### 3.4 TYPICAL WEATHER SCENARIOS FOR SAFARI 2000

Michael de Villiers and Roelof Burger, SAWB

Typical weather scenarios were presented through the use of Meteostat imagery being shown in a temporal loop. Imagery for the period August 1999 was selected for the demonstration. (These images will not be included in these proceedings but are obtainable from the SAWB.) It was indicated that the synoptic patterns which characterised this period may not necessarily be typical of the August month in general.

Anticyclonic conditions dominated though much of August 1999. Average airflow during August 1999 reflected the presence of the continental high pressure with its core over the northwestern part of the region at the surface. At 700 hPa the core of the anticyclone was situated over the central part of the region, whilst at 500 hPa the core was located over Namibia and Angola. On occasions when cold fronts passed over the subcontinent, strong NW airflow was observed to occur ahead of the cold front, with slightly weaker SW airflow prevailing to the rear of the front.

## SESSION 4: MISSION PLANNING
## CHAIR: BOB SWAP, UVA

### 4.1 GENERIC AIRCRAFT FLIGHT PLANS TO MEET SAFARI 2000 NEEDS

**Bob Swap, UVA**

Given the main aims of investigating (i) biomass burning, (ii) industrial pollution, and (iii) cloud-aerosol interactions, the following potential flight path types were indicated:

- Gyre multi a/c wall-volume flights
- Gyre single a/c probe
- Fire flights
- Satellite underflights
- Aircraft (ER-2) underflights
- Coastal stratus flights

Attention was drawn to the map indicating the location of ground-based activities (see Figure 21). It was emphasized that the location of these activities be taken into account in the flight planning exercises. What was needed for the IFC was a map comprising specific latitudes and longitudes of sampling locations and information regarding the instruments to be operational at these locations during the IFC. . The AERONET sampling points were recommended as potential anchor points for flight paths (Figure 27). Flight paths should attempt to cover as many of the sectors as is possible. Such paths must be planned with the relevant synoptics in mind

The confirmed bases at Pietersburg and Windhoek were acknowledge and attention drawn to the proposed bases at Lusaka and Kasane. During the meeting a strong desire was expressed that aircraft operate out of Kasane. The nominal ranges of the various aircraft operating during Safari 2000 are illustrated in Figure 28, with the Aerocommanders and the ER-2 flying out of Pietersburg, the CV-580 out of Kasane, and the C-130 out of Windhoek. Examples of operational areas with land and off-shore focuses are presented in Figures 29 and 30, respectively.

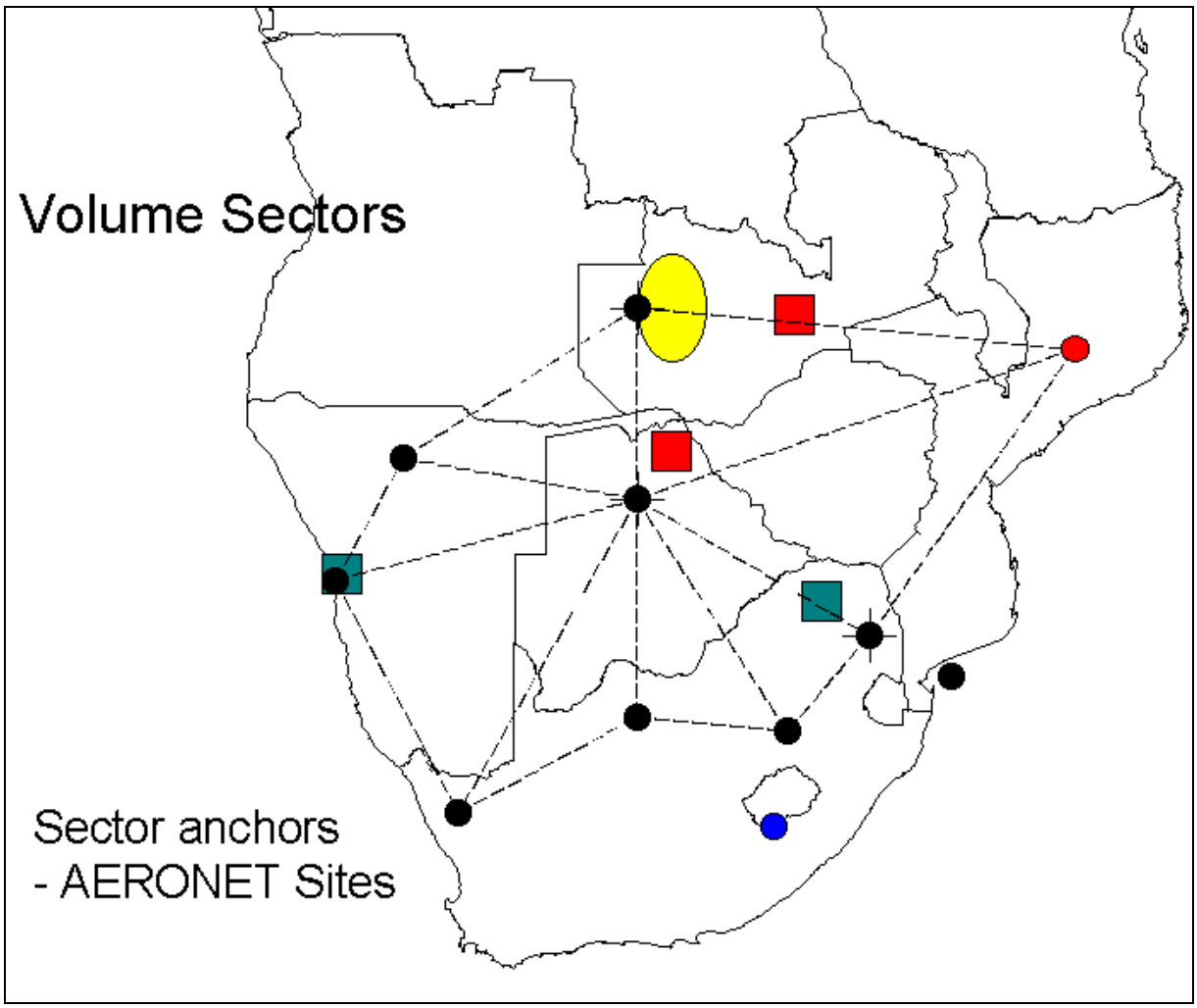


**Figure 27. Recommended sectors to receive attention in flight planning with AERONET sites being used as the basis for defining anchor points.**

