- INTAR –
Networking of Radars for Small-, Meso-, and Large-Scale Atmosphere Observations

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In January 2005 a Colloquium on an "International Network on Tropical Atmosphere Radars – INTAR - " was held at the Sri Venkateswara University (SVU) in Tirupati and the National MST Radar Facility (NMRF) in Gadanki, India. The purpose of this Colloquium was to initiate a functional collaboration and coordinate a regular process to establish a scientific and operational program for studies of the tropical atmosphere, mainly by means of radars and related instruments.

This project INTAR covers several disciplines, from meteorology, atmospheric dynamics to radar techniques and international management. Besides dealing with the synergy of these disciplines it in particular covers atmospheric interaction and coupling processes.

It is considered that the tropical atmosphere plays a fundamental role in determining global weather and climate. On the planetary scale insulation in the tropics is a principal driver of the global circulation. Clouds and convection are key actors in the regional and global energy and water cycles. Equatorial waves and the Madden-Julian Oscillation (MJO), which are fundamentally linked to tropical convection, are responsible for much of the variability on intra-seasonal time scales. These waves play an important role in linking the tropics and extra-tropics and in the dynamics of the quasi-biennial oscillation (QBO) of the tropical lower stratosphere. Deep convection generates gravity waves that transport energy and momentum up into the middle and upper atmosphere. Tropical cyclones (hurricanes and typhoons) are initiated in the Intertropical Convergence Zone (ITCZ) causing major damage from strong winds, torrential rain and flooding.

Important roles are played by the inter-annual and decadal variability associated with El Nino and the Southern Oscillation (ENSO and the North Atlantic Oscillation (NAO). In the western Pacific the ENSO interacts with the Indian Ocean Dipole Mode, which results in not yet fully understood variations of monsoon activity. In the eastern pacific El Nino causes main changes in the dynamics linking the Indo-Pacific sector and the South-American sectors with the tropical atmosphere and the global climate system are very complex with air-sea interaction and scale interactions playing a major role. Indeed, sea surface temperatures and land surface conditions set the boundary conditions for global climate dynamics. Convection and associated scale interactions and feedbacks are crucial in defining the large-scale response of the atmosphere to changes in surface conditions. Physical and dynamical processes linked to convection are fundamental in determining the regional and global water cycle that governs the availability of water for agricultural purposes and human consumption.

Diverse observations come from surface instruments, ships, buoys, aircraft, satellites, Doppler weather radars, radar wind profilers and balloon-borne sensors. The collection, dissemination and assimilation of data into models from these platforms is a major activity of national meteorological services. Collectively, such observations together with state-of-the-art models provide an integrated view of the evolving atmosphere. However, current numerical models and supporting observations are incapable of providing a complete picture of the continually evolving complex atmosphere. For example, the distribution of observing platforms is very non-uniform around the globe and large-scale numerical models are incapable of adequately representing convection.

A few observatories known as stratosphere-troposphere radars (ST radars) and MST radars exist near the equator measuring winds, waves, turbulence and stability in the troposphere and lower stratosphere. These instruments and facilities make observations that lead to improved understanding of tropical meteorology and deliver input to regional and global atmospheric models. A larger coordinated network of such observatories together with ancillary observations would further advance understanding and provide valuable data to support climate research and weather forecasting. The terms and plans of this international project will finally be discussed.