

# On up-dating “*The International Antarctic Weather Forecasting Handbook*”

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## 1.0 Introduction

In an ever increasingly information-technology enhanced world one might query the need for an arguably “old fashioned” handbook of anything. In the case of weather forecasting, for example, a strategy for maximizing the effectiveness of Antarctic weather services could be to develop a “one-stop shop” for Numerical Weather Prediction (NWP) output. However, not everyone in a high-latitude context can utilize NWP output. Nor does NWP adequately provide information on all Antarctic weather forecasting parameters: nor does it provide all of the “knowledge metadata” that underpins our understanding of Antarctic weather processes or the forecast needs of those working in the Antarctic.

Another strategy is to maintain alternative forecasting mechanisms. For example, a handbook, or a similar consolidation, of information relevant to assisting operational weather forecasters produce weather forecast products and services that are more efficient and effective than if the information was not so readily available.

This leads to a specific objective of updating “*The International Antarctic Weather Forecasting Handbook*” (Turner and Pendlebury, 2004) (for convenience, hereafter termed “the Handbook”). With this in mind, the co-editors, together with a colleague (Adams), are coordinating an update of the Handbook as a contribution to the International Polar Year (IPY) 2007-08 <[www.ipy.org](http://www.ipy.org)>. The 3<sup>rd</sup> Antarctic Meteorological Observation, Modeling, and Forecasting Workshop (AMOMFW) provides a perfect opportunity to get participants’ guidance on the updating of the Handbook.

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## 2.0 “The International Antarctic Weather Forecasting Handbook”

### 2.1 Background

To aid the exchange of information on weather forecasting in an Antarctic context, the First International Symposium on Operational Weather Forecasting in the Antarctic was held in Hobart, Australia, in 1998 (Turner *et al.*, 2000). One of the major outcomes of that meeting was the decision to prepare an international Antarctic weather forecasting handbook, which was seen as a good way of providing a reference volume of material on forecasting methods used in the Antarctic.

The resulting Handbook (Turner and Pendlebury, 2004) was subsequently prepared under the auspices of a number of organisations, including the British Antarctic Survey (BAS), the Australian Bureau of Meteorology, the Scientific Committee on Antarctic Research (SCAR), the World Meteorological Organization (WMO), the International Commission on Polar Meteorology (ICPM) and the Council of Managers of National Antarctic Programs (COMNAP). The outcome was made possible by the excellent work of 59 contributors from the following 15 countries, highlighting the truly international effort involved:

- Argentina
- Australia
- Belgium
- China
- Chile
- France
- Germany
- India
- Italy
- Japan
- Russia

- South Africa
- Ukraine
- United Kingdom
- United States of America.

## 2.2 Overview of structure, content

The Handbook basically splits into two parts. The *first part* presents an overview of the meteorology and climatology of the Antarctic aimed at the forecasters who are new to working on the continent: the following topics are included.

*The physical environment of the Antarctic.* This section deals with the topographic conditions across the continent, the oceanic environment and the role of the Antarctic in the global climate system.

*The forecasting requirement.* In this section the needs of aviation and those operating ships in the Antarctic is examined, along with the requirements for field parties.

*Data availability and characteristics.* This section considers the value and error characteristics of each form of data available and provides recent maps of the locations of the staffed stations and the automatic weather stations. The value of the model analyses and forecasts are also considered.

*Analysis techniques.* In this section information is provided on the preparation of surface and upper air analyses, and on some of the non-standard charts that are prepared, such as streamline analyses.

*The Forecasting process.* Here there are details of the means used to forecast the full range of weather systems from long waves to mesoscale lows. All the important elements that have to be predicted are then considered, including surface and upper winds, cloud, visibility and fog, surface contrast, horizontal definition, precipitation, temperature, wind chill, aircraft icing, turbulence, sea ice, waves, swell and hydraulic jumps.

The *second part* of the Handbook is concerned with the forecasting techniques used for particular sectors on the continent and on the various stations. For each location information is provided on topography and the local environment, operational requirements and activities relevant to the forecasting process,

data sources and services provided and then deal with important weather phenomena and forecasting techniques used at the location. Prediction of surface wind and the pressure field, upper wind, temperature and humidity, clouds, visibility and fog, horizontal definition, precipitation, temperature and chill factor, icing, turbulence, hydraulic jumps, sea ice and wind waves and swell are all covered.

## 2.3 Availability

Initially, (2000 version) the Handbook was available by CD and download only. The June 2004 version had a limited (several hundred) hard-copy release courtesy of funds provided by WMO. This version is still available for electronic download and consists of around 685 pages of information held in a single portable document file (PDF) file of ~25 MB in size, from links shown in the appendix.