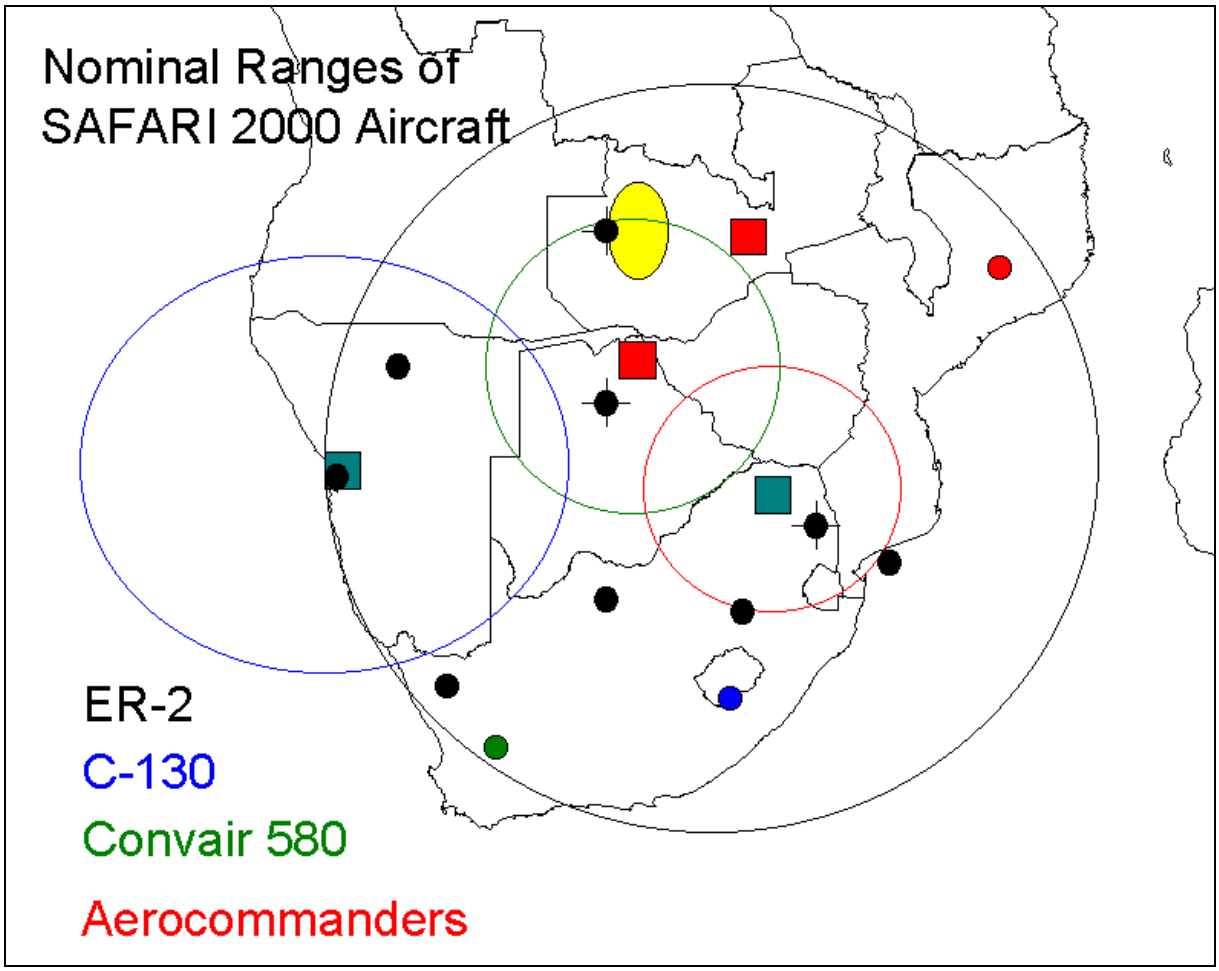


**Figure 28. Nominal ranges of various aircraft during the Safari 2000 IFC in August - September 2000. (Aerocommanders and ER-2 based at Pietersburg, CV-580 at Kasane, and UK Met Office C-130 at Windhoek.)**

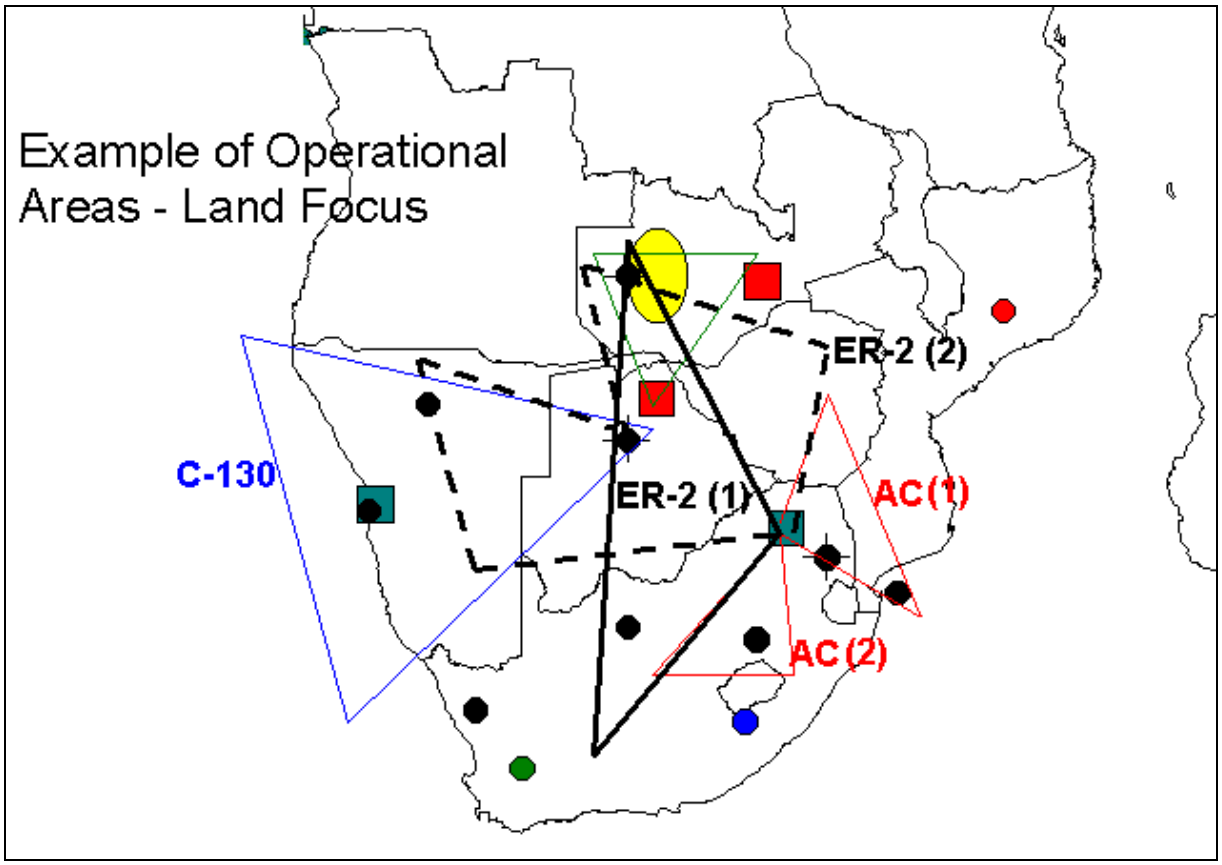


**Figure 29. Example of possible flight paths of SAWB's Aerocommanders (AC), UK Met Office's C-130 and NASA's ER-2 with a land focus.**

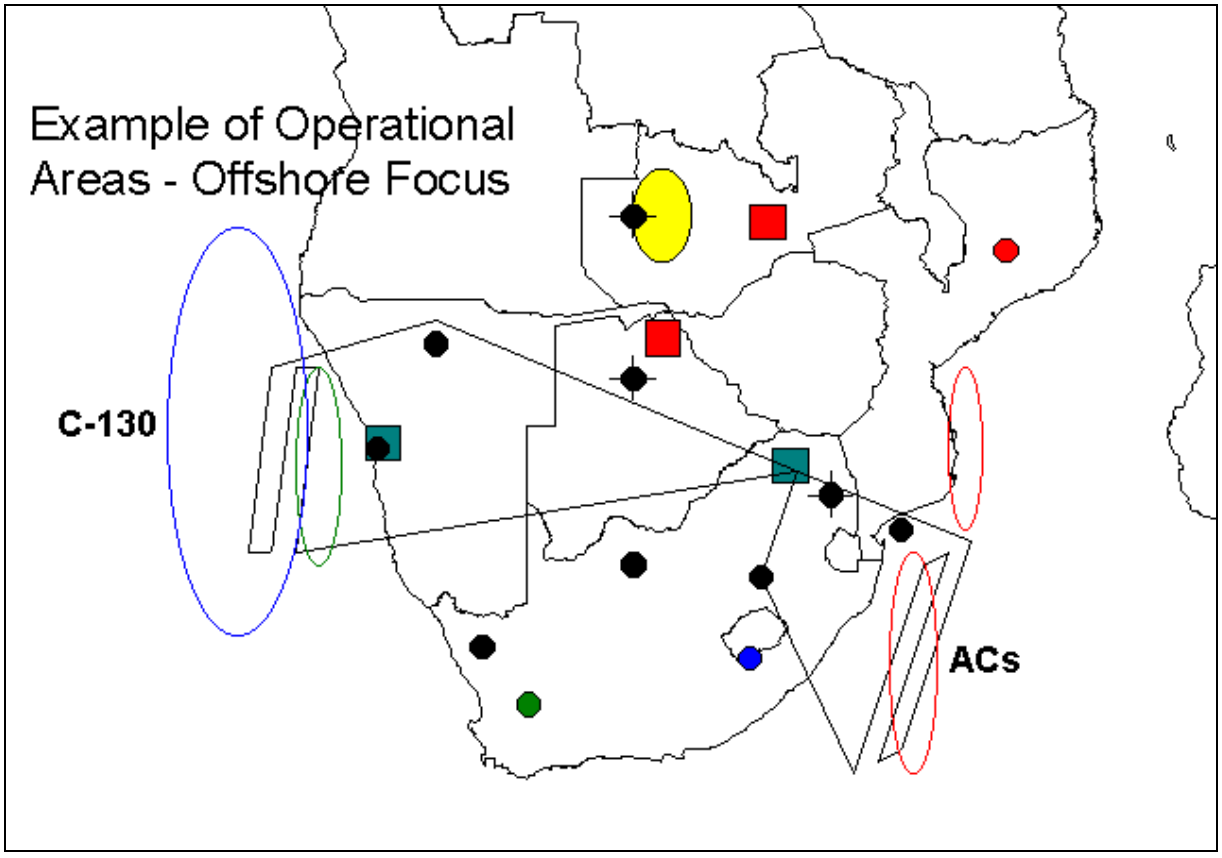


**Figure 30. Example of possible flight paths of UK Met Office's C-130 and the SAWB's Aerocommanders with an off-shore focus.**

**Flight Planning taking into account Overpasses**

Close attention must be paid to swath widths during the flight planning exercises. MOPITT personnel was inflow and outflow measurements. In situ flights are currently planned off the west coast. MOPITT personnel want measurement over the east coast to facilitate closing the loop.

Measurement of biomass burning, industrial pollution and offshore cloud needs to be balanced with the overpasses of MODIS, MISR and MOPITT. The types of flight profiles most suited to such overpasses need also be determined (e.g. saw tooth).

Steve Platnick (NASA GSFC) and Jim Drummond (University of Toronto) are to come up with the cycles of the various overpasses (16 day cycle of overpasses).

