

## **8. Sverre Petterssen, the Bergen School, and the Forecasts for D-Day**

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### **Introduction**

The beginning of the end of World War Two in Europe depended on what were arguably the three most critical forecasts in history -- two successful ones by the Allies and one failure by the Germans. On the Allied side, six meteorologists working in three different teams were responsible for the D-Day forecasts. The American team used an analogue method that compared the current weather with past conditions. Their forecast was overly optimistic and would have resulted in disaster on June 5, 1944. The British Admiralty and the British Meteorological Office urged delay. They were aided by the brilliant Norwegian theoretician Sverre Petterssen (1898-1974), a giant in the field of weather analysis and forecasting and an international leader in meteorology during the mid-twentieth century.

In the wee hours of June 5, beneath the storm-drenched skies of England, the Allied forecasters advised General Eisenhower that a very short break in the weather would allow the invasion to proceed. On Tuesday, June 6, 1944, under barely tolerable conditions, the largest amphibious landing force ever assembled landed on the beaches of Normandy.

Ironically the German meteorologists, aware of new storms moving in from the North Atlantic, had decided that the weather would be much too bad to permit an invasion attempt. The Germans were caught completely off guard. Their high command had relaxed and many officers were on leave; their airplanes were grounded; their naval vessels absent.

This paper focuses on Petterssen's early career and contributions to the war effort, highlighting his role as the only Norwegian-trained meteorologist involved in the contentious forecasts for D-Day.

## The Forecasts for D-Day

Three things are certain concerning the Forecasts for D-Day: 1) the invasion was postponed on June 5, 1944; 2) the invasion occurred under marginal weather conditions on June 6; and 3) the German meteorologists decided that the weather conditions were too poor to permit an invasion attempt. That is about all that is certain.

Two accounts of D-Day have dominated the literature: 1) the heroic story, oft-repeated, in which the American team of Irving Krick and Ben Holzman found the “possible” weather that allowed the great invasion of Europe to proceed; and 2) a standard bureaucratic account by James Stagg published in 1971 that so infuriated Sverre Petterssen that he composed his own historical memoir with five chapters on Overlord. The Petterssen manuscript, written in English and published in Norwegian translation in 1974, has now been published (2001) in an English-language edition that is becoming the third standard account.<sup>1</sup>

## Introducing Petterssen

Sverre Petterssen (1898-1974) came from the traditional fishing area of Hadsel in northern Norway and worked his way through school by working at the telegraph office and by means of a scholarship provided to military recruits. In 1923, as a student at Oslo University, he attended a seminar led by Tor Bergeron and became an apprentice of the Bergen school of meteorology founded by Vilhelm and Jacob Bjerknes.

Bergeron’s analysis of the “Ryder Storm” of 1922 convinced Petterssen to pursue a career in the new methods of weather analysis and forecasting (fig. 1).

