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| **World Meteorological Organization**  **Commission for Instruments and Methods of Observation**  **CIMO Management Group**  **Fifteenth Session** Geneva, Switzerland, 26 – 29 March 2018 | **CIMO/MG-15/Doc. 2.4(4)** |
| Submitted by: S. Cohn/M. Garcia  19.03.2018 |

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# Report on progress, recommendations and future activities of TASK team ON THE INTERNATIONAL CLOUD ATLAS

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| **Summary and purpose of document**  This document provides information on progress of the revision of the International Cloud Atlas, Manual on the Observation of Clouds and Other Meteors (WMO-No. 407). |

**Action proposed**

The Meeting is invited to take note of progress and status, and provide any recommendations going forward.

The Meeting is invited to consider the enclosed Recommendations for future and ongoing enhancements to the International Cloud Atlas following its finalization.

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**Appendices:** I [Updated Workplan](#Appendix1)

II [Additional Information](#Appendix2)

III [Draft List of Cloud Types Requiring Time Laps Imagery](#Appendix3)

**EXECUTIVE SUMMARY**

Rapid progress was made during this reporting period. The TT has largely completed creating and finalizing the structure, content, and creation of the ICA website English edition. Remaining work is to create a final report and recommendations, facilitate creation of alternative formats (e-book and printed format), and support any needs during translation into all WMO official languages. A beta-version ICA website was launched on World Meteorological Day, 23 March 2017. According to the WMO Media Officer, the ICA release “was one of the most successful ever media launches.” There were more than 750 000 pageviews from many countries. Numerous press articles have been written about the ICA in at least 9 languages. The ICA was honoured with an award from the Atmospheric Scientists Librarians International (ASLI).

As the work of this Task Team nears completion, a set of recommendations is provided for additional enhancements and additions to the ICA. These are items that the current Task Team did not have time or resources to include. The strongest recommendation is for creation of educational tools and platforms to leverage the ICA content and format. There are additional recommendations in the areas of explanatory graphics, targeted expansion with a small number of images in areas that were not covered in this revision, some specific enhancements to the text, and formalization of feedback mechanisms to connect public input to WMO experts.