**DAY 3**

## 4.2 PREPARATION FOR MISSION PLANNING: EMPHASIS ON SCIENCE GOALS AND MISSION PLANNING APPROACH

**Bob Swap, UVA**

In the flight planning exercises, teams were asked to remember the Safari 2000 science goals and to plan accordingly. These goals were listed in two classes:

(1) Emissions:
- Biomass burning (widespread, episodic, dependent on meteorology)
- Industrial (static source, constant, independent of meteorology)
- Mineral (very dependent on meteorology)
- Biogenic (important for Zambia and lowveld which do not usually get early rains - can fly through clean air and look at impacts on vegetation)

(2) Transports and Transformations:
- Wall flights across the gyre - 'eularian' stacked flights; parallel flights
- Transit flights - 'lagrangian' type flights

**The Mission Planning Approach to be adopted is as follows:**

**AFTERNOON BEFORE MISSION:**

(1) Determine aircraft status (ER-2, CV-580, JRA, JRB, C-130)
(2) Meteorology Report - standard forecast
(3) Satellite fields analysis - determine presence and location of clouds and fires
(4) Review context in term of satellite overpasses (determine optimum locations and look angles)
(5) Science discipline leads have been nominated
- Land surface / burn scar
- Land vegetation / BRDF
- Atmosphere aerosol / clouds / radiation (Peter Hobbs)
- Atmospheric chemistry (Bruce Doddridge, Paul Novelli)

(6) Mission proposals
(7) Mission discussions
(8) Mission decisions

(back to back if necessary)

**DAY OF MISSION:**

(1) ER-2 and project lead scientist to meet 4 hours prior to ER-2 takeoff with Meteorological Officer.

(2) Mission decision made - go / no go based on latest meteorology.

## 4.3 PRESENTATION OF TYPICAL SCENARIOS

Brief for this session: for each scenario the pertinent people would present the synoptic charts, trajectories, satellite imagery and satellite overpass information relevant to a particular synoptic circulation type. Following which, flight planning team would meet to determine the most suitable flight paths taking into account the science goals in terms of (i) emissions and (ii) transports and transformations to be investigated.

### 4.3.1 SCENARIO 1: 16 August 1999 - High Pressure Prevails over Subcontinent

#### *4.3.1.1 Synoptic Scale Circulation and Vertical Moisture Profiles*
**Mark de Villiers, SAWB**

Wind, temperature and pressure plots and vertical profiles were shown for 16 August 1999 demonstrating conditions occurring as a result of a high pressure (HP) prevailing over the subcontinent. The spatial distribution of surface pressure illustrated in Figure 31 reflects the location of the HP's core over the easternmost parts of the subcontinent. Temperature and wind profiles for 25°S (which coincides with the location of Pietersburg) were extracted for review (Figure 32). The location of the HP core (at 25°S lat) between 27°E and 30°E at the surface, and the anticyclonic airflow around this core is evident. Off-shore flow dominates over the west coast, with on-shore flow occurring over the east coast. Cooler temperatures ahead (to east of) the core are indicative of the influx of moist maritime airflow over the subcontinent.

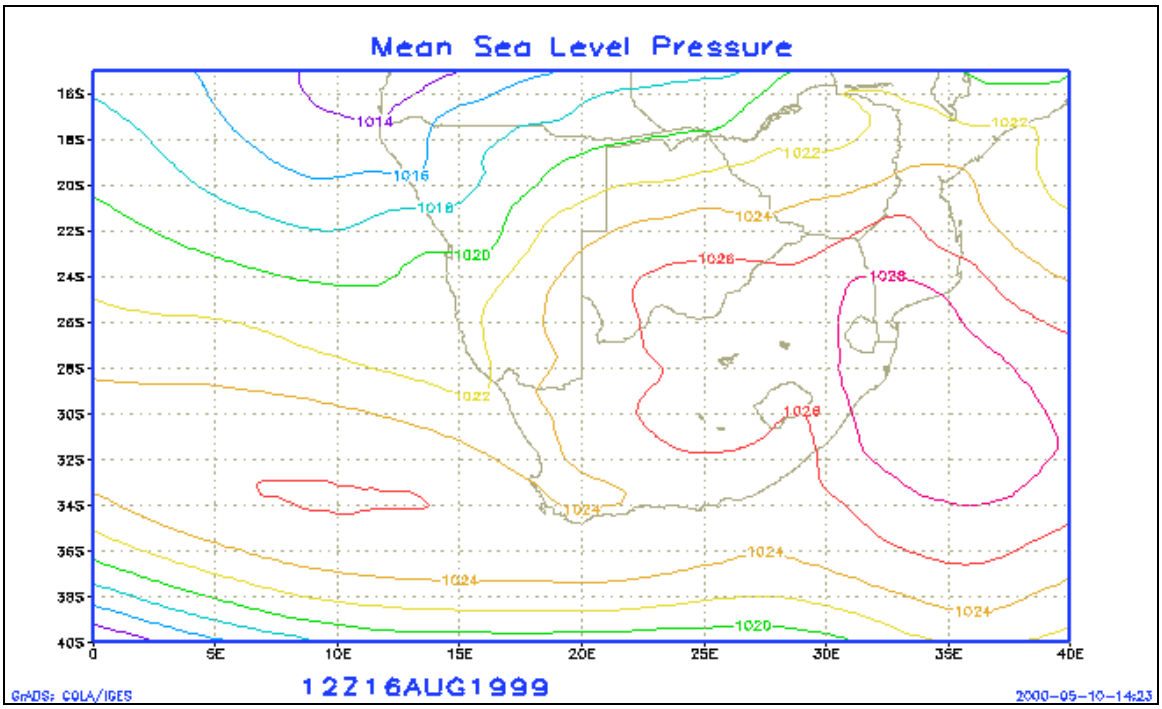


**Figure 31. Surface pressure observed on 16 August 1999.**

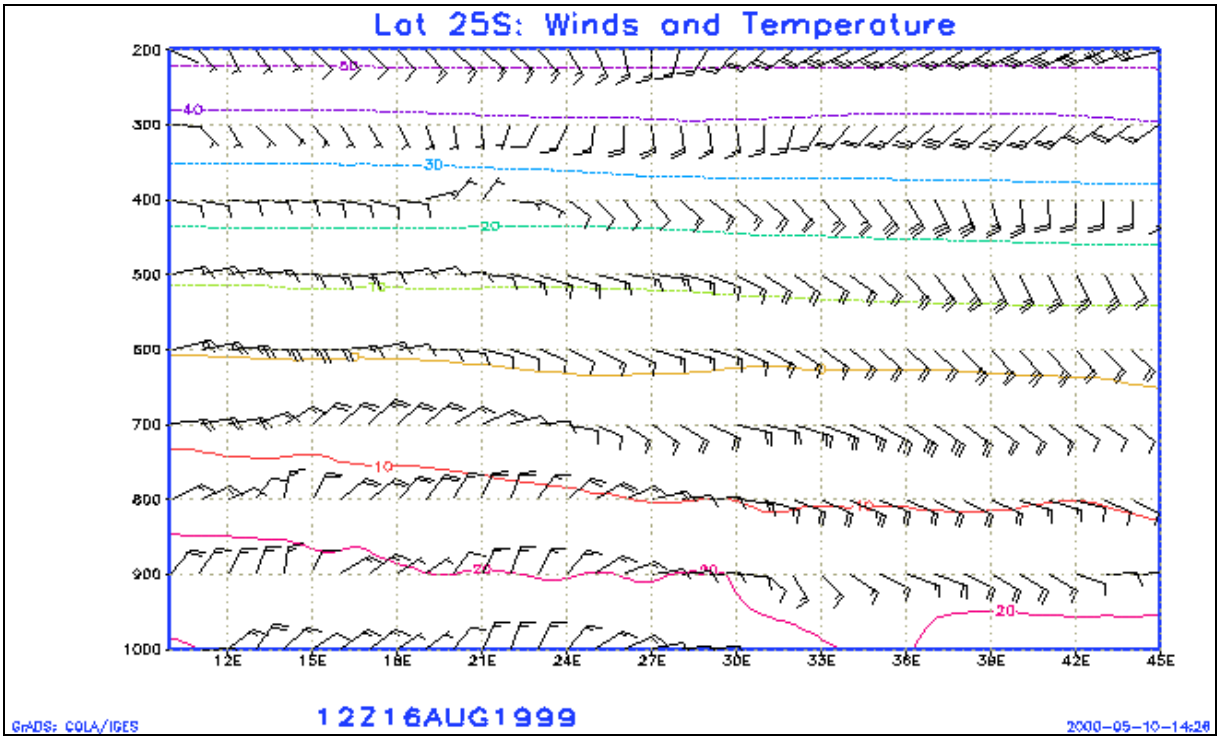


**Figure 32. Vertical profile of wind and temperature across the subcontinent, as taken along 25°S latitude as observed on 16 August 1999.**

The core of the HP slopes towards the NW with height as is evident from the analysis of the wind field at 700 hPa, where the core of the HP is located over the central interior (Figure 33). The depth of the anticyclonic flow over the subcontinent is clearly apparent.

