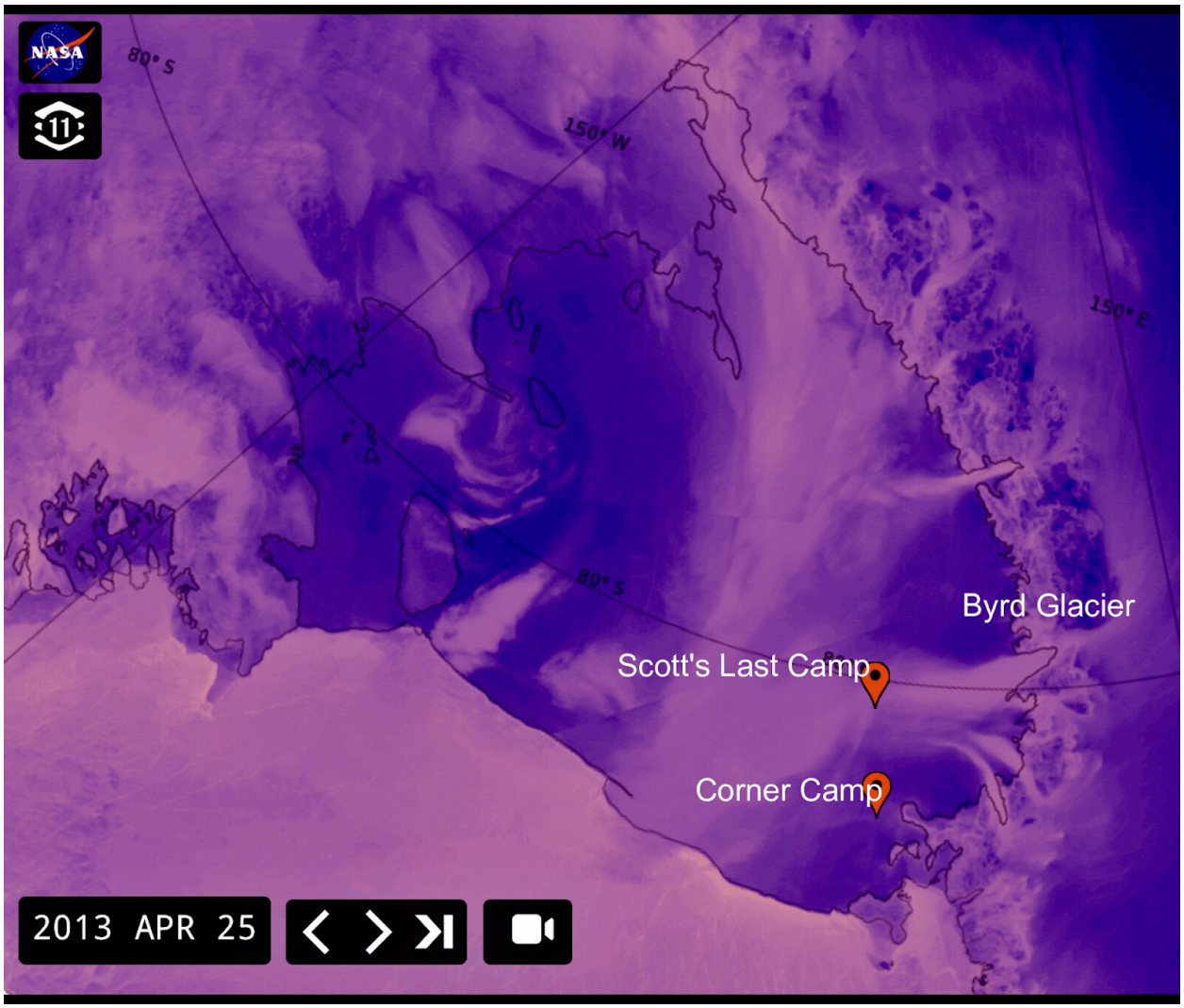

Figure 6. NASA Earthdata (n.d.) satellite infrared image shows a large cyclone swirling over the Ross Ice Shelf in Antarctica on April 25, 2013. Two locations, Scott's Last Camp and Corner Camp, are marked. The image also reveals warm signatures of katabatic winds. These appear as lighter (warmer), linear features flowing off the Transantarctic Mountains. A katabatic blizzard is occurring in the vicinity of Scott's Last Camp, driven by a surge descending from Byrd Glacier. In contrast, conditions at Corner Camp remain calm. The katabatic surge from the southern Marie Byrd

Land does not affect either the area of the Scott's Last Camp of Corner Camp.