**REPORT ON ACHIEVEMENTS, RECOMMENDATIONS AND FUTURE ACTIVITIES OF CIMO TASK TEAM INTERNATIONAL CLOUD ATLAS**

1. **INTRODUCTION**
   1. Background: The CIMO Task Team on the International Cloud Atlas (TT-ICA) was formed in August 2014, consisting of members with diverse experience in cloud observations, and Secretariat participation and support. The committee is building on the work of the 2013 task team (largely including the same members) that evaluated the need for a revision and proposed specific steps and changes. The TT-ICA works though individual and small subgroup efforts, with frequent meetings via WebEx. The Task Team had in-person meeting in 2014, 2015, and 2016. Revision of the International Cloud Atlas received strong support at Cg-17 (2015). Congress was pleased that CIMO has taken steps in developing a new web-based edition of the International Cloud Atlas (ICA) – Manual on the Observation of Clouds and Other Meteors (WMO No. 407, Volumes I and II) as a WIGOS-related document needed for the operation of NMHSs, particularly in developing countries.
   2. This summary covers the period since the last MG meeting in April 2016. Over this period TT-ICA met approximately 60 times through WebEx for group discussions, decisions, and updates. TT-ICA also met once in person in Hong Kong (2016). The team is indebted to Mr Chi-ming SHUN, the Permanent Representative of Hong Kong, China with WMO, for hosting that meeting, and to TT-ICA member Mr Kwong Hung TAM for his excellent and thoughtful local planning. Since April 2016, the TT-ICA greatly advanced all remaining tasks, implementing the shared vision for a web-based ICA.
   3. The English edition ICA debuted in beta format (for public open testing) in March 2017 on World Meteorological Day – fitting well into that year’s theme “Understanding Clouds”. Since that date, the Task Team has been finalizing the content and function, and as of March 2018 TT-ICA has nearly completed its work. Remaining activities for this Task Team are to collaborate with WMO Secretariat for creation of an e-book and printed format of the ICA, and to provide any assistance as the ICA is translated into WMO official languages.
   4. The status of Workplan tasks is updated Section 2 and in **Appendix** I, and information on the public reception of the ICA is described Section 3. Section 4 and **Appendix II** summarize features of the new ICA and provide Task Team recommendations for future enhancements and additions, for MG consideration.
   5. TT-ICA has and continues to benefit from invaluable efforts and large time commitments from all members. The dedication shown by all Task Team members is greatly appreciated by the Chair.
2. **ACHIEVEMENTS WITH RESPECT TO WORKPLAN**
   1. Rapid progress was made during this reporting period. The TT has largely completed creating and finalizing the structure, content, and creation of the ICA website English edition. This includes its text, cloud and other meteors images, and associated descriptions and supporting images. Remaining work is to create a final report and recommendations, facilitate creation of alternative formats (e-book and printed format), and support any needs during translation into all WMO official languages.
   2. After thorough internal review and blind testing, a beta-version ICA was launched on World Meteorological Day, March 23, 2017. This allowed a broad public response to identify any errors or obstacles to its use.
   3. Following the beta-release, the Task Team has thoroughly re-checked all text and images, corrected minor errors, completed enhancements such as the addition of lists of tables, figures, and acronyms, added several more annotated images filling needed gaps in cloud or meteor illustration, verified the correct names of all photographers, and improved navigation within the website.
   4. The TT, largely led by efforts at the Hong Kong Observatory, has made progress creating web-based tools for translation to all WMO official languages.
   5. The Workplan (**Appendix I**) indicates progress for each task.
3. **RECEPTION FOLLOWING PUBLIC RELEASE**
   1. The new web-based Atlas was highlighted in March 2017 during WMO World Meteorological Day, generating much visibility, media coverage, and public interest.
   2. From March through December 2017, the International Cloud Atlas webpage had approximately 769 350 pageviews. ICA pages with most visits are the search engine, the cloud classification pages, and the cloud description pages. Top searches are generally for the new cloud classifications including asperitas, volutus, fluctus, and cavum. The most active countries are USA, Hong Kong China, Chile, United Kingdom, France, and Germany.
   3. In the months following World Meteorological Day, Task Team members and WMO staff participated in dozens of press interviews, both audio/video and print. A large number of news and blog articles appeared, especially during March and April 2017. Media interest in the ICA has been tracked by WMO Media Officer Clare Nullis, and the following points are summarized from her assessment.

* The ICA release “was one of the most successful ever media launches.”
* Ms Nullis noted in just the week following the launch:
* more than 5 000 online impacts in past week
* 1 million reached through Facebook
* #WorldMetDay hashtag used thousands of times on Twitter, with thousands of retweets about Cloud Atlas.
* Coverage and media interest has continued in the year since this release, with a steady stream of requests about a printed version.
* Lots of tweets in Spanish in particular about the cloud atlas and clouds in general.
* A steady stream of requests to WMO on whether a printed version will be published.
* Media reports and articles were published in (at least) English, Spanish, French, German, Russian, Chinese, Portuguese, Vietnamese, and Turkish.
  1. In January 2018 the International Cloud Atlas was honoured with the 2017 ASLI Choice Science Award from the Atmospheric Science Librarians International, Honourable Mention. The citation reads, “For the visionary initiative to create an online, updated version of this renowned work”. This is the first award ASLI has presented to a website.