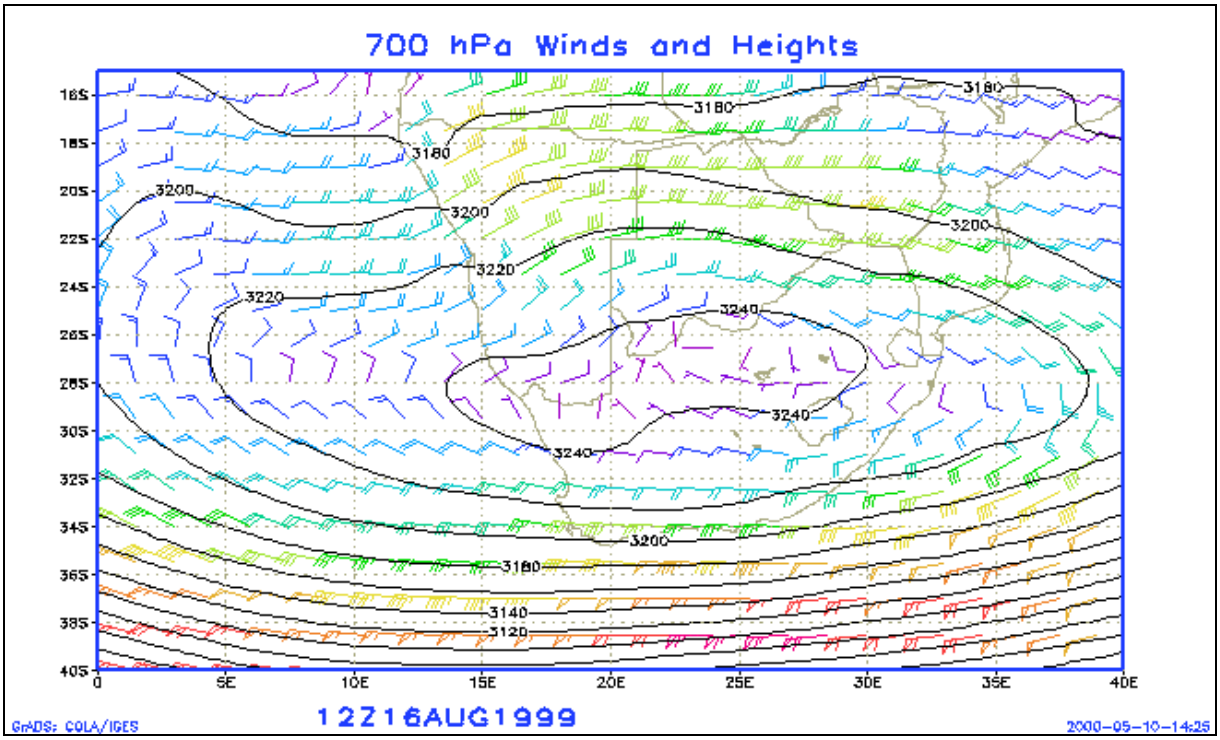


**Figure 33. Wind vectors and geopotential heights plotted for the 700 hPa level for 16 August 1999.**

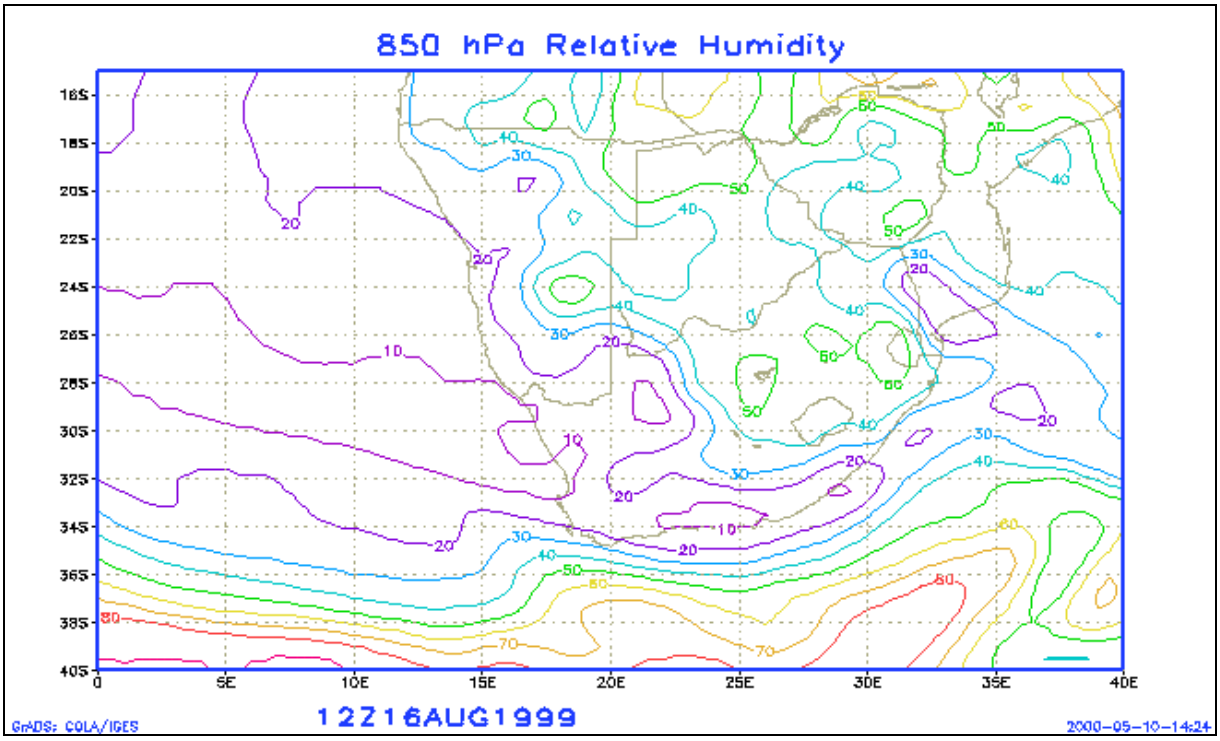


**Figure 34. Relative humidity (%) observed at the surface on 16 August 1999.**

The higher relative humidity which occurs to the east of the HP core, which is due to the influx of moist marine air, is evident from the analysis of the vertical RH profile presented in Figure 35. Much drier conditions are experienced to the west of the HP core, with moisture having been lost during the flow of air over the land.

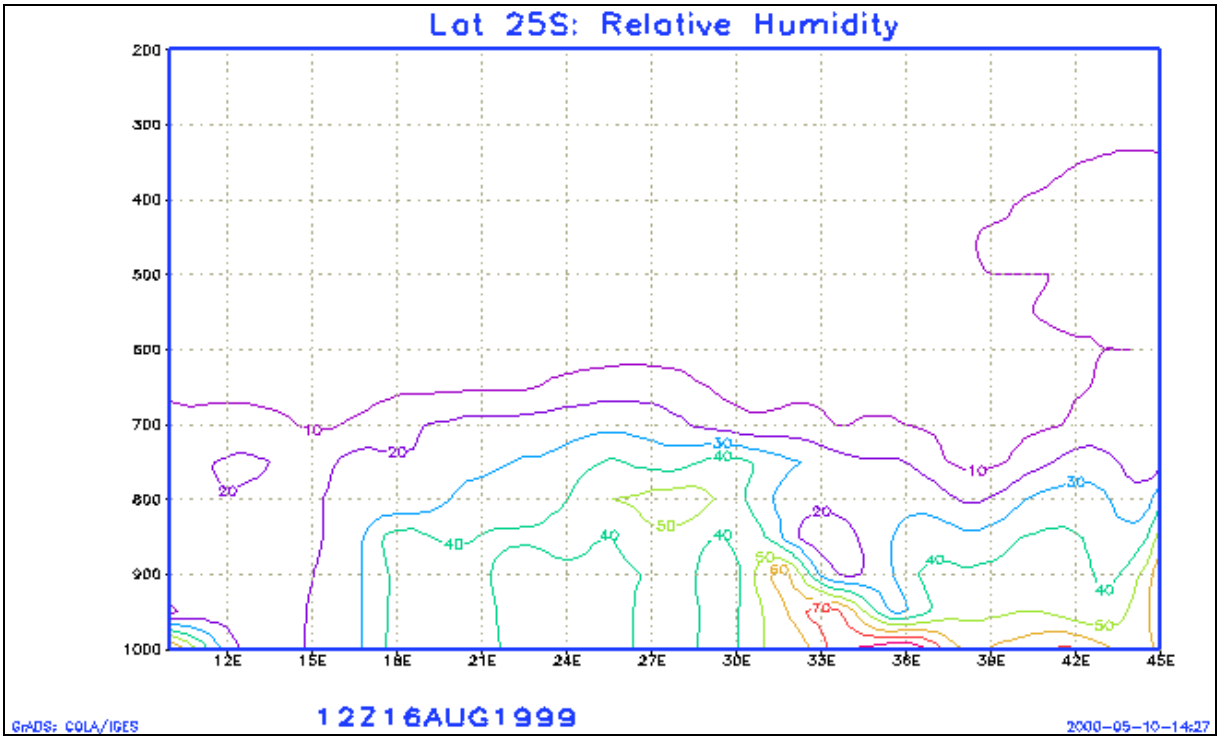


**Figure 35. Vertical profile of relative humidity (%) across the subcontinent, as taken along 25°S latitude as observed on 16 August 1999.**

### *4.3.1.2 Trajectory Modelling*

**Tali Freiman, SAWB**

Two day forward and two day back trajectories were run for the region to demonstrate likely paths to be followed by air parcels on 16 August 1999. Very stable and dry conditions prevailed on 16 August, as is evident from the plots presented in the previous subsection. The back trajectories run for Mongu clearly reflect the on-shore flow of moist air over the east coast, with the off-shore flow over the west coast being evident from the forward trajectories run for this site. Trajectories were also run using Pietersburg (Figure 36), Windhoek and Springbok as starting points. The ascent and descent of the trajectory, indicated by pressure level values given along the trajectory, should also be taken into account in the flight planning. Trajectories therefore indicate points, in both the vertical and horizontal, that flights may be able to intersect with specific air parcels is flight planning is done effectively.

