# Tracking IP AOPC Action

# Date: 20 September 2017

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| **Action A1** | **Near-real-time and historical GCOS Surface Network availability** | | | **Status** |
| **Explanation** | Improve the availability of near-real-time and historical GSN data especially over Africa and the tropical Pacific | | | |
| **Benefit** | Improved access for users to near-real-time GSN data | **Time Frame** | Continuous for monitoring GSN performance and receipt of data at archive centre | |
| **Who** | NMHSs, regional centres in coordination/cooperation with WMO CBS, and with advice from AOPC | **Performance Indicator** | AOPC review of data archive statistics at the World Data Center for Meteorology at Asheville, NC, USA, annually and national communications to UNFCCC | |
| **Background** | Monitoring statistics for GSN & RBCN stations are provided monthly and quarterly by NCEI to GNM. These are used for fault monitoring and diagnostic by GNM and CBS-LC-GCOS, and summarized in an annual report. | **Responsible within AOPC**  GCOS Network Manager (GNM) | | |
| **Timeframe/ deliverables**: ONGOING  Annual report and presentation to AOPC  Summary text and statistics included in GCOS reports to WMO CG & EC, Regional Association and Technical Commission Sessions. | | |
| **20th June** | In progress | | | |
| **20th Sep.** | In progress-ongoing | | | |
| **Jan 2018** | Ongoing | | | |

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| **Action A2** | **Land database** | | | **Status** |
| **Explanation** | Set up a framework for an integrated land database which includes all the atmospheric and  surface ECVs and across all reporting timescales | | | |
| **Benefit** | Centralized archive for all parameters. Facilitates QC among elements, identifying gaps in the data, efficient gathering and provision of rescued historical data, integrated analysis and monitoring of ECVs. Supports climate assessments, extremes, etc. Standardized formats and metadata. | **Time Frame** | Framework agreed by 2018 | |
| **Who** | NCEI and contributing centres | **Performance Indicator** | Report progress annually to AOPC | |
| **Background** | NCEI is an in kind partner to a four-year Copernicus (EU) funded project to produce a harmonized global land in situ database as well as a next generation ICOADS over the marine domain | **Responsible within AOPC**  Peter Thorne-Imke Durre | | |
| **Timeframe/ deliverables: ONGOING**  Annual report and presentation to AOPC | | |
| **20th June** | Loading data to Copernicus, doing an inventory of everything, deadline end of August 31 will be met. | | | |
| **20th Sep.** | Inventory delivered to ECMWF and accepted. Inventory will be hosted on service website in coming weeks and has been shared with Steve Foreman to aid discussion of WIGOS OSCAR-surface identifiers issue. | | | |
| **Jan 2018** | Test data release via STFC CEDA web service. Work now in progress to start building beta release due at end of 2018. Meeting to occur at NOAA NCEI at end of Jan. Caterina to attend as member of advisory panel. | | | |

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| **Action A3** | **International exchange of SYNOP and CLIMAT reports** | | | **Status** |
| **Explanation** | Obtain further progress in the systematic international exchange of both hourly SYNOP reports and daily and monthly CLIMAT reports from all stations | | | |
| **Benefit** | Enhanced holdings data archives | **Time Frame** | Continuous, with significant improvement in receipt of RBSN synoptic and CLIMAT data by 2019 | |
| **Who** | NMHSs, regional centres in coordination/cooperation with WMO CBS, and with advice from AOPC | **Performance Indicator** | Data archive statistics at data centres | |
| **Background** | This has to be considered not only a work of monitoring, but where gaps are found, it requires an action. | **Responsible within AOPC:** GSNMC, Andreas Becker | | |
| **Timeframe/ deliverables:**  Annual report and presentation to AOPC | | |
| **20th June** | Sent email to Andreas | | | |
| **20th Sep.** | None – send an email to Andreas asking for input (Secretariat) | | | |
| **9th Jan 2018** | Email sent . Update received from Andreas.  Software design and concept Document addressing this request has been procured and completed. The new Web Page will Feature the following capabilities:  - digesting BUFR  - Monitoring and visualization arrivals at deadlines that can be customized  - increased scope of stations monitored to Include all RBCN stations  Three Prototypes have been implemented. If requested my colleague Peter Finger can provide you with Illustrations. Moreover Christel Lefevbre can provide more Detail as she has Governed the Software procurement. In case that the Financial resources can be Secured the GSNMC Web Page Upgrade shall be implemented this year. | | | |

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| **Action A4** | **Surface Observing stations transition to automatic** | | | **Status** |
| **Explanation** | Follow guidelines and procedures for the transition from manual to automatic surface observing stations | | | |
| **Benefit** | More stable time series | **Time Frame** | Ongoing | |
| **Who** | Parties operating GSN stations for implementation. WMO CCl, in cooperation with WMO CIMO, WMO CBS for review | **Performance Indicator** | Implementation noted in national communications and relevant information provided | |
| **Background** | Ongoing challenge, despite there being support and documentation on how to manage the change. KNMI report (need details of this).Parallel observations database project being led by Victor (also Victor would like any parallel measurements) | **Responsible within AOPC:** Phil Jones | | |
| **Timeframe/ deliverables:**  Annual report and presentation to AOPC, With KNMI report as an example, request from WMO Regional Associations and Technical Commissions any other national and regional reports (and datasets of parallel measurements that might be available). | | |
| **20th June** | Phil has sent an email to Albert Klein-Tank at KNMI to see if he can get the KNMI document about the transfer to AWSs.  No progress for the parallel measurements.  The only way we’re likely to make any progress here is to for a letter to go from GCOS to all members, or for this to be raised at Regional Association meetings. | | | |
| **20th Sep.** | Phil has now access to several documents about requirements for the transition and KNMI reports on monitoring the transition. There are several documents also from CIMO and expert teams.  Phil provided to Ken ½ page of summary, which will also mention the need of parallel measurements. | | | |
| **13th Oct** | Action on A4 is going ahead within WMO circles. We need to monitor this. It would be useful to know exactly who in CIMO is involved in this. Maybe my contact at KNMI is this person? ET-OIST is the group. | | | |