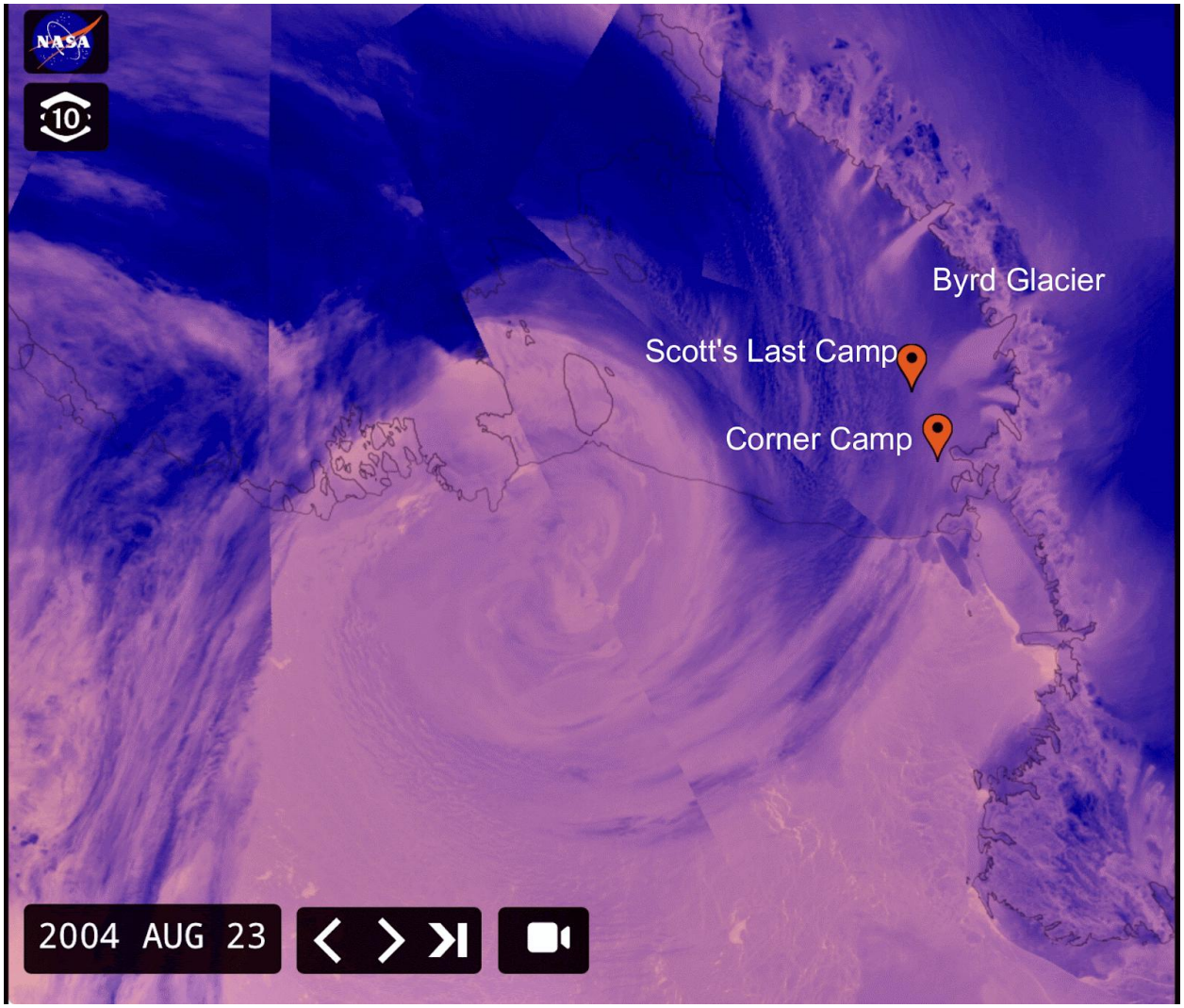

Figure 7. NASA Earthdata (n.d.) satellite infrared image shows a large cyclone swirling over the Ross Sea and the Ross Ice Shelf in Antarctica on August 23, 2004. Two locations, Scott's Last Camp and Corner Camp, are marked. The image also reveals warm signatures of katabatic winds. These appear as lighter (warmer), linear features flowing off the Transantarctic Mountains. A katabatic blizzard is occurring in the vicinity of Scott's Last

Camp, driven by a surge descending from Byrd Glacier. There is a barrier blizzard at Corner Camp.