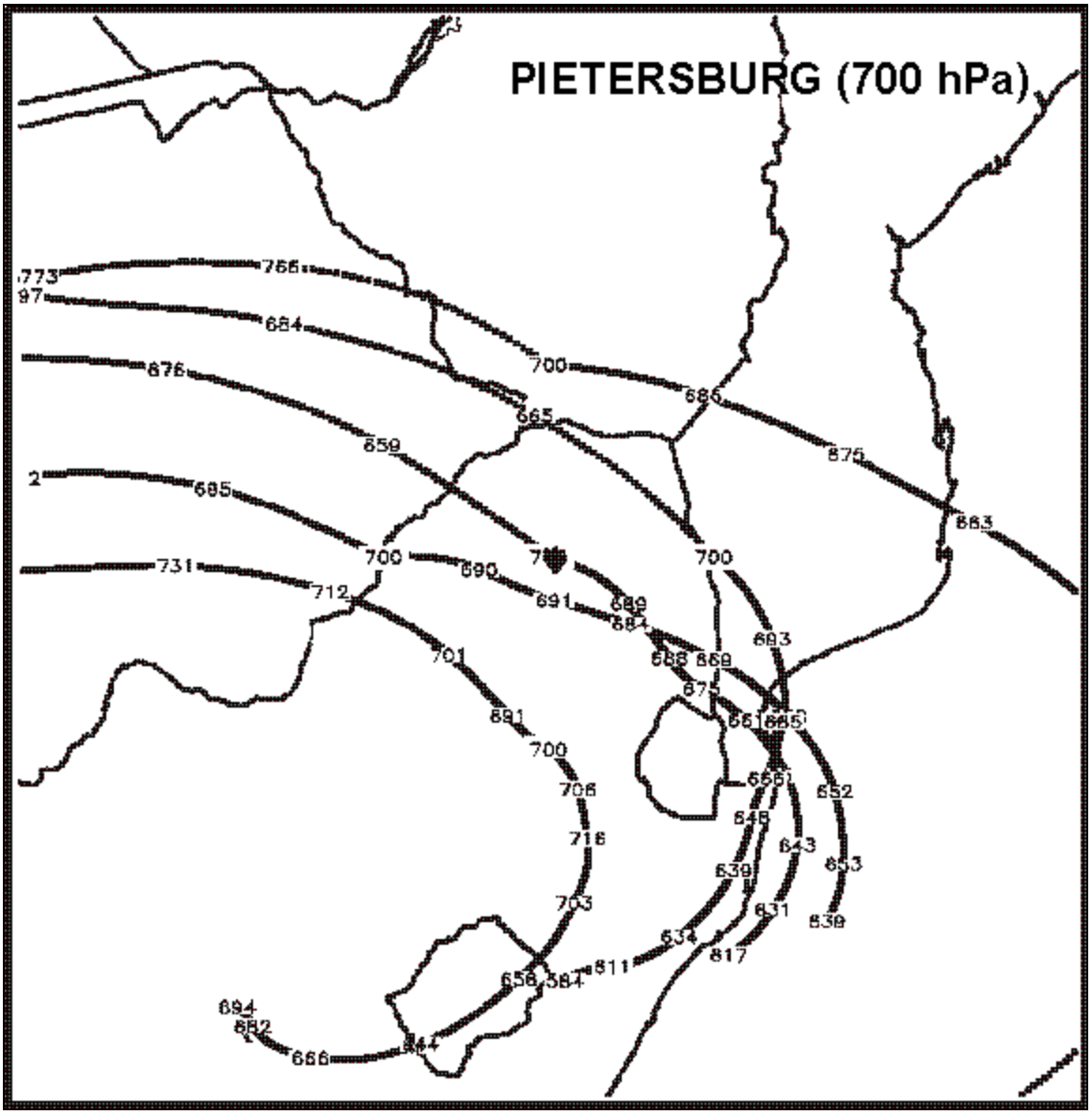


**Figure 36. Backward and forward trajectories for Pietersburg for 16 August 1999.**

One of the main issues in trajectory modelling is WHERE the trajectories are run from. Fire locations would need to be determined (Jackie Kendal and SAWB).

**Questions and Answers:**

Q Will the trajectories be run for multiple points to determine their validity?

A Trajectories can be run from points which are, for example, 0.5° apart of less. Too much divergence between the trajectories may indicate a break down of the model assumptions

(exception to this is when systems such at the ITCZ result in widely divergent airflow over short distances.)

Recommendation: That multiple points be run and the validity of trajectories evaluated as part of the planning process.

Q Can the plume rise of fires be obtained?
A It would be possible to archive 1 km data to enable someone going back and doing post-plume rise calculations. There are not sufficient funds to do this currently.

Q In terms of fires in the Kruger National Park, should park personnel indicate renegade burns to the Safari 2000 teams?
A Yes. Lines of communication should be set up to facilitate communication between the KNP and Pietersburg.

Q Could Harry Biggs work with people from other parks in the region (e.g. Chobe, Wanke) and determine their willingness in communicating fire occurrences with the Safari 2000 team, particularly Peter Hobb who will be flying over this area?
A A fire communication person is needed in Pietersburg during the campaign to communicate with the various parks on fire occurrences.

#### *4.3.1.3 Satellite Imagery*

**Eugene Poolman, SAWB**

A series of satellite images were shown to demonstrate the amount and location of cloud cover over the subcontinent during the period 13 August to 16 August 1999. No cloud cover occurred during this period with most of the subcontinent experience fine, mild and cloud-free conditions characteristic of the predominance of high pressures over the region.

#### *4.3.1.4 Satellite Passes*

**Jim Drummond, University of Toronto**

Ground track files, including 1 week and 7 week predictions for Terra, are available from the following site:

**ftp://198.118.192.20/pub/outgoing/FDD**

The file format is as follows:

- Header line with satellite name (AM1) and the file type
- Line with time information: creation time, start time for data, end time for data

time format - yyyyddd.hhmmss - where:
yyyy - year
ddd - julian day
hhmmss - time (UCT, hours, minutes, seconds)

- several thousand data lines
- time, orbit number, latitude, longitude (0 to 360 increasing eastwards from prime meridian)

The Terra ground track image presented for Scenario 1 is given in Figure 37. Such images will be necessary to demonstrate the swaths of MODIS, MISR, MOPITT, and LANDSAT, etc. TOMS has a wide enough swath width to cover the region, making it unnecessary to modify flight paths to fit in with the TOMS swath.