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| **Action A5** | **Transition to BUFR** | | | **Status** |
| **Explanation** | Encourage dual transmission of TAC and BUFR for at least 6 months and longer if inconsistencies are seen (to compare the two data streams for accuracy). | | | |
| **Benefit** | Transition to BUFR does not introduce discontinuities in the datasets. BUFR allows metadata to be stored with data. | **Time Frame** | Ongoing for implementation; review by 2018 | |
| **Who** | Parties operating GSN stations for implementation | **Performance Indicator** | Proven capability to store BUFR messages giving same quality or better as TAC data | |
| **Background** | Monitoring Statistics being produced by ECMWF and DWD. Proposed to be included under the terms of reference of the Radiosonde Task Team | **Responsible within AOPC:** GCOS Network manager (Radiosonde task Team) | | |
| **Timeframe/ deliverables:**  Report from Radiosonde Task Team. Annual statistics on GUAN stations reporting in BUFR. Presentation at AOPC as required | | |
| **20th June** | Part of the work of the radiosonde Task Team. In progress. | | | |
| **20th Sep.** | In progress, TT will have meeting in December | | | |

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| **Action A6** | **Air temperature measurements** | | | **Status** |
| **Explanation** | Enhance air temperature measurements networks in remote or sparsely populated areas and over the ocean | | | |
| **Benefit** | Improved coverage for better depiction of climate system | **Time Frame** | Ongoing | |
| **Who** | National Parties and international coordination structures such as the Global Cryosphere Watch (GCW) | **Performance Indicator** | Coverage of air-temperature measurements | |
| **Background** | Increased global coverage of and access to air temperature measurements. Linked to the work under A2 and likely to be included in the metadata inventory. | **Responsible within AOPC**: Phil Jones | | |
| **Timeframe/ deliverables:**  Linked to A2. C3S/NCEI working on this 2017-21, so annual reports of the increase in station numbers by WMO Regions.  Reports to AOPC and also to WIGOS and WMO Regions and CBS Lead Centres. | | |
| **20th June** | Actions in IP includes many more variables than just air temperature. Ideally the increased global coverage needed applies also to all the surface ECVs (e.g. precipitation, water vapour/RH/Dewpoint and eventually radiation/sunshine, #s 10 and 12). The C3S project Peter leads and involves Matt should help | | | |
| **20th Sep.** | Ongoing. Phil will add some text here | | | |
| **13th Oct** | Phil: C3S will put together a dataset (with help from NCEI) in Lot 2. This will enable Peter/AOPC to know where observations are poorest in data sparse regions. How we go about enhancing monitoring is difficult as it will be Africa and South America (and maybe a few other places) where coverage is poor.  It would be good to get more measurements over the oceans, but all we can do is recommend here. We ought to link with OOPC on this. | | | |
| **Jan 2018** | Inventory information will be publically posted for both land and marine. Copernicus lots are working to address this issue (Lot 1 – led by MO and Lot 2 led by Maynooth) | | | |

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| **Action A7** | **Atmospheric pressure sensors on drifting buoys** | | | **Status** |
| **Explanation** | Enhance to 100% the percentage of drifting buoys incorporating atmospheric pressure sensors, in particular by benefiting from barometer-upgrade programmes | | | |
| **Benefit** | Measurements over oceans of surface pressure will improve coverage. | **Time Frame** | Ongoing | |
| **Who** | Parties deploying drifting buoys and buoy-operating organizations, coordinated through JCOMM, with advice from OOPC and AOPC | **Performance Indicator** | Percentage of buoys with sea-level pressure (SLP) sensors in tropics and sub-tropics | |
| **Background** | More information required on the true cost of adding pressure sensors | **Responsible within AOPC:** Liz Kent, Ken Holmlund and Roger Saunders | | |
| **Timeframe/ deliverables:**  Assessment of network costs by end of July 2017 | | |
| **20th June** | Liz talked to Bruce Ingleby. From NWP side there is a lot of activity, many of the impact studies are not specific for reanalysis. The difference between NWP and reanalysis cost benefit is not clear. Ken and Roger will find references for NWP and see how to translate the information to climate. | | | |
| **20th Sep.** | Ken to discuss with ECMWF | | | |
| **Jan 2018** | Peter discussed on sidelines of an ESA hosted meeting at NPL in October with the coordinator of the buoy program and passed a synthesis of that to Liz who was going to progress the conversation. | | | |
| **17 Jan 2018** | Liz sent an update: forwarded information received from Jon Turton. Target for drifters with pressure obs is 80%, not 100%. Some of the metrics are "excluding high death rate regions, marginal seas and lat>60N/S" so it might be worth thinking about refining the target in the future with the help of this rather detailed information from JCOMMOPS. Adding the sensors is about $1k per buoy, so the approximate additional cost of going to 100% pressure would be 740 units x 50% to uplift from current pressure installation rate x $1k = $370k and a total overall cost of $740k.  Headline is that currently the trend is downwards rather than upwards. | | | |

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| **Action A8** | **Provide precipitation data to the Global Precipitation Climatology Centre** | | | **Status** |
| **Explanation** | Submit all precipitation data from national networks to the Global Precipitation Climatology Centre at the Deutscher Wetterdienst | | | |
| **Benefit** | Improved estimates of extremes and trends, enhanced spatial and temporal detail that address mitigation and adaptation requirements | **Time Frame** | Ongoing | |
| **Who** | NMHSs with coordination through the WMO CCl and the GFCS. | **Performance Indicator** | Percentage of nations providing all their holdings of precipitation data to international data centres. | |
| **Background** | Getting also radar data into precipitation data; associated with Task Team for radar data for climatology (Elena) | **Responsible within AOPC:** Andreas  Becker and Leader of the task team for radar for climatology | | |
| **Timeframe/ deliverables:**  Useful to supply precipitation data to C3S/NCEI | | |
| **20th June** | Part of the radar task team work | | | |
| **20th Sep.** | Ongoing work of radar TT. | | | |