## 3.0 Current update efforts: rationale, scope, and summary of content

### 3.1 Rationale behind an update

It is about 10 years since the Handbook was conceived. Since then new Antarctic stations have come, or are coming, online, advances have occurred in technology, there is an improved understanding of climate and weather, NWP continues its rapid improvement, and of course IPY 2007-08 is underway. These developments combine to suggest that a review of the Handbook is now considered timely.

Most of the discussion which follows concerns *current update efforts* which are to be seen as a leading to an “interim installment” of the major post-IPY revision, since it will take some time for the ramifications of the IPY to be fully understood.

### 3.2 Scope

The interim update will follow the broad structure of the (original) Handbook but will try and focus mainly on information not available in earlier versions. There will, of course, be some duplication with existing Handbook material in order to maintain a context for the information provided. The main sections envisaged are as follows.

*Climate, Climate variability and climate change.* These topics are considered vital as a “well-rounded” forecaster cannot afford to ignore climate aspects, especially in a world where climate change is relatively rapid. Also as ambassadors for their “trade”, forecasters need to be across climate change and teleconnections.

*Advances in Observation Systems.* In recent years there have been advances in *in-situ* and remote sensing observation systems, (especially with satellite-borne sensors): these will be of great interests to forecasters. Topics to be covered include: overview of recent missions/sensors; new installations; national networks.

*NWP.* NWP models have improved over the last few years. Regional climate models, in particular, are increasingly getting better, and the European Center for Medium range Weather Forecasting (ECMWF) operational system now has a resolution of ~25 km, so should be able to give much better predictions in areas such as the Antarctic Peninsula. The revised handbook will include, for example, information on the Antarctic Mesoscale Prediction System (AMPS), and on ensemble forecasts for Antarctic locations. Discussion could also include promotion of a “one stop shop” concept for Antarctic NWP alluded to earlier eg: BAS, US National Center for Atmospheric Research (NCAR), Australian Bureau of Meteorology, and/or other centres (eg COMNAP), might have web pages with links to all available Antarctic-focussed NWP.

*Forecasting requirements for new stations &/or stations not covered in the original handbook, or updates to existing station information.* Examples of where updated or new information might be useful include:

- *sub-Antarctic and Antarctic stations omitted from the original Handbook:* eg: Amsterdam Island
- *interests of some countries not fully included in the original handbook:* eg: Sweden; Brazil
- *new stations opened:* eg. Princess Elisabeth (Belgium); developments at Dome A (China); India establishing a station in/near the Larsemann Hills
- *developments at other stations:* eg. The Hobart–Casey Airlink is now in operation;

Concordia (Dome C) is now well-established – are there new forecasting requirements?

- *wind power experiments:* eg.: at Mawson Station (and elsewhere?)
- *sea ice:* eg. developments in sea ice analysis/prediction
- *updated communications methods:* eg. Iridium communications
- *others:* eg. weather service needs of Antarctic Tourism, which has greatly increased since the Handbook project started.
- *Key Appendices:*
  - an updated list of stations and AWS in the sub-Antarctic and the Antarctic
  - updated climate tables for many of these stations
  - a list of web resources relevant to the weather forecasting process for the sub-Antarctic/Antarctic.

### 3.3 Contributions to update already received

There have already been some very useful contributions provided for the update. These are:

- *Teleconnections:* Andrew Carleton
- *Future climate change:* Tom Bracegirdle
- *Behaviour of Southern Ocean cyclones:* Ian Simmonds
- *READER Project:* Steve Colwell
- *US AWS network:* Shelley Knuth
- *Atmospheric chemistry:* Alexander Mangold; Ralf Brauner *et al.*
- *NWP:* Neil Adams; Jordan Powers
- *Forecasting requirements for new stations &/or stations not covered in the original handbook or updates to existing station information:*
  - *Belgium* (Alexander Mangold)
  - *Finland* (Timo Vihma)
  - *France* (Christian Lafayne)
  - *Germany* (Ralf Brauner *et al*)

- *Italy* (Roberto Bove)
- *New Zealand* (Sylvia Nichol)
- *Norway* (Eirik Førland)
- *Spain* (Antonio Labajo)
- *Sweden* (Swedish Polar Secretariat)
- *US* (Jordan Powers)
- *while for South Africa and China* Johan Stander and Bian Lingen have, respectively, advised no changes are needed (Dome A developments notwithstanding).

### 3.4 Contributions agreed to and hopefully still coming:

- the role, and expected outcomes of IPY 2007-08
- developments in sea ice observation, analysis, and prediction
- developments in the Australian AWS network
- role of the Southern Ocean in Antarctic weather and climate
- a summary on self organising maps as a new forecasting tool
- update on volcanic ash services
- update in relation to COMNAP's requirements
- advice in relation to IAATO's requirements
- update of information for stations of the following countries:
  - Australia
  - Brazil
  - Chile
  - Russian Federation
  - South Korea
  - United Kingdom.
- update in relation to weather at Patriot Hills.