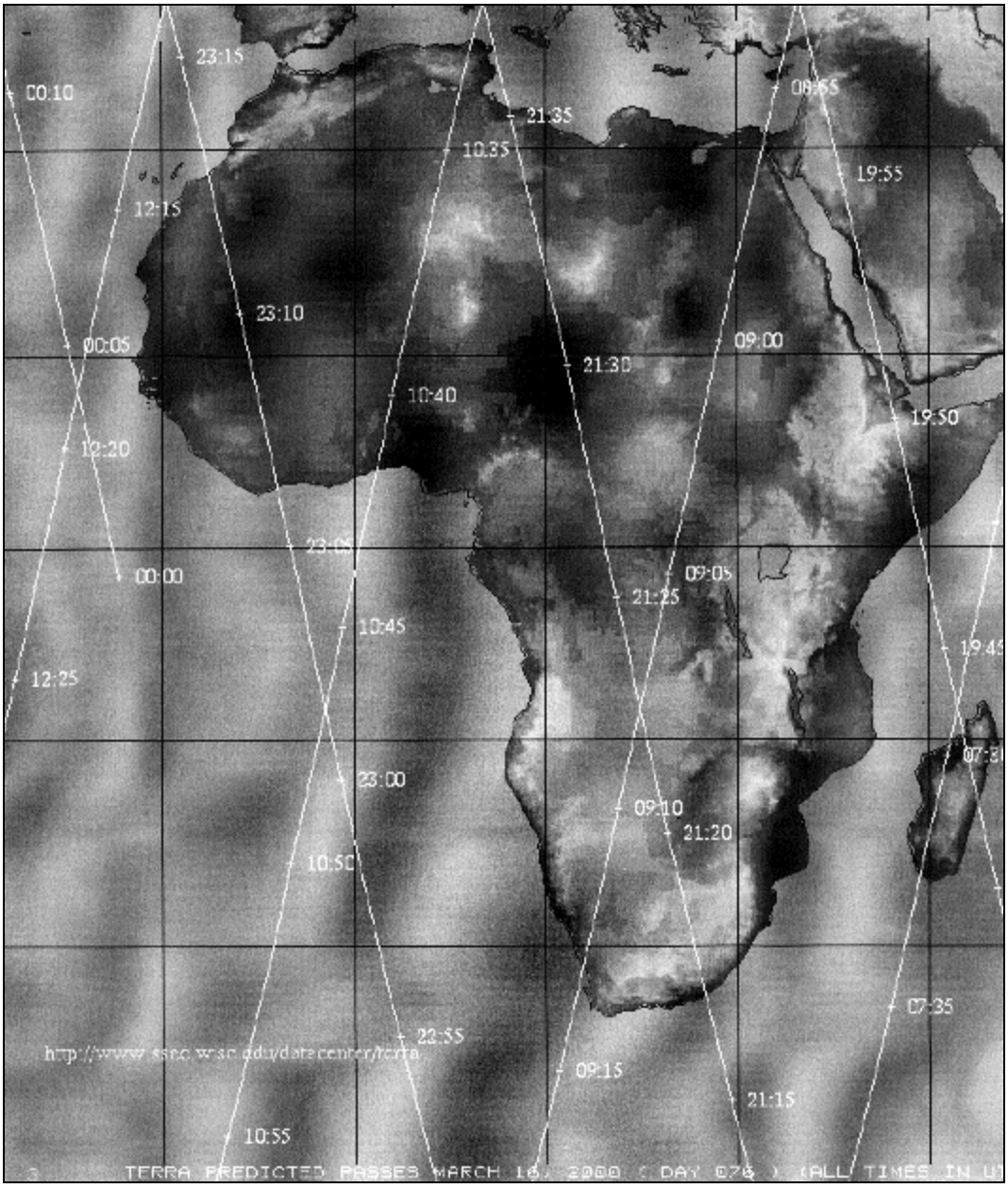


**Figure 37. Image reflecting Terra ground track image for Scenario 1.**

### *4.3.1.5 Flight Paths Planned*

**Steve Platnick - ER-2 Flight Planning**

The path planned for the ER-2, given the meteorological conditions prevalent on 16 August 1999, is sketched in Figure 38. The small MISR swath width determined the take-off time. Take-off was scheduled at 09h00 to get to the area of interest before the MISR overpass at 10h00.

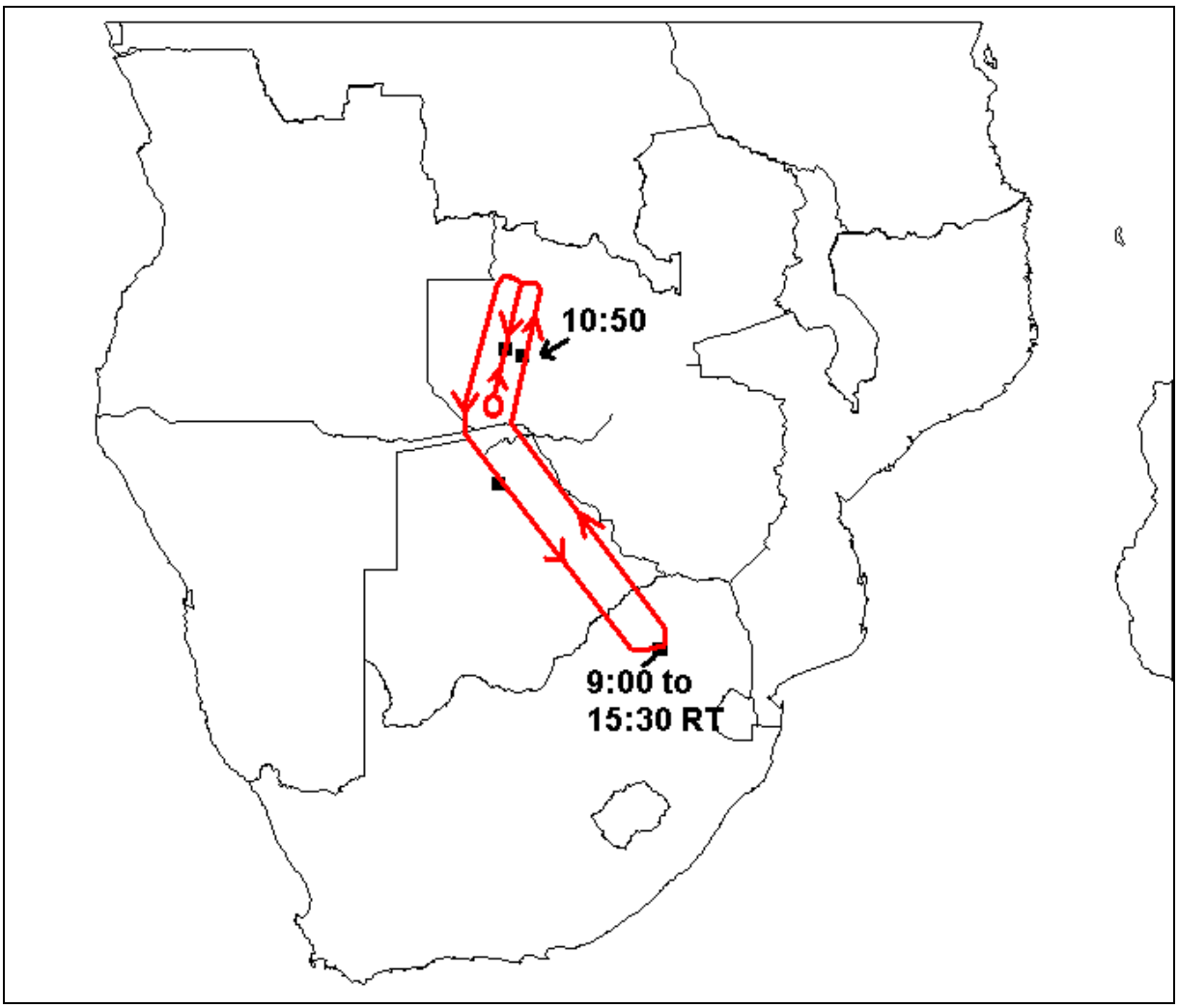


**Figure 38. Possible flight path for the ER-2 given the synoptic circulation and overpass tracks outlined for Scenario 1.**

**Peter Hobbs - Convair-580**

The team is to be based in Lusaka this week. Potential sources to be investigated and activities to be undertaken were identified as including:

- 3 prescribed burns

- flights over the Mongu tower
- coordination with the ER-2 and satellite overpasses
- copper smelting in north of the country
- Zambian box

It was decided that the impacts of pans and copper smelting was best done out of Pietersburg. Prescribed burns were given priority. The flight profile was described as comprising spiraling up in the vertical to 1500 ft, and to do horizontal tracts at different layers of interest depending on the location of the stable layers and the location of good sun photometer and other ground-based measurements.

**Issues raised by Peter Hobb's team:**

- Air to ground scientist communication (e.g. using radios - need to know the frequencies). Telephones are preferred by map not be up and running.

- More fires occur in the afternoon, but at present all flights are scheduled for the morning.

**Questions and Answers and Points raised:**

Q (asked of Darold Ward) How may fires will be set?
A Three. One morning fire, which will be coordinated with the Terra overpass. Two afternoon fires.

P If there is a lidar on the ground, it will be necessary to coordinate with Darold Ward on the ground who is responsible for setting the fires.

P In terms of spiralling over the sun photometer sites, coordination with Brent Holben would be necessary to determine if the sun photometer is working and whether additional instruments may have been added to the site. (Brent Holben has 2 phones.)

P Radio availability and frequencies should be addressed in the implementation plan.

Q Is the entire project to use UTC or South African standard time?
A UCT preferred by all participants.

**Stuart Piketh - JRA and JRB Flight Plans - Option 1**

The "High Pressure predominant over the region" synoptic situation is likely to occur 3 times during the campaign. It was therefore decided to determine more than on flight plan for this scenario, in order to facilitate the focussing on different science objectives. The assumption is made that the Convair-580 is

also based at Pietersburg during this planning period, with plans also having been sketched for this aircraft to coordinate with JRA and JRB's paths.

The first flight path is illustrated in Figure 39. This path aims to characterise: (i) the recirculation of material over the subcontinent, and (ii) biomass burning emissions from Mozambique which are transported westwards. JRA will fly towards the coast - over the sea along the east coast in a northerly direction - and return to Pietersburg. One of the main aim of this flight would be to characterise the recirculation of material. JRB would fly along a path to the west of Pietersburg, for example, to characterise the industrial pollution plume being transported from the Highveld region. The CV-580 would fly along a north-south trajectory aimed at investigating industrial emissions from copper smelting in Botswana and mineral dust generated from the Sowa pan.

