5.3.1.3. Aircraft meteorological stations

In the northern hemisphere, meteorological data derived from aircraft platforms, especially the automatic data produced by the AMDAR system, are an excellent complement to the data derived from the radiosonde network. This system produces vertical profile data in the vicinity of airports and single-level data when aircraft are flying at cruise levels. It has been shown through NWP impact studies that their impact on numerical forecasts has a magnitude similar to the impact of the radiosonde network. In the southern hemisphere and in the tropics the aircraft data coverage is very poor although there is some potential for developing it, preferably in a way that is complementary to existing AMDAR and radiosonde networks.

Extending aircraft observations data coverage is important and can be achieved through the extension of the programme to new airlines and aircraft operating in data-sparse areas. The programme coverage can also be improved greatly through an optimization process. This can be achieved through two general activities. Firstly, existing programmes can be extended so that internationally-operating aircraft are activated for reporting outside the national areas or regions that tend to be restricted by national programme constraints. Secondly, one can enhance the capabilities of programmes to control data output through the wider development and implementation of automated data optimization systems. Such systems, whilst allowing the efficient growth of the programme outside and across international boundaries with appropriate agreements in place, will also offer the potential to utilize the AMDAR system as an adaptive observing network (capability to change the reporting regime to serve the changing purposes of programme areas).

Action G17

Action: Improve AMDAR coverage over areas that currently have poor coverage, especially within Regions I and III, focussing on the provision of data at airports in the tropics and southern hemisphere where vertical profiles are most needed to complement current radiosonde data coverage and its likely evolution.
Who: NMSs, NMHSs in collaboration with commercial and other airlines, Regional Associations. CBS and AMDAR Panel to lead the action.
Time-scale: Continuous
Performance indicators: Number of airports where AMDAR measurements are taken. Amount of vertical profiles and AMDAR data in general, measured by the usual indicators of current AMDAR programmes.

Action G18

Action: Extend the AMDAR Programme so as to equip and activate more internationally-operating fleets and aircraft (i.e. fleets and aircraft flying to and between international airports outside the country of origin) and extend the use of data optimization systems in support of improved upper air observations coverage and efficiency, and also the adaptive functionality of the system.
Who: NMSs, NMHSs in collaboration with commercial and other airlines, Regional Associations, CBS and AMDAR Panel. CBS and AMDAR Panel to lead the action.
Time-scale: Continuous
Performance indicators: The number of airports where AMDAR measurements are taken and number of vertical profiles per day at each airport. The number of international airlines and aircraft equipped to provide AMDAR observations. The adaptability of the AMDAR programme.

Action G19

Action: Given the nature of the aircraft observing system as an increasingly critical and basic component of the Global Observing System, seek to establish agreements with airlines and the aviation industry to ensure that the system, infrastructure, data and communications protocols are supported and standardized within relevant aviation industry frameworks so as to ensure continuity and reliability of the system.

Who: NMSs, NMHSs in collaboration with national and other airlines and aviation industry, Regional Associations, CBS and AMDAR Panel. CBS and AMDAR Panel to lead the action.
Time-scale: Continuous
Performance indicators: Agreements made with aviation industry partners and organizations.

Humidity sensors are now used operationally on an increasing number of aircraft both in the USA and Europe, and it is critical and strategic to continue this development in order to converge to systems which measure humidity as well as air pressure (pressure altitude), temperature and wind as do radiosondes. Such an extension will provide an increased opportunity to restructure the upper air observing systems for efficiency and improvement in coverage.

Action G20

Action: Continue the development and operational implementation of humidity sensors as an integrated component of the AMDAR system to ensure that humidity data is, processed and transmitted in the same way as wind and temperature.
Who: NMSs, NMHSs in collaboration with commercial and other airlines and WMO commissions (CBS, CIMO) and AMDAR Panel. CBS and AMDAR Panel to lead the action.
Time-scale: Continuous.
Performance indicators: A number of aircraft providing humidity data in real-time.

The lower cost of aircraft observations in comparison to the radiosonde information as well as the reduced reliance on ground-based systems and infrastructure make it an ideal candidate system for rapid and reliable expansion of upper air observations for developing countries in support of local, regional and global data users. Such an expansion should be undertaken in parallel with the necessary development action to facilitate the provision and utilization of data.

Observations of turbulence and icing are also made on some aircraft and it is desirable to expand this capability of the AMDAR system with these parameters in support of aviation operations and safety as well as other meteorological applications.

Action G21

Action: Enhance and extend the capability to report observations of atmospheric turbulence and icing variables as an integrated component of the AMDAR system and in line with the requirements of the relevant programme areas and data users.
Who: NMSs, NMHSs in collaboration with airlines and WMO TC (CBS, CIMO) and AMDAR Panel, RAs. CBS and AMDAR Panel to lead the action.
Time-scale: Continuous.
Performance indicators: A number of aircraft providing atmospheric turbulence and icing data in real-time.

AMDAR systems for smaller General Aviation aircraft, which usually involve the deployment of a sensor and communications package, have been tested in some areas and on a limited number of aircraft. However, due to the application of a different data policy, data from these systems are not currently used in full operational mode and not made available to data users on a global basis in real time. These aircraft tend to fly and generate level data in the middle troposphere whilst operating over shorter regional flight legs. This type of observation would be very useful for regional and local purposes and could also contribute to optimizing global data coverage. Priority should be placed on equipping aircraft operating on, to and out of isolated islands and remote sites where radiosonde observations are not available, e.g. deserts, islands and the Arctic.

Action G22

Action: Develop and implement operationally AMDAR systems which are adapted to small aircrafts operating at the regional scale and flying at low altitude in the troposphere.
Who: Airlines operating small aircraft, NMSs, NMHSs in collaboration with Regional Associations, CBS and AMDAR panel. CBS and AMDAR Panel to lead the action.
Time-scale: Continuous

Performance indicators: number of small aircrafts providing AMDAR observations operationally in real-time.

Atmospheric composition measurements for several species, aerosols and volcanic ashes are measured on some aircraft, but more in research than in operational mode. The actions related to atmospheric chemistry are documented in section 5.4.4.