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| **Action A9** | **Submit Water Vapour data** | | | **Status** |
| **Explanation** | Submit water-vapour (humidity) data from national networks and marine platforms to the international data centres | | | |
| **Benefit** | Improved coverage of surface water-vapour measurements | **Time Frame** | Ongoing | |
| **Who** | NMHSs, through WMO CBS and international data centres, with input from AOPC | **Performance Indicator** | Data availability in analysis centres and archive and scientific reports on the use of these data | |
| **Background** | Linked to the work under A2 and likely to be included in the metadata inventory; Assessment of RH Quality | **Responsible within AOPC:** Matt Menne-Imke Durre | | |
| **Timeframe/ deliverables:**  Linked to A2 and also A6 and A7 | | |
| **20th June** | Part of the land data base, inventory. Have a special assessment for water vapour on land surface | | | |
| **20th Sep.** | No progress | | | |
| **Jan 2018** | Water vapour measurements will be part of the work of the Copernicus lot (see A2). | | | |

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| **Action A10** | **Incorporating national sunshine records into data centres** | | | **Status** |
| **Explanation** | National sunshine records should be incorporated into International Data Centres | | | |
| **Benefit** | Better description of surface radiation fields | **Time Frame** | Implement in next 2 years | |
| **Who** | NMHS | **Performance Indicator** | Performance indicator Sunshine record archive established in international data centres and in analysis centres by 2018 | |
| **Background** | National sunshine records into Data Centres | **Responsible within AOPC:** | | |
| **Timeframe/ deliverables:**  Future | | |
| **20th June** |  | | | |
| **20th Sep.** | Both for A10 and A12: Many data are in private hands and risk to be lost. We need to encourage them to make the data available. Ken to discuss during SC-25 how to convince private sector to share data | | | |

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| **Action A11** | **Operation of the the GCOS Baseline Network for Surface Radiation** | | | **Status** |
| **Explanation** | Ensure continued long-term operation of the BSRN and expand the network to obtain globally more representative coverage and improve communications between station operators and the archive centre | | | |
| **Benefit** | Continuing baseline surface radiation climate record at BSRN sites | **Time Frame** | Ongoing | |
| **Who** | Parties’ national services and research programmes operating BSRN sites in cooperation with AOPC and the WCRP GEWEX Radiation Panel | **Performance Indicator** | The number of BSRN stations regularly submitting valid data to international data centres | |
| **Background** |  | **Responsible within AOPC:** BSRN Project Lead  GCOS Network Manager | | |
| **Timeframe/ deliverables:**  ONGOING  BI-ANNUAL Workshop Report  Presentation at AOPC as required | | |
| **20th June** | In progress | | | |
| **20th Sep.** | In progress | | | |
| **Jan 2018** | Work on C3S 311a Lot 2 has highlighted how timescale dependent these records are. Available records are disproportionately monthly and what is recorded is distinct across timescales which complicates making the case for their use as things stand. | | | |

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| **Action A12** | **Surface radiation data to the World Radiaiton Data Centre** | | | **Status** |
| **Explanation** | Submit surface radiation data with quality indicators from national networks to the WRDC; expand deployment of surface radiation measurements over ocean | | | |
| **Benefit** | Expand central archive; data crucial to constrain global radiation budgets and for satellite product validation; more data over ocean would fill an existing gap. | **Time Frame** |  | |
| **Who** | NMHS and others, in collaboration with WRDC | **Performance Indicator** | Data availability in WRDC | |
| **Background** |  | **Responsible within AOPC:** | | |
| **Timeframe/ deliverables:**  Future | | |
| **20th June** | Future | | | |
| **20th Sep.** | Both for A10 and A12: Many data are in private hands and risk to be lost. We need to encourage them to make the data available. Ken to discuss during SC-25 how to convince private sector to share data | | | |

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| **Action A13** | **Implement vision for future of GCOS Upper-Air Network operation** | | | **Status** |
| **Explanation** | Show demonstrable steps towards implementing the vision articulated in the GCOS Networks Meeting in 2014 relating to the future of GUAN operation | | | |
| **Benefit** | Improved data quality, better integrated with GRUAN and more closely aligned with WIGOS framework | **Time Frame** | 2019 for adoption at Nineteenth World Meteorological Congress | |
| **Who** | Task team of AOPC with GCOS Secretariat in collaboration with relevant WMO commissions and WIGOS | **Performance Indicator** | Annual reporting in progress at AOPC of task team | |
| **Background** | Updated requirement for GUAN as a baseline network, focusing on availability, scheduling and burst heights. Linking GUAN with GRUAN. BUFR take-up. Global coverage including remote locations | **Responsible within AOPC:** Peter Thorne  GCOS Network Manager | | |
| **Timeframe/ deliverables:**  Agree Terms of Reference for Radiosonde Task Team and proposed membership (May 2017)  Meeting of Task Team (2nd half 2017)  Report to next AOPC (April 2018) | | |
| **20th June** | Radiosonde task team, in progress | | | |
| **20th Sep.** | Radiosonde TT will meet in December 2017 | | | |
| **Jan 2018** | Good progress at meeting with robust discussions. Meeting report in prep by Tim Oakley | | | |