1. **CONTINUING WORK, FUTURE IMPROVEMENTS, and RECOMMENDATIONS**
   1. Although the English edition of the web-based ICA is nearly complete, work continues on two activities. These are led by the WMO Secretariat, with support from the Task Team.
      * ICA design characteristic determined by TT\_ICA-1 (2013) include that the *ICA should be also accessible as a .pdf file for attractive hardcopy or reading on portable devices.* This requirement is incorporated into the concept of an e-book version with a print/hardcopy feature. This task is being investigated, and the TT emphasizes its importance.
      * ICA design characteristics determined by TT\_ICA-1 (2013) include that *User friendly switching between different languages should be provided for.* This translation task is underway, and TT emphasizes its importance.
      * ICA design characteristics (TT\_ICA-1, 2013) include that *The website should enable the public to easily find this website e.g. via links from WMO and by Google search.* The TT strongly supports this. We further recommend that this topic, and topics such as website monitoring, security, and technology updates, remain priorities for WMO and for the ICA’s HKO website hosts.
      * The TT notes that the Introductory Video (Welcome to the new International Cloud Atlas), is engaging and interesting. However, we recognize that it should not remain a permanent feature of the home page and recommend it be moved (perhaps within the Other Information tab) after a period of time.
      * A more detailed description of changes to the ICA appears in **Appendix II**.
   2. TT\_ICA-1 (2013) and subsequent meetings identified a great many essential or desired characteristics of a web-based WMO International Cloud Atlas. The 2017 Edition addresses most of these. However, the TT recognizes some gaps remain and that there is an imperative for continued future improvement. **Appendix II** provides the TT recommendations for Future Work and Improvements.

1. **RECOMMENDATION**
   1. That CIMO MG considers the Future Work and Improvements proposed by the Task Team and plan for their realization.

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**APPENDIX I**

**Updated Workplan 2014-2018. Version of March 2018.**

| **No.** | **Task description** | **Person responsible** | **Action** | **Deliverable** | **Deadline for deliv.** | **Status**  **[%]** | **Comments** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1. | Establish sub-groups as required (text experts, image experts, decision aid) and prepare detailed plan of action | All, **Cohn, Bruhn** | 1. Develop project plan  2. Continuous review. | 1. Detailed Project Plan  2. Refinement of plan. | 1. complete  2. ongoing until project end | 100  95 | CIMO-16 4.35-36 |
| 2. | Identify needs for new/ replacement imagery and metadata. Generate a list of images and metadata required | Image Expert Sub-Group: **Bruhn (lead),** Anderson, Trice (others) | 1. Review imagery  2. Prepare list of required images and metadata | 2. List of the needs for new/ replacements imagery and metadata | 1. complete  2. complete | 100  100 | Complete |
| 3. | Draft the new Glossary | Glossary Sub-Group : **Lovell (lead),** Rae, Cohn, others | 1. Prepare List  2. Add definitions  3. Finalise glossary | 1. List  2. Glossary of terms  3. Final version | 1. complete  2. complete  3. complete | 100  100  100 | Complete |
| 4. | Review, revise and update text | Text Expert Sub-Group: **Rae,** Anderson, Lovell, Cohn | 1. Review  2. Revise/update  3. Finalise text | 3. Completed text | 1. complete  2. complete  3. complete | 100  100  100 | Complete |
| 5. | Acquire and sort candidate imagery | Secretariat, **Tam,** Trice | 1. Build and test web portal  2. Request submissions  3. Sort/Assess Images/Metadata | 1. Portal debugged and live.  2. Letter to PRs  3. Candidate images online | 1. complete  2. complete  3. complete | 100  100  100 | Complete |
| 6. | Select Imagery | Image Expert Sub-Group (Bruhn, Anderson, Lovell, others | 1. Select prov image set  2. Assemble metadata, Compose descriptions. Check permissions.  3. Second opinion on final image and metadata. | 1. Prov Imagery Set  2. Associated metadata completed  3. Completed and posted imagery set | 1. complete  2. complete  3. complete | 100  100  100 | Complete |
| 7. | Create an updated Cloud Coding Decision Aid and develop a simplified Cloud Classification Decision Aid (limited to identifying genera) | Decision Aid Sub-Group: **Thurig-Jenzer (lead),** Rae, Campos, Lovell | 1. Develop Decision/Coding Aid  2. Develop simplified Identification Aid | 1. Updated Cloud Coding Decision Aid  2. Classification Idenfitication Aid | 1. complete  2. complete | 100  100 | Complete |
| 8. | Determine functional requirements for website and the web-based ICA, including the Image Template, functionality, final formats needed (e.g. printable subsets), and search requirements | **Trice (lead),** Tam, others | 1. Document functional requirements  2. Document text flow structure  3. Seek CIMO MG approval  4. Build testsite. | 1. Specification of functional requirement  2. Text flow diagram  4. Test Website | 1. complete  2. complete  3. complete  4. complete | 100 | Complete |
| **EXTERNAL REVIEW POINT** | | | | | | | |
| 9. | Build the website | **Tam (lead)**, Trice, others | 1. Do it  2. Quantify O&M cost | 1. Functional offline website | 1. complete | 100 | Complete |
| 11. | Complete web site functionality | Tam, Stephen Lau |  | 1. Fully functional website | 1. complete | 100 | Complete |
| 11a | ´´Blind user´´ Test | Cohn (lead), others, Thurig-Jenzer | 1. Test every page, link and navigation | 1. List of bugs | 1. complete | 100 | Complete |
| 12. | Final proof-read, error correction, and approval | **Thurig-Jenzer (lead)** |  | 1. Errors/bugs removed | 1. complete | 100 | Complete |
| 13. | Publication | Stephen Lau and Secretariat (lead) |  | 1. ICA (English) web-published  2. ICA hard copy and e-book available  3. Translation to WMO official languages | 1. complete  2. pending  3. pending | 100  15  15 | Hardcopy through e-book (WMO leads)  Translation: WMO leads, HKO partner.  TT prepares advice for future |