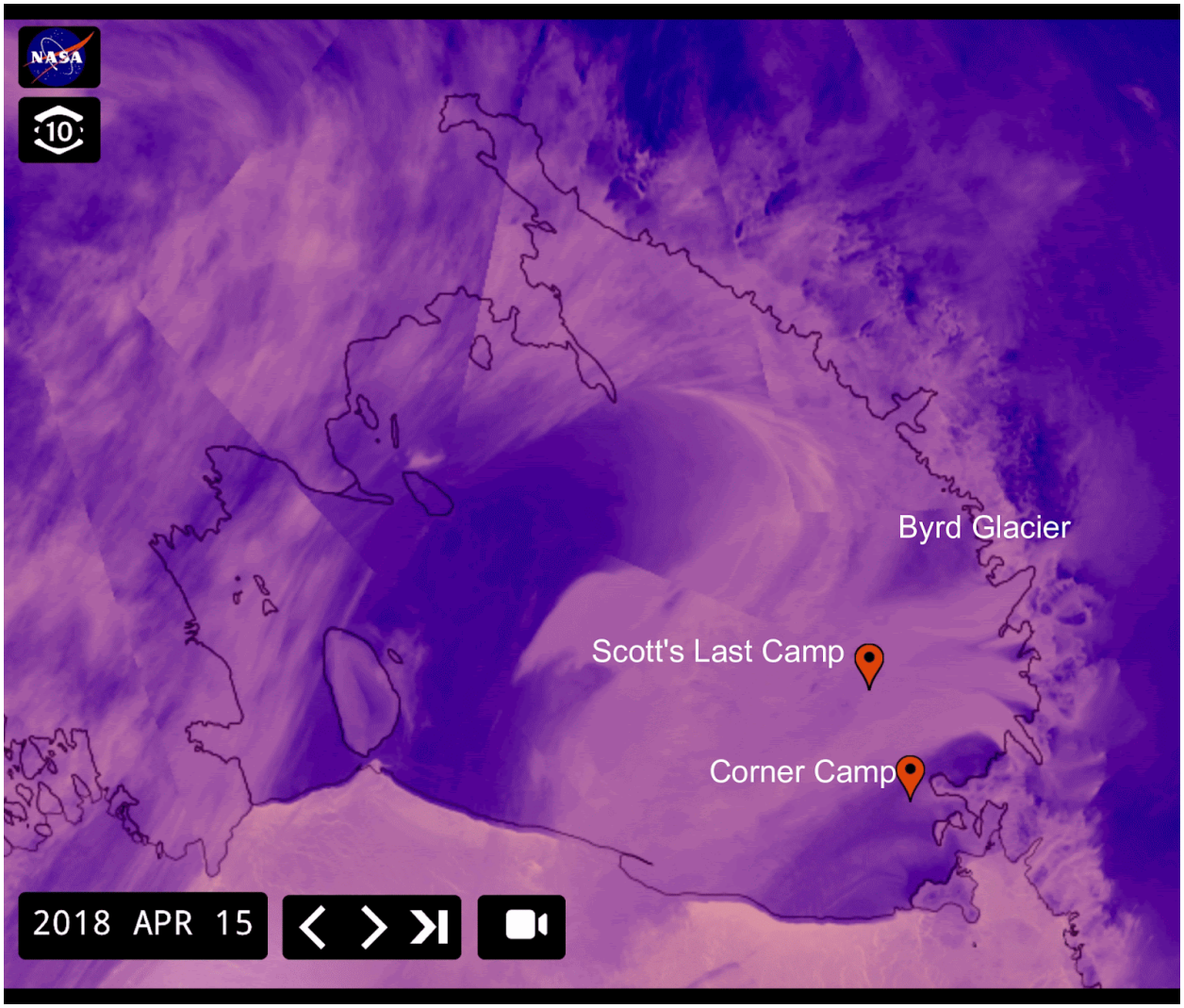

Figure 8. NASA Earthdata (n.d.) satellite infrared image shows a large cyclone swirling over the Ross Ice Shelf in Antarctica on April 15, 2018. Two locations, Scott's Last Camp and Corner Camp, are marked. The image also reveals warm signatures of katabatic winds. These appear as lighter (warmer), linear features flowing off the Transantarctic Mountains. A katabatic blizzard is occurring in the vicinity of Scott's Last Camp, driven by

a surge descending from Byrd Glacier. In contrast, conditions at Corner Camp remain calm.

Neglected Data

Northerly winds

Solomon (2002, p. 171) describes an instrument at Corner Camp that recorded the direction of prevailing winds and writes:

> *It strikingly confirmed the strong southwesterly winds of the Barrier, the flow from behind that should help speed the return journey.*

Then Solomon (2002, p. 317) described after a blizzard wind pattern:

> *… after a blizzard, winds generally continue to blow, albeit much more lightly. The flood subsides, but a stream continues. The prevailing direction of those breezes is southerly, like the blizzards.*

This leads Solomon (2002, p. 322) to speculate why no explorer attempted to reach the depot 18 km north and return to Scott's Last Camp with a fresh supply of food and oil.

> *A round trip from the last camp to the depot therefore would have required not just an easy outbound journey with the sail but also an excruciating trek back with the wind in the sledger's face.*

While the southern direction is indeed a prevailing feature of the Ross Ice Shelf Airstream, it is not a constant. Once again, *The Coldest March* overlooks Simpson's (1919, p.250) observations:

> *As a matter of fact northerly winds most often occur immediately on the termination of a blizzard…*

The year 1912 was far from typical. Studies have documented the historically significant December 1911 blizzard—a four-day event that was wet, warm, and affected both the Ross Ice Shelf and the Polar Plateau (Solomon, 2002; Fogt et al., 2017). This blizzard was likely driven by an atmospheric river (Zinkova, 2024). Additionally, the summer months saw extraordinarily high air pressure and temperatures on the Polar Plateau (Fogt et al., 2017), followed by freezing conditions in late February and early March 1912 on the Ross Ice Shelf (Scott, 1913; Solomon, 2002, 2012). These anomalies have no modern analogs (Solomon and Stearns, 1999; Solomon, 2002, p. 317). It is clear that the air temperature and pressure exhibited anomalous behavior, and the winds correspondingly deviated from expected atmospheric conditions. Let us turn to Captain Scott's own journals, where he frequently laments the presence of northerly headwinds. A few examples include:

> *March 12, 1912. Not a breath of favourable wind for more than a week, and apparently liable to head winds at any moment* (Scott, 1913, p. 407).

March 14. 1912. Yesterday we woke to a strong northerly wind with temp. -37°. Couldn't face it, so remained in camp …(Scott, 1913, p. 407).

March 18. ,,,had to stop marching; wind N.W., force 4, temp. -35°. No human being could face it, and we are worn out nearly. Scott, 1913, p. 409).

Figure 9 provides a satellite depiction of a pronounced northerly wind event occurring near the Last Camp.