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| **Action A14** | **Evaluation of benefits for GUAN** | | | **Status** |
| **Explanation** | Quantify the benefits of aspects of GUAN operation including attaining 30 hPa or 10 hPa, twice-daily as opposed to daily ascents and the value of remote island GUAN sites | | | |
| **Benefit** | Better guidance to GUAN management, improved scientific rationale for decision-making | **Time Frame** | Completed by 2018 | |
| **Who** | NWP and reanalysis centres | **Performance Indicator** | Published analysis (in peer reviewed literature plus longer report) | |
| **Background** | Included in TOR for Radiosonde Task Team  See A13 | **Responsible within AOPC:**  Peter Thorne  GCOS Network Manager | | |
| **Timeframe/ deliverables:**  Agree Terms of Reference for Radiosonde Task Team and proposed membership (May 2017)  Meeting of Task Team (2nd half 2017)  Report to next AOPC (April 2018) | | |
| **20th June** | Radiosonde task team, in progress | | | |
| **20th Sep.** | Radiosonde TT will meet in December 2017 | | | |
| **Jan 2018** | Some progress in at least discussing how this may be addressed at TT meet but resource limitations an issue still. | | | |

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| **Action A15** | **Implementation of Reference Upper-Air Network** | | | **Status** |
| **Explanation** | Continue implementation of GRUAN metrologically traceable observations, including operational requirements and data management, archiving and analysis and give priority to implementation of sites in the tropics, South America and Africa | | | |
| **Benefit** | Reference-quality measurements for other networks, in particular GUAN, process understanding and satellite cal/val. | **Time Frame** | Implementation largely completed by 2025 | |
| **Who** | Working Group on GRUAN, NMHSs and research agencies, in cooperation with AOPC, WMO CBS and the Lead Centre for GRUAN | **Performance Indicator** | Number of sites contributing reference-quality data streams for archival and analysis and number of data streams with metrological traceability and uncertainty characterization; better integration with WMO activities and inclusion in the WIGOS manual. | |
| **Background** |  | **Responsible within AOPC:** Peter Thorne | | |
| **Timeframe/ deliverables:**  Report to AOPC  Deliver GRUAN IP | | |
| **20th June** | GRUAN ICM-9 held in Helsinki June 2017. New action plan til ICM-10 (April 2018) agreed. Report with action will be available within 3 months. Progressing | | | |
| **20th Sep.** | Significant issue has arisen over co-chair Greg Bodeker which we are discussing. Several options being pursued presently. Should be clearer by meeting in Lindenberg in December when to be discussed. Presence of at least 1 of the AOPC chairs requested. Peter sent docs to Carolin and Tim. Not clear when to have meeting with Peter, one of AOPC Chair and secretariat. Ken to raise the issue at SC | | | |
| **1Oct** | Short version of the report of ICM-9 available, to be circulated among panel members | | | |
| **Jan 2018** | ICM-9 to be published as GCOS document. . Ruud Dirksen to be invited to next AOPC to provide a substantive network update from the perspective of the Lead Centre. | | | |

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| **Action A16** | **Implementation of satellite calibration missions** | | | **Status** |
| **Explanation** | Implement a sustained satellite climate calibration mission or missions | | | |
| **Benefit** | Implement a sustained satellite climate calibration mission or missions | **Time Frame** | Ongoing | |
| **Who** | Space agency | **Performance Indicator** | Commitment to implement by the next status report in 2020; proof-of-concept proven on ISS pathfinder | |
| **Background** | Ken as chair of AOPC should go to CEOS and keep this ongoing. GCOS/AOPC needs to make a strong user requirements to space agencies for this mission, by writing a 1 page doc to show science benefits | **Responsible within AOPC:**  Ken Holmlund | | |
| **Timeframe/ deliverables:**  Milestone: report of meeting addressing this request (CGMS:June2017  CEOS:October2017)  Next AOPC session | | |
| **20th June** | The WGClimate are taking care of the satellite calibration mission. Ken will keep on monitoring and report after October 2017 | | | |
| **20th Sep.** | Keep monitoring | | | |

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| **Action A17** | **Retain original measured values for radiosonde data** | | | **Status** |
| **Explanation** | For radiosonde data and any other data that require substantive processing from the original measurement (e.g. digital counts) to the final estimate of the measurand (e.g. T and q profiles through the lower stratosphere); the original measured values should be retained to allow subsequent reprocessing. | | | |
| **Benefit** | Possibility to reprocess data as required, improved data provenance | **Time Frame** | Ongoing | |
| **Who** | HMEI (manufacturers), NMHSs, archival centres. | **Performance Indicator** | Original measurement raw data and metadata available at recognized repositories | |
| **Background** | Included in TOR for Radiosonde Task Team; See A13 | **Responsible within AOPC:**  Peter Thorne; GCOS Network Manager | | |
| **Timeframe/ deliverables:** | | |
| **20th June** | See A13 | | | |
| **20th Sep.** | See A13 | | | |

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| **Action A18** | **Hyperspectral radiances reprocessing** | | | **Status** |
| **Explanation** | Continue reprocessing of AMVs derived from geostationary satellite imagery in a coordinated manner across agencies | | | |
| **Benefit** | Consistent time series of AMVs for monitoring and reanalyses, improved CDRs computed from the FCDRs | **Time Frame** | Ongoing | |
| **Who** | Space agencies | **Performance Indicator** | Reprocessed FCDRs available for upper-air winds | |
| **Background** | This action is about reprocessing level 1 radiances. In process. There is a need to involve American CRIS and AIRS experts to share experience on how to produce a consistent record and to ensure consistency with IASI. | **Responsible within AOPC:**  Ken Holmlund | | |
| **Timeframe/ deliverables:** | | |
| **20th June** | not followed up yet, no progess | | | |
| **20th Sep.** | No progress. Ken to try to find out more details | | | |