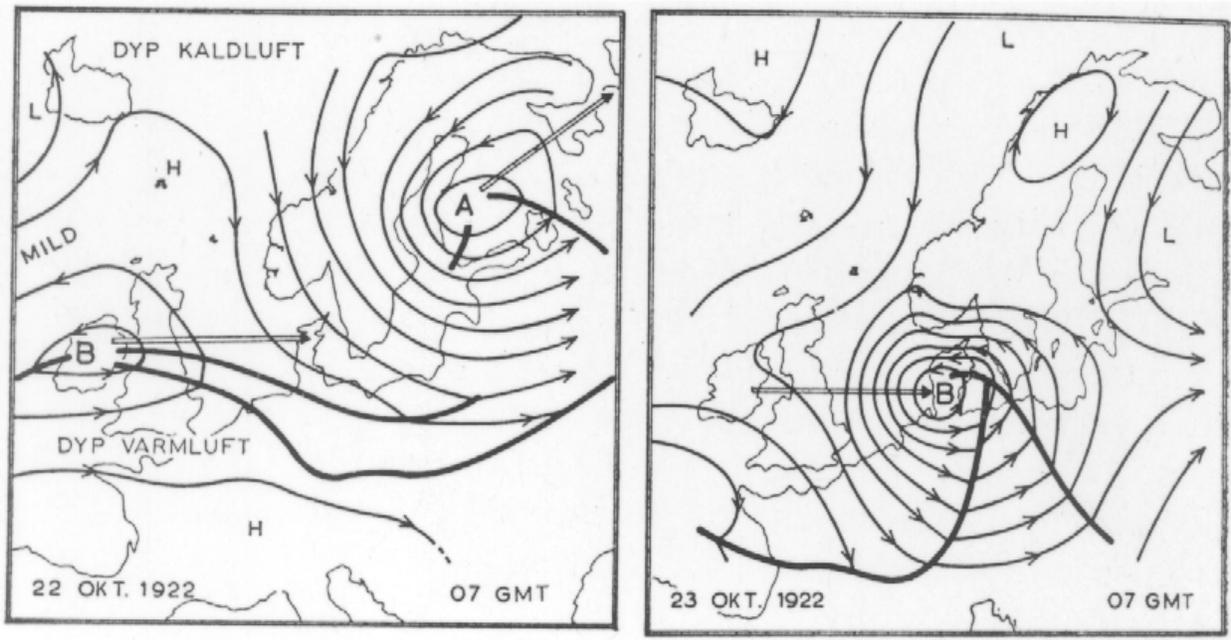


Figure 1. Ryder Storm of 1922

Petterssen may have recalled the surprise development of this storm (B) when he was working on the forecast for D-Day.

In the next fifteen years Petterssen served tours of duty as a forecaster in Oslo, at the Geophysical Institute in Tromsø, and as head of the Bergen regional forecasting center from 1931 to 1939. During his first trip to the United States in 1935 he lectured on Norwegian methods for the Navy and at Caltech.<sup>2</sup> In 1939 he was appointed head of the meteorology department at Massachusetts Institute of Technology where he wrote two well-received text books, *Weather analysis and forecasting* (1940) and *Introduction to meteorology* (1941).<sup>3</sup>

With war in Europe and the Nazis occupying Norway, Petterssen decided to leave MIT to serve in Meteorological Office of the British Air Ministry as an advisor on loan from the Norwegian Air Forces. Sir Nelson Johnson, head of the British Met Office, appointed Petterssen head of the Upper Air Branch at Dunstable with primary responsibility for preparing forecasts for bombing raids over Germany.



Figure 2. Sverre Petterssen in Norwegian uniform.

During this period Petterssen identified strong upper level winds later known as the jet stream and investigated linkages between upper level and surface conditions. In addition to many other duties, he prepared the long-range forecasts for the Anzio landings in Italy and was the only Norwegian-trained meteorologist involved in the contentious forecasts for D-Day.

### Meteorological Background to D-Day

Although Petterssen argued for a team of meteorologists working in the same place and cultivating personal contacts, the Chain of Command centered on Stagg and Yates at headquarters with three forecast centers communicating by scrambled telephone lines: Widewing with the Americans Krick and Holzman, Admiralty with Wolfe and Hogben, and Dunstable with Douglas and Petterssen.

The weather for early June was exceptionally stormy, with conditions more like April as storm after storm crossed the Atlantic. On June 4 storm F led to the postponement of D-Day. On June 5 storm E stalled, leading to the invasion the following day. On June 6 by mid-day the weather conditions were more moderate (figure 3).