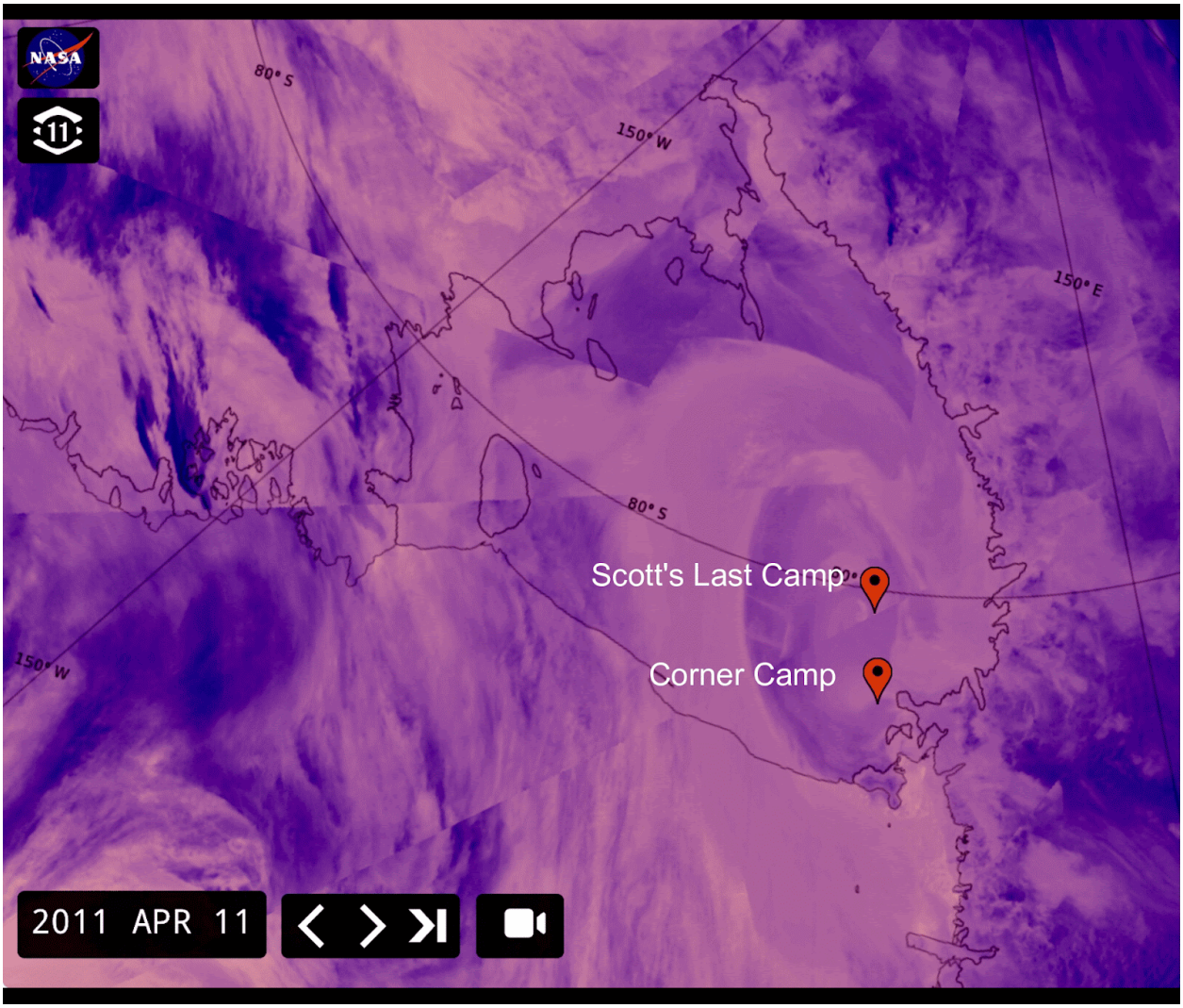

Figure 9. NASA Earthdata (n.d.) satellite infrared image shows a large cyclonic storm swirling over Ross Sea and the Ross Ice Shelf in Antarctica on April 11, 2011. Two locations, Scott's Last Camp and Corner Camp, are marked. This cyclone resulted in the strong northerly wind in the area of Scott's Last Camp.