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| **Action A19** | **Reprocessing of atmospheric motion vectors** | | | **Status** |
| **Explanation** | Continue reprocessing of AMVs derived from geostationary satellite imagery in a coordinated manner across agencies | | | |
| **Benefit** | Consistent time series of AMVs for monitoring and reanalyses, improved CDRs computed from the FCDRs | **Time Frame** | Ongoing | |
| **Who** | Space agencies | **Performance Indicator** | Reprocessed FCDRs available for upper-air winds | |
| **Background** | GOES has some unprocessed records for early data in 1970s (Roger to check) . GCOS to invite the CGMS international winds working group (IWWG) to explain their plans for reprocessing. Ken to write a letter to the IWWG chairs.  Note: SCOPE-CM activities is relevant here. | **Responsible within AOPC:**  Roger Saunders  Ken Holmlund | | |
| **Timeframe/ deliverables:** | | |
| **20th June** | reprocessing is done, goes back now from 1982-2016, keep trying to make it available from 1970s. Ken: IWWG started to create a wind processing package consistent with older s Eumetsat and GOES satellite. Ken sees 1977-1979, roughly | | | |
| **20th Sep.** | Ken to ask (IWWG?) to discuss progress and plans at meeting in Korea in Spring 2018. Roger has looked in to this and the current status is that NOAA will process GOES images back to 1982 with the latest GOES-R methodology. This is progress but nothing planned for 1970s. | | | |

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| **Action A20** | **Increase the coverage of aircraft observations** | | | **Status** |
| **Explanation** | Further expand the coverage provided by AMDAR, especially over poorly observed regions such as Africa and South America | | | |
| **Benefit** | Improved coverage of upper-air wind for monitoring and reanalysis | **Time Frame** | Ongoing | |
| **Who** | NMHSs, WIGOS, RAs I and III. | **Performance Indicator** | Data available in recognized archives | |
| **Background** | Future | **Responsible within AOPC:** | | |
| **Timeframe/ deliverables:** | | |
| **20th June** |  | | | |
| **20th Sep.** |  | | | |

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| **Action A21** | **Implementation of space-based wind-profiling system** | | | **Status** |
| **Explanation** | Assuming the success of ADM/Aeolus, implement an operational space-based wind profiling system with global coverage | | | |
| **Benefit** | Improved depiction of upper-air windfields: improved reanalyses, 3D aerosol measurements as a byproduct | **Time Frame** | Implement once ADM/Aeolus concept is proven to provide benefit | |
| **Who** | Space Agencies | **Performance Indicator** | Commitment to launch ADM follow-on mission | |
| **Background** | Not currently being addressed by EUMETSAT. Needs to be reviewed a year from now. CGMS and CEOS to keep it on the agenda. In China: the prototype is organized potentially in 10 years. | **Responsible within AOPC:**  Ken Holmlund | | |
| **Timeframe/ deliverables:**  To be reviewed before AOPC 2018  Milestone: update after CEOS meetings | | |
| **20th June** | Being monitored, ongoing.: Eumetsat and ESA will organize a workshop before next mission. Reflected also in WIGOS. | | | |
| **20th Sep.** | Joint workshop EUMETSAT-ESA. Needs discussion on how to proceed in case this mission does not deliver. Ken to follow progress with EUMETSAT. | | | |

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| **Action A22** | **Develop a repository of water vapour climate data records** | | | **Status** |
| **Explanation** | Develop and populate a globally recognized repository of GNSS zenith total delay and total column water data and metadata | | | |
| **Benefit** | Reanalyses, water vapour CDRs | **Time Frame** | By 2018 | |
| **Who** | AOPC to identify the appropriate responsible body | **Performance Indicator** | Number of sites providing historical data to the repository | |
| **Background** | Develop a repository of ZTD/water vapour CDRs. The action is about gathering the data in a recognized archive and reprocessing in the future. GNSS has a recognized center, E-GVAP for Europe. Roger to provide more information. AOPC recognized the champion, needs now to see whether is implemented | **Responsible within AOPC:**  Roger Saunders | | |
| **Timeframe/ deliverables:**  Status report until AOPC-23 2018 | | |
| **20th June** | Follow-up with Fabio Madonna, who is the C3S\_311a\_Lot3 leader. Caterina will bring Roger in contact with Fabio. Roger will talk to Fabio and see whether they can take this action up. | | | |
| **20th Sep.** | Invite Fabio Madonna to next AOPC. Roger has contacted Fabio and received a positive reply regarding a repository for GNSS TCWV (reply copied separately to Secretariat) | | | |
| **Dec 2017** | Fabio Madonna has been invited and will present plans at AOPC. | | | |

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| **Action A23** | **Measure of water vapour in the UT/LS** | | | **Status** |
| **Explanation** | Promote the development of more economical and environmentally friendly instrumentation for measuring accurate in situ water-vapour concentrations in the UT/LS | | | |
| **Benefit** | Improved UT/LS water vapour characterization, water-vapour CDRs | **Time Frame** | Ongoing | |
| **Who** | NMHSs, National measurements institutes, HMEI and GRUAN | **Performance Indicator** | Number of sites providing higher-quality data to archives | |
| **Background** | Promote development of more economical and environmentally friendly instrumentation for measuring accurate in-situ water vapour concentrations in the UT/LS. To be addressed under action 15 | **Responsible within AOPC:**  Dale Hurst | | |
| **Timeframe/ deliverables:** | | |
| **20th June** | Session at GRUAN ICM-9 highlighted a number of potential emerging approaches although many use R23 a potent GHG and all are expensive. Further discussion in GRUAN foreseen. Reported also to new BIPM WG on environmental thermometry | | | |
| **20th Sep.** | No update | | | |