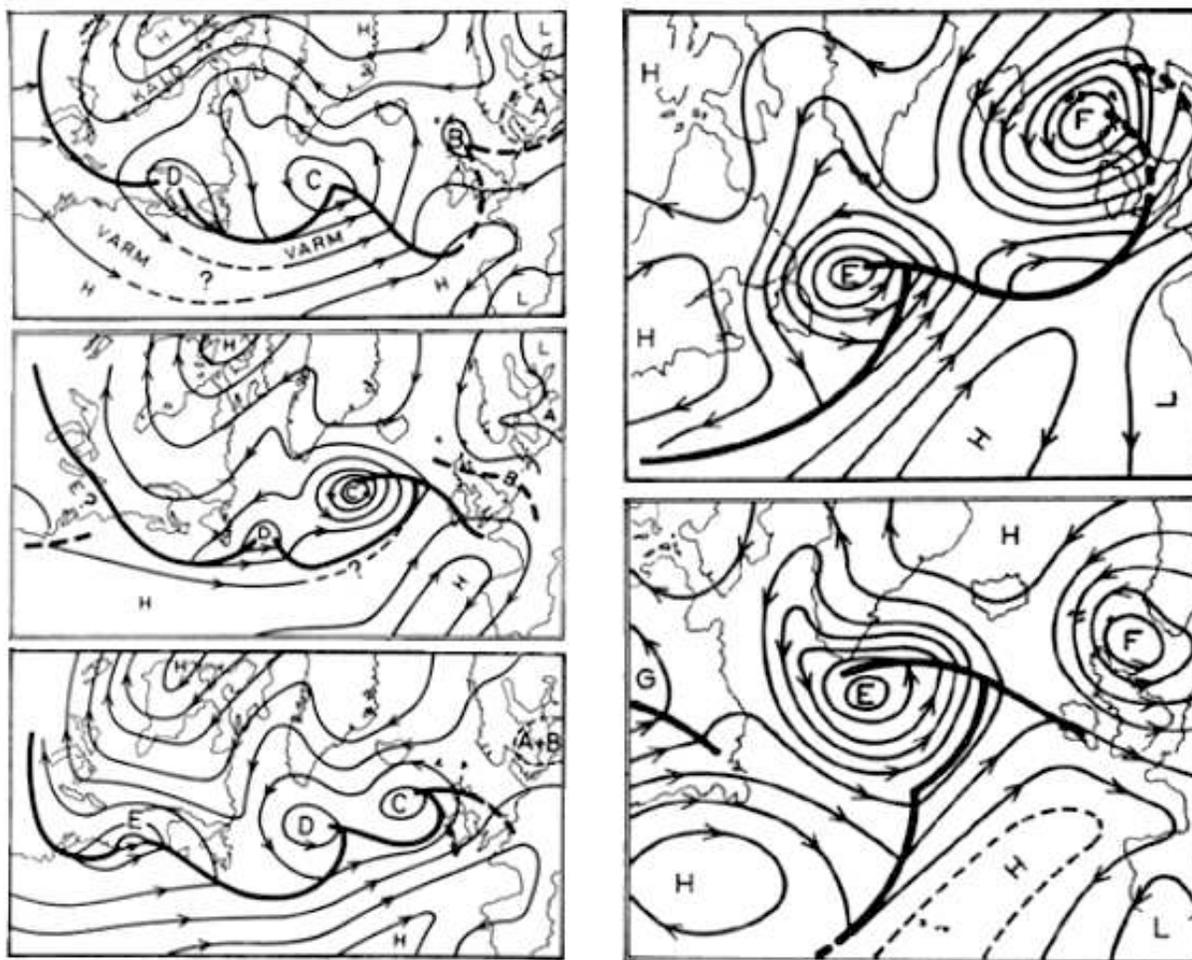


Figure 3. Left: Weather maps for 1, 2, 3 June 1944 at 1300 GMT. Right: Weather maps for 4 June 1300 GMT and 6 June 0600 GMT.

## D-Day, the American Story

According to Petterssen, “almost immediately after D-Day, extravagant rumors reached Washington and soon spread from coast to coast, mainly through newspapers and magazines”:

Though the frills varied within generous limits, the hard core of the rumors was unique: the British teams had failed in their predictions for D-Day, and Overlord had been saved by the U.S. Army Air Corps team, using Krick’s “analog” techniques. Unlike old soldiers, these rumors never faded away. They are still active, and it stands to reason that, in the aggregate, their advertising value must have been considerable, especially for Dr. Krick, who soon became heavily engaged in a variety of commercial consultant services, including forecasting for different time spans.<sup>4</sup>