"A textbook example of a katabatic blizzard"

In the book, Solomon (2002, p. 311) cites a story from Cherry-Garrard's *The Worst Journey in the World*:

> *The ferocious wind that spirited away the tent of the Cape Crozier party and threatened the survival of Wilson, Bowers, and Cherry-Garrard in July 1911 was a textbook example of a katabatic blizzard. It blew with hurricane force at more than seventy miles per hour, but the trio survived the storm in large part because it subsided in less than forty-eight hours, when the reservoir of cold air was emptied.*

However, at the same page and just a few sentences below Cherry-Garrard (1922, p. 282) writes:

> *I knew that parties which had come to Cape Crozier in the spring had experienced blizzards which lasted eight or ten days.*

The omission of the "eight or ten days" blizzards in Solomon (2002) is puzzling. Moreover, the July 1911 event that Solomon (2002, p. 311) described as a "textbook example of a katabatic blizzard"—appears more consistent with the characteristics of a barrier wind regime.

Conclusion

Dr. Susan Solomon's *The Coldest March* advances the claim of Captain Scott's dishonesty and worse in his description of the Final Blizzard, a conclusion founded on her fundamental misinterpretation of the Ross Ice Shelf airstream. The suggestion that the region is "shielded" from cyclonic activity is false. Documented synoptic incursions and the complex interactions between large-scale atmospheric systems and local topography make such a claim untenable.

Likewise, the description of conditions at the Ross Ice Shelf as "strongly katabatic" exaggerates the role of katabatic flow in a region shaped by multiple wind regimes. Barrier winds and cyclonic winds—both frequently observed—are governed by distinct dynamics and must be considered alongside katabatic processes when assessing local climatology.

Equally flawed is the inference that katabatic winds must follow a singular directional flow, and that the absence of a blizzard at Corner Camp implies its absence elsewhere. Such reasoning ignores the spatial variability that defines Ross Ice Shelf meteorology, where localized weather phenomena can differ markedly even across short distances.

Taken together, these interpretations impose artificial constraints that are not grounded in the full spectrum of meteorological principles. Clarifying these points is essential not only for scientific accuracy but also for preserving the integrity of historical accounts associated with the region.

Acknowledgments

The author gratefully acknowledges Dr. Mark W. Seefeldt for his generous guidance and thoughtful support.

Disclosure statement

The author reports no conflict of interest.

Author contributions

Mila Zinkova -100%.

Funding

Unfounded.

Data Availability Statement

Infrared satellite imagery used in this analysis is publicly accessible via NASA's Worldview platform at https://worldview.earthdata.nasa.gov. Historical expedition accounts by George Simpson (1919) and Apsley Cherry-Garrard (1922) are available through public archives and published sources. *The Coldest March* (2002) is available from Yale University Press, and the 2012 public presentation hosted by the Royal Society of Chemistry is available on YouTube at https://youtu.be/5LoWsLqcizA.

References

Bromwich, D. H., Carrasco, J. F., & Stearns, C. R. (1992). Satellite observations of katabatic- wind propagation for great distances across the Ross Ice Shelf. *Monthly Weather Review*, *120*, 1940–1949.

Cherry-Garrard, A. (1922). *The Worst Journey in the World: Antarctic, 1910–1913* (Vol. 1). Constable and Company Limited.

Chang K. 2001. How Bad Luck Tipped the Scales to Disaster. *New York Times.* https://www.nytimes.com/2001/08/28/science/how-bad-luck-tipped-the-scales-to-disaster.html. (accessed on 20 August 2020).