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| **Action A24** | **Implementation of archive for radar reflectivities** | | | **Status** |
| **Explanation** | To implement a global historical archive of radar reflectivities (or products of reflectivities if reflectivities are not available) and associated metadata in a commonly agreed format | | | |
| **Benefit** | Better validation of reanalyses, improved hydrological cycle understanding | **Time Frame** | Ongoing | |
| **Who** | NMHSs, data centres, WIGOS | **Performance Indicator** | Data available in recognized archive, agreed data policy | |
| **Background** | Task Team on Radar data for climatologies | **Responsible within AOPC:**  Rainer Hollmann | | |
| **Timeframe/ deliverables:** | | |
| **20th June** | Part of the Radar Task Team work. In progress | | | |
| **20th Sep.** | Ongoing work of radar task team | | | |

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| **Action A25** | **Continuity of global satellite precipitation products** | | | **Status** |
| **Explanation** | Ensure continuity of global satellite precipitation products similar to GPM | | | |
| **Benefit** | Precipitation estimates over oceans for global assessment of water-cycle elements and their trends | **Time Frame** | Ongoing | |
| **Who** | Space agencies | **Performance Indicator** | Long-term homogeneous satellite-based global precipitation products | |
| **Background** | See A16 - Continue to push the importance of the missions to space agencies. | **Responsible within AOPC:**  Ken Holmlund | | |
| **Timeframe/ deliverables:**  Milestone: report of meeting addressing this request (CGMS:June2017  CEOS:October2017)  Next AOPC session | | |
| **20th June** | Check report of the meeting to see whether this request has been addressed.  Next opportunity with CEOS in September and October | | | |
| **20th Sep.** | Check report of the meeting to see whether this request has been addressed.  Next opportunity with CEOS in September and October | | | |

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| **Action A26** | **Development of methodology for consolidated precipitation estimates** | | | **Status** |
| **Explanation** | Develop methods of blending raingauge, radar and satellite precipitation | | | |
| **Benefit** | Better precipitation estimates | **Time Frame** | By 2020 | |
| **Who** | WMO technical commissions | **Performance Indicator** | Availability of consolidated precipitation estimates | |
| **Background** | Work with WMO technical Commissions | **Responsible within AOPC:**  GCOS Secretariat | | |
| **Timeframe/ deliverables:**  Interim report next AOPC | | |
| **20th June** | Discussed within WMO. Need connection to IPWG. Caterina will continue to liaise with group. | | | |
| **20th Sep.** | Caterina to make connection with IPWG | | | |

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| **Action A27** | **Dedicated satellite Earth Radiation Budget mission** | | | **Status** |
| **Explanation** | Ensure sustained incident total and spectral solar irradiances and ERB observations, with at least one dedicated satellite instrument operating at any one time | | | |
| **Benefit** | Seasonal forecasting, reanalyses, model validation. | **Time Frame** | Ongoing | |
| **Who** | Space agencies | **Performance Indicator** | Long-term data availability at archives | |
| **Background** | See A16 - Continue to push the importance of the missions to space agencies | **Responsible within AOPC:**  Ken Holmlund | | |
| **Timeframe/ deliverables:**  Milestone: report of meeting addressing this request (CGMS:June2017  CEOS:October2017)  Next AOPC session | | |
| **20th June** | JWG is preparing a response to GCOS IP satellite related actions for SBSTA for October-6. Need to make sure that AOPC can review the input before submission | | | |
| **20th Sep.** | Ken to check the status of the report.  Most likely there will be no time for AOPC to review | | | |
| **October** | Draft report was circulated to panel chairs for comments. | | | |

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| **Action A28** | **In-situ Profile and Radiation** | | | **Status** |
| **Explanation** | To understand the vertical profile of radiation requires development and deployment of technologies to measure in-situ profiles. | | | |
| **Benefit** | Understanding of 3D radiation field, model validation, better understanding of radiosondes | **Time Frame** | Ongoing | |
| **Who** | NMHSs, National measurements institutes, HMEI | **Performance Indicator** | Data availability in NMHSs archives | |
| **Background** | Future | **Responsible within AOPC:** | | |
| **Timeframe/ deliverables:** | | |
| **20th June** |  | | | |
| **20th Sep.** |  | | | |
| **Jan 2018** | This was work of Meteo Swiss (Payerne) site by a staff member no longer employed. Would suggest that Secretariat follow up with Bertrand Calpini to ascertain status of this work. | | | |

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| **Action A29** | **Lightning** | | | **Status** |
| **Explanation** | To define the requirement for lightning measurements, including data exchange, for climate monitoring and to encourage space agencies and operators of ground-based systems to provide global coverage and reprocessing of existing datasets | | | |
| **Benefit** | Ability to monitor trends in severe storms | **Time Frame** | Requirements to be defined by 2017 | |
| **Who** | GCOS AOPC and space agencies | **Performance Indicator** | Update to Annex A for lightning and commitments by space agencies to include lightning imagers on all geostationary platforms. Reprocessed satellite datasets of lightning produced. | |
| **Background** |  | **Responsible within AOPC:** | | |
| **Timeframe/ deliverables:** | | |
| **20th June** | Talked to CCl and will work in cooperation with them. | | | |
| **20th Sep.** | Task team currently set up. ToR drafted and experts asked.  Ken to discuss during SC-25 how to convince private sector to share data | | | |

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| **Action A30** | **Water vapour and ozone measurement in upper troposphere and lower and upper stratosphere** | | | **Status** |
| **Explanation** | Re-establish sustained limb-scanning satellite measurement of profiles of water vapour, ozone and other important species from UT/LS up to 50 km | | | |
| **Benefit** | Ensured continuity of global coverage of vertical profiles of UT/LS constituents | **Time Frame** | Ongoing, with urgency in initial planning to minimize data gap | |
| **Who** | Space agencies | **Performance Indicator** | Continuity of UT/LS and upper stratospheric data records | |
| **Background** | No planned mission for limb sounders except of Altius- Belgian proposal with support from ESA measuring atmospheric composition and to be launched in 2020.  See A16 | **Responsible within AOPC:**  Ken Holmlund; Peng Zhang; Zhanqing Li; Peter Thorne, Dale Hurst | | |
| **Timeframe/ deliverables:**  Milestone: report of meeting addressing this request (CGMS:June2017  CEOS:October2017)  Next AOPC session | | |
| **20th June** | Keep on reporting.  It Is also discussed in WIGOS, was mentioned in CGMS in June 2017, annual symposium NASA and NCAR. | | | |
| **20th Sep.** | Include GRUAN in discussion. | | | |