Eleven years after Overlord, Krick wrote a popular account that emphasized the reticence of the British and the bravado of the Americans: “The British, using short-range methods, could see no weather coming up in the unstable atmospheric conditions of those touch-and-go days of the first week in June 1944, that would justify the risk of committing the great expedition to the stormy Channel crossing”.<sup>5</sup> As Krick reminds us, “Had not the skilled meteorologists using modern methods [i.e. the Americans using analog techniques] correctly foreseen tiny chinks opening in the . . . weather of 1944 in western Europe, almost as fleeting as glimpses of blue sky between storm clouds (and had not the military commanders taken their word), all the mighty preparations for D-Day might have gone for naught, and the war in Europe might have gone on for years”.<sup>6</sup>

Krick uses the term “possible” several times in his account to emphasize the can-do American spirit, of course in the aftermath of a successful invasion. “The Americans, using analog forecast methods, saw “possible” weather. They also foresaw worsening weather for some weeks, if this present opportunity were passed up. General Eisenhower probably has never known how bitter was the division and argument within the forecast team around June 1 to 4, as to whether the next few days would provide any weather opportunity at all for the invasion. But at last the decisive word was taken to him that the weather should be “possible”, and he ordered the great movement to start. . . A forecast ruling the weather “impossible” might have delayed for a year the ending of the war”.<sup>7</sup> Petterssen comments that Krick made no reference to the British forecast that led to the postponement of D-Day since the American forecast was overly optimistic and would have resulted in disaster on June 5, 1944.<sup>8</sup>

Some twenty-five years after the fact the American account was codified and given quasi-official status by Patrick Hughes in *A Century of Weather Service* in 1970, a celebratory volume produced by the U.S. Department of Commerce.

By June 3 it was obvious the weather would not be good enough [to go on June 5], so Eisenhower postponed the invasion until the 6<sup>th</sup>. On the evening of the 4<sup>th</sup>, the weathermen predicted relatively good weather for the 6<sup>th</sup>, and the signal was given to go. The next day, the last chance for cancellation, the American team still said go, one British team said no. The other British group was undecided; when it joined the Americans, Eisenhower was briefed and the invasion was on.<sup>9</sup>

By Hughes' account, the American team predicted not only the need for postponement but also the possible conditions on June 6. According to Petterssen:

In reading Hughes' story one is led to wonder whether there exists in the worthy science of topology a theorem that defines an upper limit to the amount of distortion at which identity is completely lost. The moral of Hughes' story might well be this: if you wish a rumor or a fantasy to be shrunk, don't take it anywhere near Washington, D.C.<sup>10</sup>

Victor Boesen's account, *Storm: Irving Krick vs. the U. S. Weather Bureaucracy*, published in 1978 and now available on the Web takes the distortions to a new level. Boesen paints the Brits, led by Petterssen as continually dark and pessimistic about the weather conditions for June 4-6 with Krick and Holzman continuing to offer an "optimistic picture". Nowhere does he indicate that June 5 would have been a disaster. For example, "At the war room briefing of 4:15 in the afternoon of June 3, Krick presented the forecast for the next five days. It indicated operational weather for both sea and air forces, beginning after the next day. The British saw it exactly the other way around: weather unfit for either plane or ship throughout the same five days". Boesen depicts the Americans stubbornly resisting pressures from the other forecasters to conform, "But it was no use. The conference forecast prevailed, and the invasion of Normandy was canceled for both Sunday and Monday, June 4 and June 5" (Boesen, ch. 7). In fact, the weather on June 4-5 included strong on-shore winds along the French coast that would have made landings impossible and continuous low cloud that would have hindered naval and aerial bombardment.

Boesen, however, ignores this issue and has Krick and Holzman emerge as heroes, with Petterssen wavering and retreating from his pessimism, and the British forecasters ultimately punished for their reticence.

As the attack unfolded on June 6 without interference from the weather, the generals congratulated Colonels Krick and Holzman for sticking with their forecast despite the disagreement of the others....

With a hold on Europe solidly established, General Eisenhower removed the British from all forecasting functions and assigned this responsibility exclusively to the forecasters of the United States Strategic Air Forces. He elevated Krick to chief of his weather information section....