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**APPENDIX II**

**ADDITIONAL INFORMATION**

**SUMMARY OF INTERNATIONAL CLOUD ATLAS ENHANCEMENTS**

**and**

**FUTURE WORK AND IMPROVEMENTS**

NOTABLE CHANGES ENACTED IN THE INTERNATIONAL CLOUD ATLAS, 2017 EDITION

The new edition of the ICA is for the first time configured as a website for electronic access. This format facilitates its use by cloud experts and students everywhere, in both training and teaching. The transition to a web-based document required many changes to the presentation of ICA content and to navigation within the document.

Atlas Structure

The most frequently used features of the website can be accessed from an illustrated carousel on the home page. In addition, by using the tab bar at the top, information can be accessed with a similar structure to the 1975 Volume I (text).

The first tab leads to the Definition of a Meteor and the General Classification of Meteors. The second tab leads to information about the cloud classification system, and all specific definitions and technical descriptions. The third tab leads to information about meteors other than clouds – namely other hydrometeors, lithometeors, photometeors, and electrometeors. The fourth tab is for the section dealing with how to accurately observe clouds and properly code them for meteorological reports. The 1986 Volume II (images) is entirely replaced with the fifth tab, which leads to an Image Viewer that accesses more than 600 new images, and descriptions, as well as contextual charts and plots. This is a very significant enhancement. Another entirely new addition to the Atlas is the Glossary (sixth tab). This provides definitions to many terms, and is consistent with definitions in WMO documents and other primary sources. A final tab leads to Appendices, the Prefaces of the previous editions, and to downloadable portable document format (pdf) versions of the previous editions.

Cloud Classification

The existing 1975 classifications have been reviewed and all have been retained. Several new, formal cloud classifications are introduced. These include one new species (volutus), five new supplementary features (asperitas, cauda, cavum, fluctus and murus), and one new accessory cloud (flumen). The species floccus has been formally recognized as being able to occur in association with stratocumulus. The separate section on Special Clouds (1975) has been removed, and the cloud and meteor types previously discussed within this section have been integrated into the cloud classification scheme as cataractagenitus, flammagenitus, homogenitus, silvagenitus, and homomutatus.