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| **Action A31** | **Validation of satellite remote sensing** | | | **Status** |
| **Explanation** | Engage existing networks of ground-based, remote sensing stations (e.g. NDACC, TCCON, GRUAN) to ensure adequate, sustained delivery of data from MAXDOAS, charge coupled device (CCD) spectrometers, lidar, and FTIR instruments for validating satellite remote-sensing of the atmosphere | | | |
| **Benefit** | Validation, correction and improvement of satellite retrievals | **Time Frame** | Ongoing, with urgency in initial planning to minimize data gap | |
| **Who** | Space agencies, working with existing networks and environmental protection agencies | **Performance Indicator** | Availability of comprehensive validation reports and near-real-time monitoring based on data from the networks | |
| **Background** | To be coordinated between satellite and composition. Needs to be more specific and give specific examples on what is needed. Jim is going to be responsible for the gases and Olga for aerosols. On the satellite side, possible point of contact from working group climate is Stephan Bojinski and from the panel Peng | **Responsible within AOPC:**  James Butler; Olga Kalashnikova; Peng Zhang | | |
| **Timeframe/ deliverables:**  Interim report for AOPC-23 2018 | | |
| **20th June** | Not pursued yet, Jim will contact Peng and Olga | | | |
| **20th Sep.** | Include GAIA-Clim. Caterina to send email to Olga and Jim | | | |
| **31st Oct** | Sent email | | | |
| **9th jan 2018** | Re-sent email | | | |
| **Jan 2018** | GAIA-CLIM now in final stages but has addressed this. You could get a demonstration of the Virtual Observatory by Joerg Schulz at AOPC. This would show the colocation tools developed and help to show progress against this action here! GAIA-CLIM has spent 3 years and 6 million euros doing precisely this and as GAIA-CLIM PI it continues to mystify me (Peter) why I am habitually cut out of the loop on this. Sorry if I sound a tad hacked off here but this isn’t the first time I have made this point. We really should claim the GAIA-CLIM work outcomes as it pretty much covers this action 1:1. Why are we ignoring it? | | | |

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| **Action A32** | **Fundamental Climate Data Records and Climate Data Records for greenhouse gases and aerosols ECVs** | | | **Status** |
| **Explanation** | Extend and refine the satellite data records (FCDRs and CDRs) for GHG and aerosol ECVs | | | |
| **Benefit** | Improved record of GHG concentrations | **Time Frame** | Ongoing | |
| **Who** | Space agencies | **Performance Indicator** | Availability of updated FCDRs and CDRs for GHGs and aerosols | |
| **Background** |  | **Responsible within AOPC:** | | |
| **Timeframe/ deliverables:** | | |
| **20th June** | No progress | | | |
| **20th Sep.** | Not started yet | | | |

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| **Action A33** | **Maintain WMO GAW CO2 and CH4 monitoring networks** | | | **Status** |
| **Explanation** | Maintain and enhance the WMO GAW Global Atmospheric CO2 and CH4 monitoring networks as major contributions to the GCOS Comprehensive Networks for CO2 and CH4. Advance the measurement of isotopic forms of CO2 and CH4 and of appropriate tracers to separate human from natural influences on the CO2 and CH4 budgets | | | |
| **Benefit** | A well-maintained, ground-based and in situ network provides the basis for understanding trends and distributions of GHGs. | **Time Frame** | Ongoing | |
| **Who** | National Environmental Services, NMHSs, research agencies, and space agencies under the guidance of WMO GAW and its Scientific Advisory Group on Greenhouse Gases | **Performance Indicator** | Data flow to archive and analysis centres | |
| **Background** | Generally ongoing, advance the measurement of isotopic forms of CO2 and CH4, and of appropriate tracers, to separate human from natural influences on the CO2 and CH4 budgets | **Responsible within AOPC:**  Jim Butler | | |
| **Timeframe/ deliverables:**  Interim report for AOPC-23 2018 on data flow | | |
| **20th June** | meeting in September, will bring up satellite issues, with Greg how to identify, important step In measurement guidelines | | | |
| **20th Sep.** | Greg will check about the meeting with Jim and send an update | | | |

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| **Action A34** | **Requirements for in-situ column composition measurements** | | | **Status** |
| **Explanation** | Define the requirements for providing vertical profiles of CO2, CH4 and other GHGs, using recently emerging technology, such as balloon capture technique | | | |
| **Benefit** | Ability to provide widespread, accurate, in situ vertical profiles economically; an excellent tool for validating satellite retrievals and improving transport models | **Time Frame** | Requirements to be defined by 2018 | |
| **Who** | GCOS AOPC and space agencies | **Performance Indicator** | Update to Annex A to include vertical profiles and XCO2 (the dry-air column-averaged mole fraction of CO2) | |
| **Background** | Define the requirements for providing vertical profiles of CO2, CH4 and other GHGs using recently emerging technology | **Responsible within AOPC:**  James Butler; Peter Thorne | | |
| **Timeframe/ deliverables:**  During 2018 | | |
| **20th June** | AC related, ongoing | | | |
| **20th Sep.** | New technology is being developed which is more accurate. However, aviation clearance is an issue. Groups developing tech. Need to be encouraged to develop mindfully of aviation restrictions. | | | |

