

# Hann's Thermodynamic Foehn Theory and its Presentation in Meteorological Textbooks in the Course of Time

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introduction

in the 19<sup>th</sup> century

in the 20<sup>th</sup> century

recently

Picture source: MAP data base

## Introduction

Certainly it is not to the dishonour of our time, that the historical element, too, is finding more and more attention and esteem in the disciplines of science (...)

However, also the works themselves of researchers of previous periods are read more assiduously and their results are commemorated more and more again. (Hann 1885)



**Julius (von) Hann**  
(1839 – 1921)

(Golden Hann Medal  
of the ÖGM)

## 19<sup>th</sup> century: how Hann started

METEOROLOGISCHE ZEITSCHRIFT. NOVEMBER 1885.

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### Einige Bemerkungen zur Entwicklungs-Geschichte der Ansichten über den Ursprung des Föhn.

Von Prof. Dr. J. HANN in Wien.

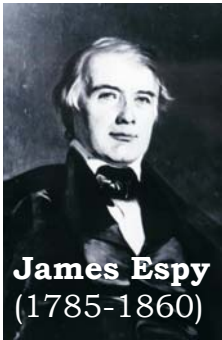


Hann, J., 1866,  
Zur Frage über den Ursprung des Föhns.  
*Z. d. österr. Ges. f. Meteorologie* **1** (1), 257-263

Hann, J., 1867,  
Der Föhn in den österreichischen Alpen.  
*Z. d. österr. Ges. f. Meteorologie* **2** (19), 433-445.

*Not so many figures at these times...*

## James Espy: acknowledged already by Hann, later often not mentioned

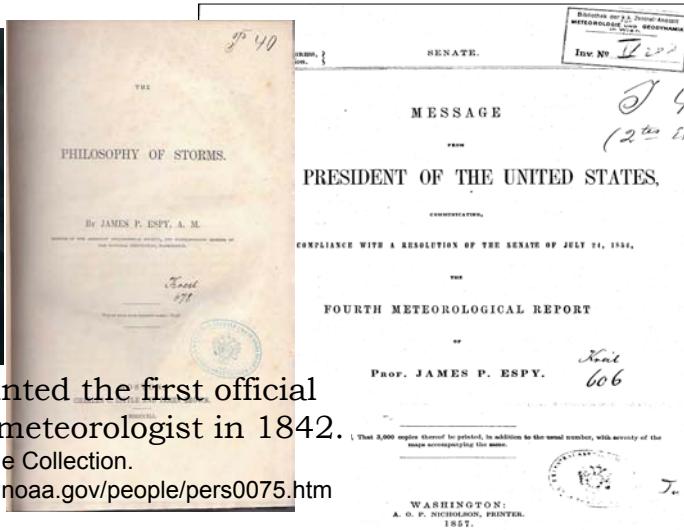


**James Espy**  
(1785-1860)

He was appointed the first official  
Government meteorologist in 1842.

Image NOAA People Collection.

<http://www.photolib.noaa.gov/people/pers0075.htm>

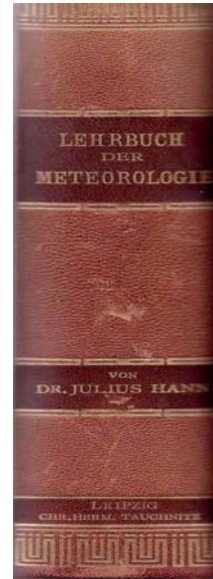


## Hann's "Lehrbuch der Meteorologie" 1901

**II. Besondere Arten der cyclonalen und anticyklonalen Winde in Gebirgsländern. (Special types of cyclonic and anticyclonic winds in mountain countries)**

**Föhn (Scirocco) und Bora. A. Föhn.**

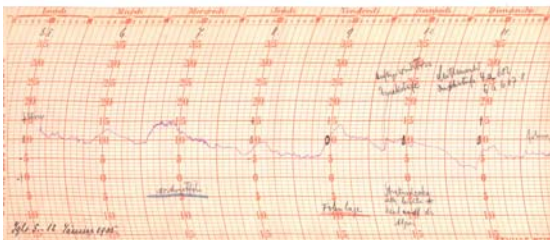
Earlier it had been assumed that (...) a strong S- or SW-wind crossing the Alps (or any mountain ridge) would be necessary, which on the southern side condenses its water vapour in heavy precipitations, and then on the northern side, experiencing 1° temperature increase for each 100 m, occurs as a very warm wind, and the high warmth there thus to be attributed to the vapour heat released on the other side. Such cases do occur indeed, and most of the long foehn periods of the autumn and winter (...) have this origin (...). However, this is not at all an absolute condition for the generation of foehn, and just the typical foehn cases come into being through the way presented previously (...). The decrease of heat with height is almost always, and especially with the calm weather preceding foehn, so little that a pure subsidence of the air from the height of the alpine crests is sufficient to impart to it the warmth and dryness of foehn.