There was disagreement amongst the team as to the most suitable vertical profile for the flight plan. The main focus would be to optimise the equipment aboard the various aircraft (the equipment differs between aircraft). The three possible flight patterns are also illustrated in Figure 39.

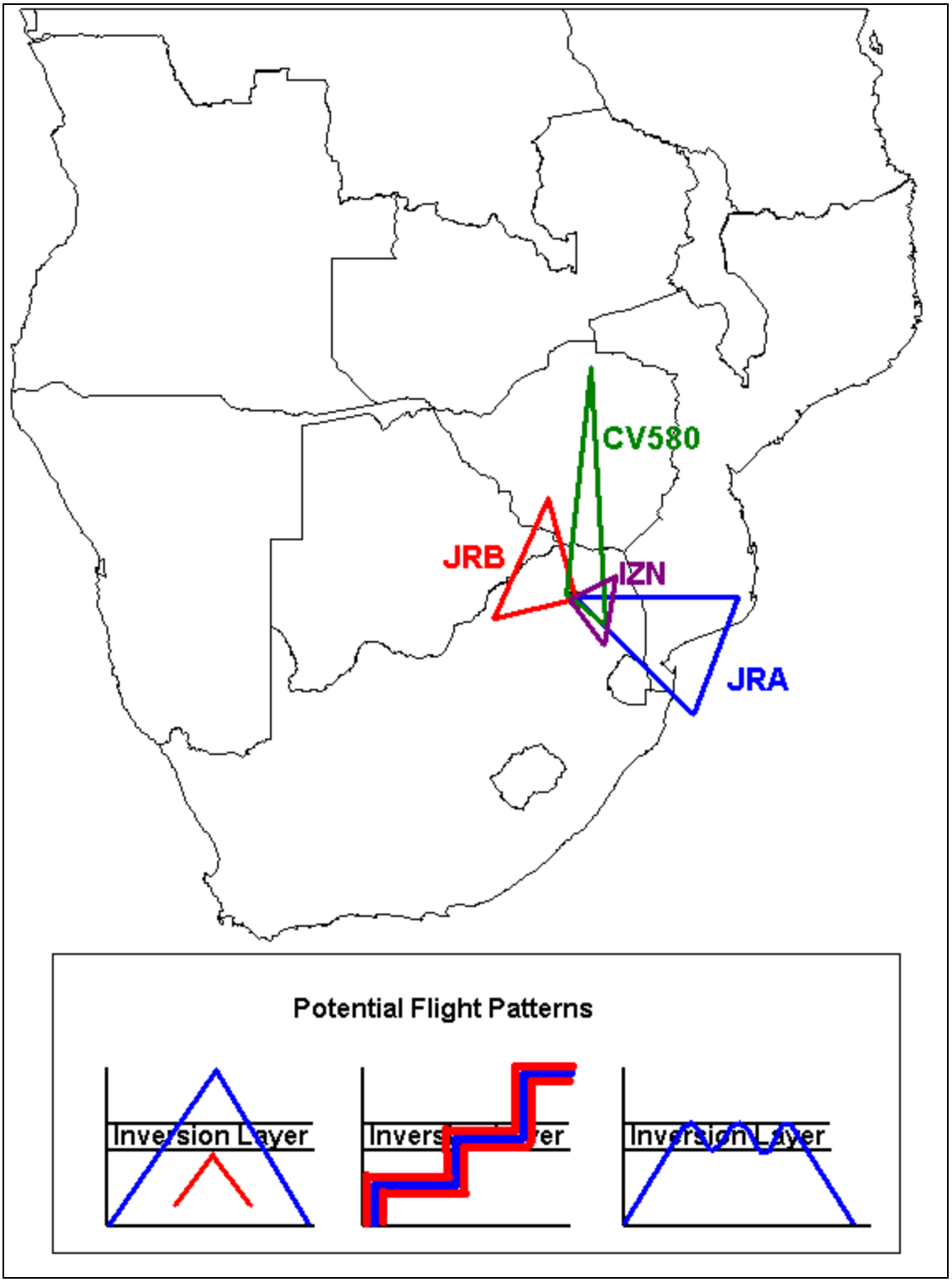


**Figure 39. First possible flight path for JRA, JRB and the Convair-580 given the synoptic circulation and overpass tracks outlined for Scenario 1.**

**Question and Answers:**

Q Does this flight path satisfy Paul Novelli's requirements?
A Yes.

**Stuart Piketh - JRA and JRB Flight Plans - Option 2**

Should the "High Pressure predominant over the region" synoptic situation occur again the flight paths sketched in Figure 40 would be proposed. JRA and JRB would both fly northwestwards from Pietersburg, covering as wide a consecutive area as possible. The aim of their flights would be to investigate wind blown dust (e.g. from Sowa pan). The Convair-580 would fly along a N-S orientated path. The aircraft would be underflying the return flight of the ER-2 outlined previously.

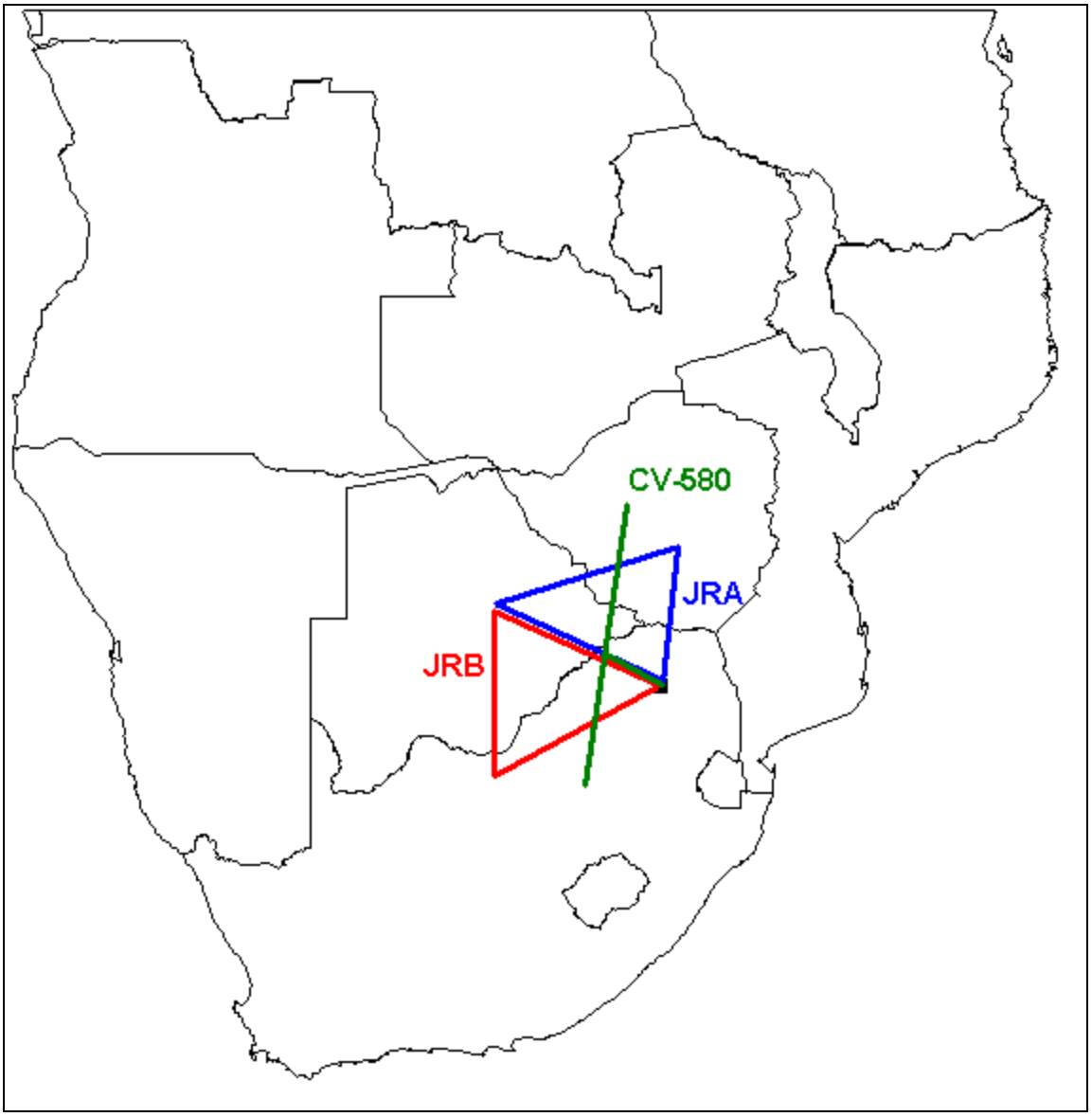


**Figure 40. Second possible flight path for JRA, JRB and the Convair-580 given the synoptic circulation and overpass tracks outlined for Scenario 1.**

**Questions and Answers:**

Q What time of the day would the flights be scheduled for?