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| **Action A35** | **Space-based measurements of C02 and CH4 implementation** | | | **Status** |
| **Explanation** | Assess the value of the data provided by current space-based measurements of CO2 and CH4, and develop and implement proposals for follow-on missions accordingly | | | |
| **Benefit** | Provision of global records of principal greenhouse gases; informing decision-makers in urgent efforts to manage GHG emissions | **Time Frame** | Assessments are ongoing and jointly pursued by research institutions | |
| **Who** | Research institutions and space agencies | **Performance Indicator** | Approval of subsequent missions to measure GHGs | |
| **Background** | Ongoing, develop and implement proposals for follow-on missions accordingly | **Responsible within AOPC:**  Greg Carmichael | | |
| **Timeframe/ deliverables:**  Interim report for AOPC-23 2018; full report for AOPC-24 2019 | | |
| **20th June** | AC related, ongoing | | | |
| **20th Sep.** | No progress. Would be interesting to have report on EU activity for carbon monitoring. Consider having a session on carbon monitoring at next AOPC | | | |

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| **Action A36** | **N2O, halocarbon and SF6 networks/measurements** | | | **Status** |
| **Explanation** | Maintain networks for N2O, halocarbon and SF6 measurements | | | |
| **Benefit** | Informs the parties to the Montreal Protocol, provides records of long-lived, non-CO2 GHGs and offers potential tracers for attribution of CO2 emissions | **Time Frame** | Ongoing | |
| **Who** | National research agencies, national environmental services, NMHSs, through WMO GAW | **Performance Indicator** | Data flow to archive and analysis centres | |
| **Background** | Future | **Responsible within AOPC:** | | |
| **Timeframe/ deliverables:** | | |
| **20th June** |  | | | |
| **20th Sep.** |  | | | |

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| **Action A37** | **Ozone networks coverage** | | | **Status** |
| **Explanation** | Maintain networks for N2O, halocarbon and SF6 measurements | | | |
| **Benefit** | Informs the parties to the Montreal Protocol, provides records of long-lived, non-CO2 GHGs and offers potential tracers for attribution of CO2 emissions. | **Time Frame** | Ongoing | |
| **Who** | National research agencies, national environmental services, NMHSs, through WMO GAW | **Performance Indicator** | Data flow to archive and analysis centres | |
| **Background** | restore the coverage as much as possible and maintain the quality and continuity of the GCOS Global Baseline | **Responsible within AOPC:**  Greg Carmichael | | |
| **Timeframe/ deliverables:**  Status report until AOPC-23 2018 | | |
| **20th June** | Send email to Greg | | | |
| **20th Sep.** | Greg will send update | | | |

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| **Action A38** | **Submission and dissemination of ozone data** | | | **Status** |
| **Explanation** | Urgently restore the coverage the extent possible and maintain the quality and continuity of the GCOS Global Baseline (profile, total and surface level) Ozone Networks coordinated by WMO GAW. | | | |
| **Benefit** | Provides validation of satellite retrievals and information on global trends and distributions of ozone. | **Time Frame** | Ongoing | |
| **Who** | Parties’ national research agencies and NMHSs, through WMO GAW and network partners, in consultation with AOPC | **Performance Indicator** | Improved and sustained network coverage and data quality | |
| **Background** | Improve timeliness and completeness of submission and dissemination of data | **Responsible within AOPC:**  Greg Carmichael | | |
| **Timeframe/ deliverables:**  Status report until AOPC-23 2018 | | |
| **20th June** | Send email | | | |
| **20th Sep.** | Greg will send update | | | |

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| **Action A39** | **Monitoring of aerosol properties** | | | **Status** |
| **Explanation** | Provide more accurate measurement-based estimates of global and regional direct aerosol radiative forcing (DARF) at the top of the atmosphere and its uncertainties, and determine aerosol forcing at the surface and in the atmosphere through accurate monitoring of the 3D distribution of aerosols and aerosol properties. Ensure continuity of monitoring programs based on in situ ground-based measurement of aerosol properties. | | | |
| **Benefit** | Reducing uncertainties in DARF and the anthropogenic contributions to DARF, and the uncertainty in climate sensitivity and future predictions of surface temperature.  Better constraints on aerosol type needed for atmospheric correction and more accurate ocean property retrieval than currently available. | **Time Frame** | Ongoing, baseline in situ components and satellite strategy is currently defined. | |
| **Who** | Parties’ national services, research agencies and space agencies, with guidance from AOPC and in cooperation with WMO GAW and AERONET | **Performance Indicator** | Availability of the necessary measurements, appropriate plans for future | |
| **Background** | Ask Olga to present a proposal on how to implement this action | **Responsible within AOPC:**  Olga Kalashnikova | | |
| **Timeframe/ deliverables:**  Interim report for AOPC-23 2018 | | |
| **20th June** | Send email | | | |
| **20th Sep.** | There is extensive work on aerosols. Greg to share the report with Olga | | | |

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| **Action A40** | **Continuity of products of precursors of ozone and secondary aerosols** | | | **Status** |
| **Explanation** | Ensure continuity of products based on space-based, ground-based and in situ measurements of the precursors (NO2, SO2, HCHO, NH3 and CO) of ozone and secondary aerosol and derive consistent emission databases, seeking to improve spatial resolution to about 1 x 1 km2 for air quality | | | |
| **Benefit** | Improved understanding of how air pollution influences climate forcing and how climate change influences air quality. | **Time Frame** | Ongoing | |
| **Who** | Space agencies, in collaboration with national environmental agencies and NMHSs | **Performance Indicator** | Availability of the necessary measurements, appropriate plans for future missions, and derived emission databases | |
| **Background** | Space-based, ground-based and in situ measurements. | **Responsible within AOPC:**  Greg Carmichael | | |
| **Timeframe/ deliverables:**  Interim report for AOPC-23 2018 | | |
| **20th June** | Send email | | | |
| **20th Sep.** | Work is in progress. Requirements are being developed to evolve the obs system. Greg will send an update. | | | |