Text Style and Cloud Classification Aids

The text itself has been thoroughly reviewed and revised to modernize the style of language. It is more readable, and is expanded in areas where scientific understanding has increased since the previous edition. This is most apparent for Meteors Other Than Clouds where several more phenomena have been included. For example, snow devil and steam devil have been added as hydrometeors, together with details regarding types of tornadoes. The optical phenomena (photometeors) have been thoroughly expanded with illustrations of various types of halo phenomena, rainbows and mirages. Upper atmospheric electrometeors known as “sprites” and “jets”, not yet commonly known when the previous edition was published, have also now been added. Other changes include replacement of the terms “bad weather” and “other than of bad weather” with “wet weather” and “dry weather”, and of “étage” with “level”.

The pictorial aids for cloud classification have been modernised, with a flow chart containing new colour illustrations provided courtesy of MeteoSwiss. These give a pictorial path to determine the correct coding for a cloud observation. A Cloud Identification Guide of basic genera is included for the benefit of amateur weather enthusiasts.

Regulatory material

Only minor changes have been made to those parts of the text that constitute regulatory material. While the Task Team considered many changes, the desire for modernity gave way to the stronger need to preserve traceability of observations, and the original regulatory wording is retained in all but a few instances. A few small errors noted in the 1975 edition have been corrected, and in a few places descriptions of outdated observing techniques have been removed.

Images

The images of Volume II of the 1987 edition have been replaced with new, high resolution, colour, digital images contributed by cloud enthusiasts from all over the world, with detailed descriptions. These are an essential part of the Atlas, illustrating and providing clear examples of clouds and other meteors. A much greater number of images is included. In some cases, multiple examples are included to show variations that can exist within a single classification. Users can compare these to illustrate differences due to season, climatic zone, or the stage of development of the cloud. Some time-lapse or video imagery has been included for selected classifications where this helps the observer understand the stages of evolution of that cloud type. Selected cloud image examples are now essentially case studies, with associated metadata added such as synoptic analyses, satellite or radar imagery, and atmospheric soundings. Many images from the 1987 Volume II have been retained as additional metadata for newer images, to enable historical traceability of observations. New images, in some cases several, are also provided for each type of hydrometeor (other than clouds), lithometeor, photometeor and electrometeor. In total, more than 600 new images are included in the web-based version of the atlas, many with supplemental metadata.

Credit and Team

In all, the changes in this latest edition of the International Cloud Atlas are extensive, though the core content is similar. Much credit is due to the members of the Task Team, with great assistance from the WMO Secretariat, and to the Hong Kong Observatory who build, host, and maintain the website. The Chair thanks each member for their invaluable contribution and commitment, and their home institutions for allowing them time to participate in this important activity.

RECOMMENDATIONS FOR FUTURE WORK AND IMPROVEMENTS

TT\_ICA-1 (2013) and subsequent meetings identified a great many essential or desired characteristics of a web-based WMO International Cloud Atlas. The 2017 Edition addresses most of these. However, the TT recognizes some gaps remain and there is an imperative for continued future improvement. We provide the following prioritized comments.

The summary below is of “what” we recommend. The TT intends to provide a more detailed report including our ideas and experiences that could be of use to WMO and to experts working on a future edition as they consider “how” to next update the ICA. For example, some attempts to gather images were more successful than other.

