Plinius Conference Abstracts,
Vol. 11, Plinius11-183, 2009
11th Plinius Conference on Mediterranean Storms

New opportunities for the study of Mediterranean storms: the unique capabilities of the Global Hawk aircraft

F. Cairo (1), R. E. Curry (2), and B. Carli (3)

(1) Istituto di Scienze dell'Atmosfera e del Clima, CNR, via Fosso del Cavaliere 100, Roma, 00119, Italy – f.cairo@isac.cnr.it, (2) NNASA Dryden Flight Research Center, P.O. Box 273, Edwards, CA 93523-0273, USA – robert.e.curry@nasa.gov, (3) Istituto di Fisica Applicata "Nello Carrara", CNR, Via Madonna del Piano, 10 - 50019 Sesto Fiorentino, Italy, – b.carli@ifac.cnr.it

Airborne measurements have often played a pivotal role in unravelling critical processess and improving our understanding of the genesis and development of atmospheric disturbances. The availability of innovative aerial platforms now opens new perspectives for the scientific research.
One of these platforms is the high altitude long endurance unmanned aircraft Global Hawk (GH), which has unique capabilities in terms of altitude, range of operation, diurnal coverage and flexibility.
The GH has an endurance of 31 hrs, a service ceiling of 20000 m and can host a payload of 680 kg. Since it can operate at altitudes close to the boundary conditions of radiative processes, can follow the diurnal variation of aerosol and clouds, can rapidly deploy new instruments with space-time coverage comparable to space-borne ones, it is a platform which is at the same time complementary and competitive with satellites.
In fact it combines the short time deployment of aircraft instruments with the global coverage of satellite instruments, while its flight altitude allows better spatial resolution than a satellite and its endurance provides a sufficiently broad overview at a scale relevant for sinoptic meteorology studies.
NASA has recently acquired two of such unmanned high altitude aircraft to address a variety of Earth Science objectives, and Italy has a decade long experience of stratospheric in-situ and remote sensing science missions using the Russian M-55 "Geophysica" high altitude piloted aircraft. There is a common interest in a bilateral cooperative program in climate change science using the GH.
The collaboration between NASA and Italian scientific institutions may offer the opportunity of deploying the GH over the Mediterranean Basin.
The Mediterranean area is of particular interest under many respects. As instance, it would be of great interest to measure, when possible, the 3-dimensional structure and evolution of the aerosol content over the Mediterranean, with particular emphasis on Saharan Air Layer (SAL) events. The frequent occurrence of such events, influencing the development of heavy precipitation systems in the region, as they do for hurricane genesis in the Atlantic west of Africa, promts the study of their impact on microphysical processes during precipitation formation; on lower and upper atmosphere destabilization stemming respectively from the production of a deep mixed layer of near zero potential vorticity and from the associated capping warm layer; and on their radiative impact leading to an enhanced heating of the lower troposphere due to solar radiation absorption by the Saharan dust itself.
A different area of investigation would be the study of origin and fate of strong mesoscale disturbances originating in the area during the end of Summer and Fall period. In fact, while most Mediterranean storms have classic baroclinic origins, there are intense mesoscale convective storms which form and evolve into warm core structures deriving their energy directly from the warm sea surface in a fashion similar to tropical cyclones, e.g. hurricanes and typhoons. This type of tropical-like storms have been named Medicanes: understanding their origin and development is of utmost importance in view of their potential changing response in relationship to expected climate changes since it has been speculated that these Mediterranean storms would become more frequent and more vigorous in the near future due to the Mediterranean sea-surface temperature increase that is (probably) already occurring because of global warming. Remote sensing instrumentation (radars, microwave radiometers, lidars) is a primary tool to address this issue from a high-flying platform, to improve the understanding of the thermodynamics, dynamics, and microphysics of clouds, by measuring the evolution of their 3-dimensional thermodynamical, dynamical, and microphysical structures and the 3-dimensional structure and evolution of the

aerosol content. The long endurance of the GH will allow the study of cloud systems following their evolution over very large areas.
An overview of these new opportunities, mission goals and strategies will be hereby given and discussed.