## Hann's "Lehrbuch der Meteorologie" later...

**1915: 3<sup>rd</sup> revised edition (Hann-Süring)**

Results of Ficker's Innsbrucker Föhnstudien added,  
no change in key statements



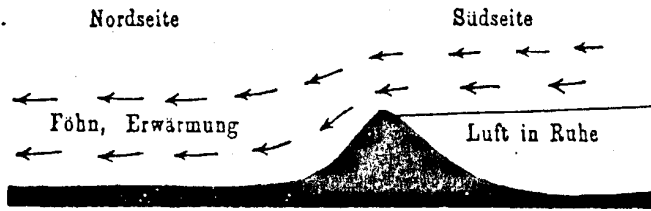
*original recording sheet from Ficker's work in Igls near Innsbruck – I have a (treasure-) chest full of them!*



Heinrich Ficker  
(1881-1957)

## Ficker 1920, still in line with Hann

The warm air on the northern side thus stems from aloft, without warm air flowing in in the lower layers of the southern side of the Alps. (...) The Alpine range (...) inhibits on the southern side of the Alps the outflow of the air towards the minimum in the northwest of the Alps (...) thus the region north of the Alps is filled with air from aloft with south wind, whose higher potential temperature delivers the foehn warming on the northern side.



## Ficker & de Rudder 1943: the paradigm shifts

If the air rises further towards the main divide, just that amount of water vapour is removed that its humidity remains always at 100%; however, now the heat released as a consequence of condensation (cloud formation and precipitation) acts against the cooling and slows it down to such a degree that the cooling per 100 m of ascent is now only about  $0.6^\circ / 100 \text{ m}$ . (...) If now the air sinks down on the other side into the foehn valley, it passes immediately into the unsaturated state because of the warming and warms up by  $1/100 \text{ m}$  (...).

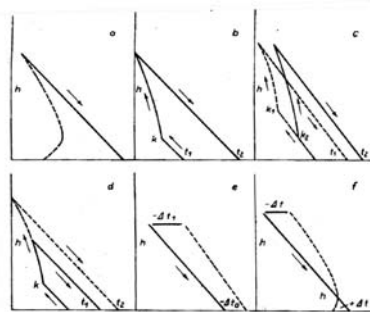
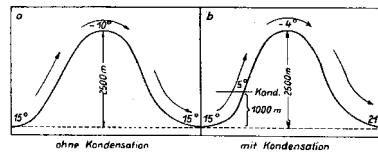


Abb. 2. Temperaturverlauf bei Föhn.  
a Einseitig entwickelter Föhn. b Föhnenschema (Südföhn). c Einfluß der Kondensationshöhe. d Einfluß der Gebirgshöhe. e Bora. f Nordföhn.  
Abszissen: Temperatur; Ordinaten: Meereshöhe.

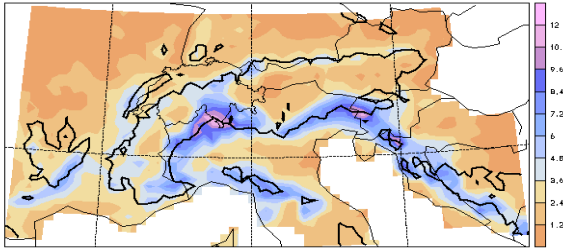


## Recent developments

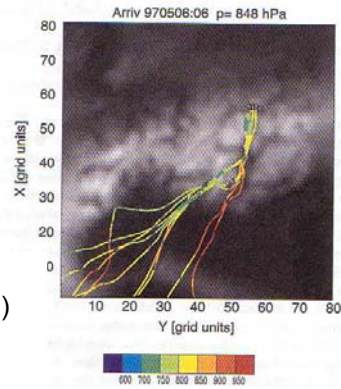


**SOP 1999**

Frequency of heavy precipitation (>20 mm/d) in the foehn-rich month of April (Frei and Schär, 1997)



*see the change of air flows from 2D to 3D in the logs!*



trajectories calculated on basis of a MM5 simulation with 6 km resolution (Seibert et al., 2000)

## Future

Ficker (1910):

"Nur mit Widerstreben konnte ich mich entschliessen, die vor fünf Jahren begonnenen Untersuchungen zur Dynamik des Föhns fortzusetzen. Denn gleich allen anderen Meteorologen bin ich der Meinung, dass die bemerkenswerten meteorologischen Eigenschaften der Fallwinde zu den besterklärten Erscheinungen der atmosphärischen Physik gehören."

"Only with reluctance I could make up my mind to continue the investigations on the dynamics of foehn (...). Like all other meteorologists, I have the opinion that the remarkable features of this fall wind are among the best-explained features of atmospheric physics."

*don't worry, foehn research history still is going on!*