Air Marshal Tedder of the Royal Air Force. . . grew so confident of the pair's ability that he telephoned Krick's headquarters for the weather each time he was in England, ready to fly back to France, ignoring the forecasts of his own British Air Ministry weathermen at RAF stations".<sup>11</sup>

A book published in 1986 by Bates and Fuller (Bates was an American wave forecaster) fares no better. It too ignores the American optimism for June 5<sup>th</sup> and says that Stagg himself made the critical decision to postpone the invasion. Even for June 6 the authors say "Widewing argued yes, Dunstable was again pessimistic, and the Admiralty thought it worth a chance. Stagg and Yates went with the majority vote".<sup>12</sup> According to Petterssen, both the Admiralty and Dunstable were adamantly opposed to June 5 and Widewing capitulated to the majority view.<sup>13</sup> Petterssen says that "With some justification I could have been criticized for *not* being sufficiently 'gloomy,' for the

weather and winds during the night of June 4<sup>th</sup>-5<sup>th</sup> turned out to be even more severe than Douglas and I had predicted”.<sup>14</sup> Concerning the forecast for June 6 Petterssen writes that “a sudden and major reorganization of the atmosphere over the Atlantic sector” on June 4 “threw the forecasters into confusion” but by the end of the day the three teams “reached a state of harmony that had hardly ever been attained since February when conference discussions began”. From Petterssen’s perspective the zonal flow in the upper atmosphere had changed into a wave-shaped pattern with rapidly growing amplitudes indicating that storm [L6] “cannot continue to move eastward as fast as I [had] predicted earlier”.<sup>15</sup> The result was avoidance of disaster on June 5 and marginally acceptable weather conditions for a successful invasion on June 6 (see fig. 3, right).

Amazingly, Irving Krick maintained, as recently as 1984, that a successful invasion could have been launched on June 5.<sup>16</sup> Keith Johannessen reminded Krick that winds of force six to seven were measured in the Channel that day, while landing craft would be swamped with winds of force four.<sup>17</sup> The prevailing view is that of Field Marshall Bernard Montgomery who wrote in his memoirs that the postponement had saved the Allies from a disaster.<sup>18</sup>

### **Petterssen on Stagg**

About a week after D-Day, Petterssen received a copy of a letter from Stagg to Sir Nelson Johnson praising the efforts of the Dunstable forecasters and panning the other forecast centers for either actively opposing or only half-heartedly accepting the “best advice” given by Petterssen and Douglas. Petterssen immediately wrote to Johnson suggesting that it might not be wise to mention contributions by individuals, as Stagg had done. Rather, he thought it satisfactory for all concerned just to have it said that the meteorological profession had stood up to the test and rendered a signal service in the liberation of Europe. This was Petterssen’s “no-name policy” and there the matter stood for twenty-seven years—until Stagg published his popular book.<sup>19</sup>

Although Petterssen was annoyed by the claims, distortions, and suppressions that appeared in print over the years in newspapers, magazines, and books, he felt that his no-name policy was sound as long as no one descended to the level of personal derogations and unfavorable reflections on the profession of forecasters. What caused him — 30 years after *Overlord* — to discard his policy was not the proverbial last straw: it was Dr. Stagg’s book, a book that led Petterssen to compose his own historical memoir. Referring to Stagg, Petterssen wrote:

. . .when someone, however skilled in the arts and maneuvers of management, does not know the theories to be adapted, nor has experience that could be called upon for this purpose, had he possessed knowledge of the theories that might be applied, and when he, amongst other things, uses a popular book to question the scientific competence and professional skills of his helpers, then one arrives at the conclusion that the no-name policy has outlived its usefulness.<sup>20</sup>

**Conclusion**

The Bergen School of meteorology as represented by Sverre Petterssen played a significant role in the D-Day forecasts. While we will never know all the details, we have a new major source of information available to supplement other accounts.<sup>21</sup> With increasing historical perspective, perhaps the best policy is a return to Petterssen's no-name policy, with credit distributed to all involved for a job well-done, but then -- how much fun would that be for historians?