### 3.5 Contributions sought but status of preparation (if any) unknown:

- update on remote sensing

- update on surface wind systems
- update on ozone/GTS/new surface observations
- update on measurement of snow accumulation
- update of information for stations of the following countries:
  - Argentina
  - India
  - Japan
  - Peru
  - Poland
  - The Netherlands
  - Ukraine
  - Uruguay.

### 4.0 Issues to be resolved with present update efforts

The scope of the update outlined in Section 3.0 above very much reflects the view of the editing team (Pendlebury, Adams and Turner). The co-editors would value guidance from AMOMFW participants. Some issues that come to mind are:

- *Scope of update:* is scope, as outlined above, suitable - any other ideas?
- *How can co-editors get other relevant contributions?* should the co-editors (represented by Turner) give a presentation on updates to the Handbook to the COMNAP meeting in St Petersburg this July?
- *Are the co-editors fully reaching the potential audience?* Eg. is the Handbook being used in South America? Should the co-editors try and get it translated into Spanish?
- *Publication media:* eg:
  - web only?
  - hard copy? CD? distribution? sources of funding?
- *Timetable for current update?*
- *Any other considerations for current update?*

## 5.0 Conclusion

Most of the above refers to work currently underway to update the “*The International Antarctic Weather Forecasting Handbook*” in a timely, but albeit, “*cut-down*” fashion as a contribution to the IPY 2007-08. But of course IPY 2007-08 itself will likely throw up a range of exciting discoveries and developments that would be of use to operational forecasters providing services for the sub-Antarctic and Antarctic. Moreover, as anticipated by the WMO Coordination meeting on Antarctic Meteorology and related IPY activities at the 2005 meeting (WMO, 2005) there will probably be a need for a *major* revision the Handbook post IPY 2007-08.

This begs the question on how a substantial review of the Handbook might be undertaken and the frequency of any subsequent amendments. With the relatively wide international participation in AMOMFW, this series of workshops could be a natural forum for input to the Handbook. Experience suggests that (a) it is quite a bit of work coordinating the various contributions; but, (b) it is worth the effort as a contribution to the community; however, (c) it is probably most efficient for one or more individuals to have responsibility for a document such as the Handbook, rather than a group. On the other hand, institutions/agencies such as Antarctic Meteorological Research Center (AMRC) (hosts for the 3<sup>rd</sup> AMOMFW), WMO, SCAR, ICPM, and COMNAP, not to mention the Australian Bureau of Meteorology and BAS, would also hopefully have a continuing interest in future updates.

So, in order to maintain the currency of an internationally collaborative effort, which has

resulted in a very useful collation of material that assists high southern-latitude weather forecasters, the best strategy going forward is, perhaps, for the Handbook co-editors to:

- continue to work with the many contributors who have provided, or undertaken to provide, material for the *current* update; and,
- liaise closely with collaborators at AMRC, WMO, etc. to effect a major revision and (subsequent updates) when the results of IPY 2007-08 are crystallized.

## 6. References

Turner, J., S. Pendlebury, L. Cowled, K. Jacka, M. Jones, and P. Targett, 2000: Report on the First International Symposium on Operational Weather Forecasting in Antarctica, *Bull. Amer. Met. Soc.* **81**, 75-94.

Turner, J. & Pendlebury, S.F., (eds), 2004: *The International Antarctic Weather Forecasting Handbook*, British Antarctic Survey, Cambridge: xviii + 663 pp.

WMO, 2005: *Coordination meeting on Antarctic Meteorology and related IPY activities: Final Report*. Retrieved on 29 May 2008 from: [www.wmo.int/pages/prog/www/OSY/Reports/Antarctic-IPY\\_StPetersburg2005.pdf](http://www.wmo.int/pages/prog/www/OSY/Reports/Antarctic-IPY_StPetersburg2005.pdf).

## 7. Acknowledgements

The authors wish to thank Ian Barnes-Keoghan and Dr. Steve Dixon for helpful suggestion in the preparation of this note.

## Appendix

The June 2004 version of the Handbook is available for electronic download from:

- the Australian Bureau of Meteorology web site  
<[www.bom.gov.au/weather/ant/handbook/handbook\\_16june04.pdf](http://www.bom.gov.au/weather/ant/handbook/handbook_16june04.pdf)>
- via anonymous FTP from the British Antarctic Survey in Cambridge, UK. Details of the procedure for transferring it are available at  
<[www.antarctica.ac.uk/met/jtu/ftpinst.html](http://www.antarctica.ac.uk/met/jtu/ftpinst.html)>
- the COMNAP web site  
<[www.comnap.aq/publications/manuals/antarctic\\_weather\\_forecast\\_handbook\\_16june2004/view](http://www.comnap.aq/publications/manuals/antarctic_weather_forecast_handbook_16june2004/view)>.