Prioritized Recommendations for Enhancements and Additions

1. Education tools: Throughout our meetings and activities, TT\_ICA has been very enthusiastic about the ICA potential for teaching and learning at all levels, as well as for training. We strongly recommend WMO undertake the creation of tools and platforms leveraging the ICA web format and its content. The TT considers that the WMO Education and Training Office could be well suited for this, in some cases supported by Expert Teams. Several TT members have expressed interest to remain engaged and pursue such activities.
2. Graphics: The ICA would benefit from additional explanatory or illustrative graphics to clearly and concisely convey information. The Task Team recognize the value of info-graphics such as the one of the polar, temperate and tropical tropopause showing the height ranges of levels within these regions (as on p. 35 of (1975) Volume I)]. Graphics may be of particular value to explain terms in the glossary that are not readily photographed, for example “cold pool”.
3. Images: The 2017 edition has many more images to illustrate clouds and other meteors that were available in the prior edition. There is, however, a remaining need to fill targeted gaps. We recommend future experts who take on the task to improve the cloud atlas consider that:
   1. Certain descriptions are best illustrated using time-lapse imagery, and not all were available for this edition. Annex VI of the TT\_ICA-2 Meeting Report (October 2014) contains a draft list of cloud types that would most benefit. This is reproduced here as **Appendix III**. As written in that report “*Video clips and time lapse imagery would be invaluable and very welcome for teaching purposes. They pick up detail that is not apparent with a casual 1-minute glance at the sky let alone a still image, it can show the transition of CL2 to CL3 to CL9; it can show the constantly changing appearance of CM4, which is rarely evident to the naked eye.”*
   2. There remain features associated with severe convective storms that are not present in the image set. This should be remedied. Especially, some Glossary definitions related to severe storms and dangerous weather could be improved with an explanatory photograph. The TT had limited success gaining usable submissions for these. Because of the impact of dangerous weather, we place this at a fairly high priority for future work. Also, as noted below, future enhancement to the text and graphics could better indicate connections between dangerous weather and certain cloud and meteor phenomena.
   3. In some cases, enhanced metadata for a cloud image would be helpful to better describe the environment in which the cloud forms or exists. This may consist of radar or satellite or synoptic maps that were not sourced for this edition. We emphasize that context should be added only where it clarifies or helps illustrate a point made in the Atlas.
   4. The ICA does show clouds how some clouds vary in appearance in different climate zone. Future work could expand this for rarely photographed cases (for example some clouds at extremely high latitude) and seek better ways to present this information to ICA users.
4. In some areas the Task Team believes there is room for further enhancement of information in the text.
   1. As noted above, in a future edition, text and graphics could be enhanced to better indicate connections between dangerous weather and certain cloud and meteor phenomena.
   2. Much information relevant to clouds as seen from aircraft was retained from the 1975 Edition ICA, and updated photographs were sourced. Our Terms-of-Reference steered the task team away from work on clouds as seen from aircraft. The Task Team suggests it would be valuable to enhance this material in the future.
   3. The TT recognizes that satellite images are used by many cloud observers as additional information and context when classifying clouds. Some satellite images are included in the new edition as metadata. Satellite remote sensing techniques and products are rapidly changing and creating a comprehensive guide for observers is outside the scope of the current task team work. However, we suggest future experts monitor this area and periodically consider if such information should be compiled.
5. The ICA has included mechanisms for public feedback through the website. These currently forward emails to a cloud expert on the Task Team, to HKO web experts, and to the WMO secretariat depending on the topic. The TT believes it is important to maintain communication between ICA users and WMO Experts. We recommend WMO formalize the relationship with cloud experts to ensure this is maintained.

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**APPENDIX III**

**Draft List of Cloud Types Requiring Time Lapse Imagery**

**(Reproduced from TT\_ICA-2 Meeting Report, Annex VI)**

1. Mutatus
   1. Cu - Sc4
   2. Cu - Ac6
   3. Cu - Cb3 - Cb9
   4. Cu - Ac6
   5. Cb - As - even Ns
   6. Cb - Ci – Cs
   7. Ci - Cs - As - Ns
2. Ci and/or Cs formed by contrail (longevity and/or spreading)
3. Lenticular and standing waves
4. Cirrocumulus/cirrostratus?
5. Classic mid latitude frontal approach (warm and cold frontal - cold frontal covered in 1g.)
6. Asperitas
7. Fallstreak holes
8. Stratospheric/mesospheric clouds
9. Severe convective clouds (wall, shelf, funnel, arcus ....)
10. Roll clouds

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