## Endnotes

<sup>1</sup> Sverre Petterssen, *Weathering the Storm: Sverre Petterssen, the D-Day Forecast and the Rise of Modern Meteorology*, James Rodger Fleming, ed., Boston, American Meteorological Society, 2001. Petterssen's manuscript "Of Storms and Men" was written in English between 1972 and 1974. The Norwegian edition of his memoir, *Kuling fra nord: en værvarslers erindringer*, Oslo, Aschehoug, 1974, is not readily available in the United States.

<sup>2</sup> [Sverre Petterssen], *Notes on Dr. Sverre Pettersen's [!] lectures on synoptic meteorology. Delivered at the Aerological Officers School, Norfolk, Va. and San Diego, Calif., 1935*, U.S. Navy, Bureau of Aeronautics, 1936.

<sup>3</sup> Sverre Petterssen, *Weather analysis and forecasting: A textbook on synoptic meteorology*, New York, McGraw-Hill, 1940; and Sverre Petterssen, *Introduction to meteorology*, New York, McGraw-Hill, 1941.

<sup>4</sup> Petterssen, *Weathering the Storm*, op. cit., pp. 250-51.

<sup>5</sup> Irving P. Krick and Roscoe Fleming, *Sun, Sea and Sky: Weather in our world and in our lives*, Philadelphia, J.B. Lippincott, 1954, p. 181.

<sup>6</sup> *Ibid.*, p. 180.

<sup>7</sup> *Ibid.*, 181.

<sup>8</sup> Petterssen, *Weathering the Storm*, op. cit., p. 253.

<sup>9</sup> Patrick Hughes, *A Century of Weather Service: A history of the birth and growth of the National Weather Service, 1870-1970*, New York, Gordon and Breach, 1970, p. 89.

<sup>10</sup> Petterssen, *Weathering the Storm*, op. cit., pp. 253-54.

<sup>11</sup> Victor Boesen, *Storm: Irving Krick vs. the U. S. Weather Bureaucracy*, New York, Putnam, 1978. Web edition <http://www.weathersage.com/texts/boesen/> (July 7, 2001), ch. 7.

<sup>12</sup> Charles C. Bates and John F. Fuller, *America's Weather Warriors, 1814-1985*, College Station, Texas A&M University Press, 1986, p. 94.

<sup>13</sup> Petterssen, *Weathering the Storm*, op. cit., pp. 253-54 242-43.

<sup>14</sup> *Ibid.*, p. 234.

<sup>15</sup> *Ibid.*, pp. 243-44.

<sup>16</sup> Irving P. Krick, "Role of Caltech Meteorology in the D-Day Forecast". Pp. 24-26 in *Some Meteorological Aspects of the D-Day Invasion of Europe, 6 June 1944*, Roger H. Shaw and William Innes, ed., Boston, American Meteorological Society, 1984.

<sup>17</sup> "Panel Discussion" moderated by Roger Shaw. Pp. 106-10 in *Some Meteorological Aspects of the D-Day Invasion of Europe, 6 June 1944*, op. cit..

<sup>18</sup> Bernard Law Montgomery, *The Memoirs of Field-Marshal the Viscount Montgomery of Alamein*, Cleveland, OH, World, 1958.

<sup>19</sup> J.M. Stagg, *Forecast for Overlord, June 6, 1944*, London, Ian Allan, 1971.

<sup>20</sup> Petterssen, *Weathering the Storm*, op. cit., p. 255.

<sup>21</sup> Petterssen, *Weathering the Storm*, op. cit. Cf. German Weather Service Group. "Weather Maps and Weather Summaries by the German Weather Service Group, 2 June 1944 through 6 June 1944". Appendix A, pp. 111-31 in *Some Meteorological Aspects of the D-Day Invasion of Europe, 6 June 1944*, op. cit.; J.M. Stagg, "Report on the Meteorological Implications in the Selection of the Day for the Allied Invasion of France, June 1944. Supreme Headquarters Allied Expeditionary Force, 22 June 1944". Typescript reproduced as Appendix B, pp. 132 in loc. cit.