Fogt, R. L., Jones, M. E., Solomon, S., Jones, J. M., & Goergens, C. A. (2017). An exceptional summer during the South Pole race of 1911/12. *Bulletin of the American Meteorological Society*, *98*, 2189–2200. https://doi.org/10.1175/BAMS-D-17-0013.1

Glancey, J. (2001). We could be heroes. *The Guardian*. https://www.theguardian.com/books/2001/nov/10/historybooks.highereducation1 (accessed 20 August 2020).

Hotz, R. L. (2001). Did Robert Falcon Scott tell the truth? *Los Angeles Times*. https://www.latimes.com/archives/la-xpm-2001-dec-23-bk-hotz23-story.html (accessed 20 August 2020).

King, J. C., and J. Turner, 1997: *Antarctic Meteorology and Climatology*. Cambridge University Press, 409 pp.

NASA Earthdata. (n.d.). Worldview. NASA. Retrieved August 16, 2025, from https://worldview.earthdata.nasa.gov

O'Connor, W. P., Bromwich, D. H., & Carrasco, J. F. (1994). Cyclonically forced barrier winds along the Transantarctic Mountains near Ross Island. *Monthly Weather Review*, *122*, 137–150.

Parish T. R., Cassano J. J (2003). The Role of Katabatic Winds on the Antarctic Surface Wind Regime. *Monthly Weather Review*, 131, 317–333, https://doi.org/10.1175/1520-0493(2003)131%3C0317:TROKWO%3E2.0.CO;2

Scott, R. F. (1913). *Scott's Last Expedition* (Vol. 1). Being the journals of Captain R.F. Scott, R.N. Dodd, Mead and Company.

Seefeldt, M. W., Cassano, J. J., & Parish, T. R. (2007). Dominant regimes of the Ross Ice Shelf surface wind field during austral autumn 2005. *Journal of Applied Meteorology and Climatology*, *46*, 1933–1955. https://doi.org/10.1175/2007JAMC1442.1

Seefeldt, M. W., & Cassano, J. J. (2012). A description of the Ross Ice Shelf airstream (RAS) through the use of self- organizing maps (SOM). *Journal of Geophysical Research*, *117*, D09112. https://doi.org/10.1029/2011JD016857

Schwerdtfeger, W., 1984: *Weather and Climate of the Antarctic*. Elsevier, 261 pp.

Simpson, G. C. (1919). *Discussion* (Vol. I). *British Antarctic Expedition 1910–1913, Meteorology*. Harrison and Sons.

Solomon, S. (2002). *The Coldest March: Scott's Fatal Antarctic Expedition*. Yale University Press.

Solomon, S. (2012). *The Coldest March: Scott's Fatal Antarctic Expedition*. https://youtu.be/5LoWsLqcizA (accessed 10 January 2022).

Solomon, S., & Stearns, C. R. (1999). On the role of weather in the deaths of R.F. Scott and his companions. *Proceedings of the National Academy of*

Sciences USA, *96*, 13012–13016.
https://doi.org/10.1073/pnas.96.23.13012
Turner, J., Bromwich, D., Colwell, S. Dixon, S.,Gibson, T., Hart, T.,Heinemann, G., Hutchinson, H.; Jacka, K.,Leonard, S., et al. (1996).The Antarctic First Regional Observing Study of the Troposphere (FROST) Project. *Bull. Am. Meteorol. Soc*. 77, 2007–2032.
Weber, N. J., Lazzara, M. A., Keller, L. M., & Cassano, J. J. (2016). The extreme wind events in the Ross Island Region of Antarctica. *Weather and Forecasting*, *31*, 985–1000. https://doi.org/10.1175/WAF-D-15-0125.1
Zinkova, M. (2024). Extreme precipitation event at the Ross Ice Shelf during the 1911–1912 South Pole run. *Antarctic Science*, *36*, 101–109. https://doi.org/10.1017/S095410202300041X
Zinkova, M. (2025). An exceptional March 1912 blizzard (the Final Blizzard) that sealed the fate of Captain Scott and his party. *Arctic, Antarctic, and Alpine Research*, *57*(1), 2522490. https://doi.org/10.1080/15230430.2025.2522490