A Coordination with the ER-2 team would be necessary in this regard. The flight over the industrial area should preferably take place in the early morning prior to the dissipation of the inversion layer.

**Peter Francis - UK Met Office C-130 Flight Plans**

Three possible flight paths were identified:

(1) Take-off from Windhoek at 08h30 local time - transit to Maun to reach there by around 10h30 local time so as to coincide with the Terra overpass - column closure over sun photometers and underflying MODIS. The flight path would be within all 3 swaths.

Questions asked of the meeting in relation to this flight path: (i) could data collected during this flight path be useful for MOPITT validation?, (ii) what type of aerosols would be present?, (iii) would a biomass burning component be present?, (iv) would wind blown dust be present? Responses: dust may be picked up from Angola. Although some biomass burning component may be evident the path is not too close to the source of emissions and this component is therefore likely to be small.

(2) Take-off from Windhoek at 08h00 local time and move over Etosha National Park for the Terra overpass at 10h50 local time - column closure over sun photometers.

(3) Take-off from Windhoek and fly to Walvis Bay - overfly the WB sun photometers under MODIS - column closure. This path could be particularly relevant for dust. Transits over the ocean are mainly intended for cloud characterisation.

**Comments:**
One hour needs to be taken off Windhoek local time to coincide with UCT during the winter. (i.e. have to take-off by 08h30 local time).

**Issues Raised by Harry Biggs Regarding Flights over the KNP and Accommodation with thin the Park**

Dr Biggs indicated that Holger Eckhardt is the single contact person for the Kruger National Park (holgere@parks-sa.co.za). If teams were to fly higher than 1500 ft above the KNP there was no formal need to contact Holger, although it would be preferred if he was informed. For flights below 1500 ft, it is mandatory to inform Holger. It is necessary to phone Holger at an early date to get a block (6 week) booking and then phone immediately prior to each flight.

Since the IFC falls within the high tourist season it should be noted that accommodation may be full if prior arrangements are not made. They have arranged subsidized accommodation in the science camp for Safari 2000 participants, but this needs to be booked in advance.

Q Are spirals over the park possible?
A Yes, please arrange with Holger.

### 4.3.2 SCENARIO 2: 12 August 1999 - Frontal System Approaching

#### *4.3.2.1 Synoptic Scale Circulation and Vertical Moisture Profiles*

**Mark de Villiers, SAWB**

Scenario 2 comprised a frontal depression approaching the subcontinent. The surface airflow (Figure 41) indicates strong convergence behind and divergence ahead of the frontal depression coinciding with strong SW and NE airflow, respectively. Anticyclonic airflow occurs over the northeast of the region. The pressure gradient which develops between the HP to the NE and the frontal depression results in strong off-shore flow and bergwind conditions over the east coast. Strong on-shore airflow occurs over the southwest coast. The depth and strength of the airflow pattern which develops is evident from Figures 42 and 43.

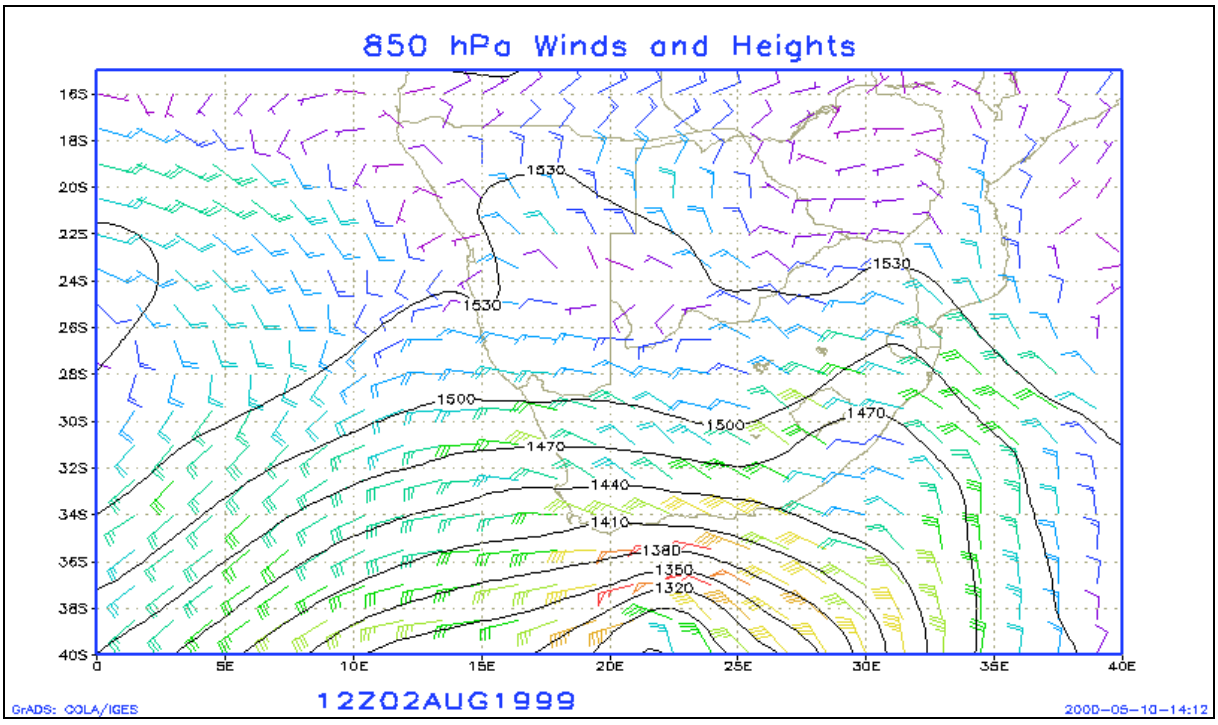


**Figure 41. Surface winds and geopotential heights observed on 12 August 1999.**

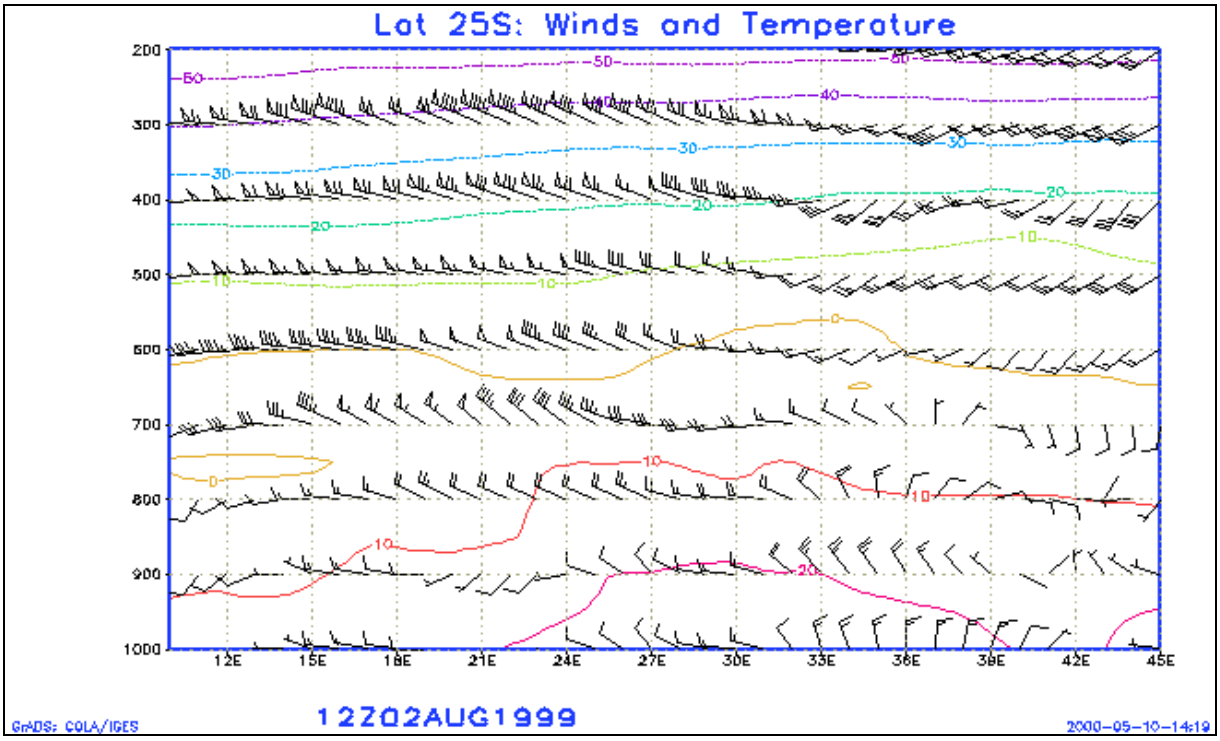


**Figure 42. Vertical profile of wind and temperature across the subcontinent, as taken along 25°S latitude as observed on 12 August 1999.**

The off-shore flow over the east coast coincides with elevated temperatures and low relative humidities as is typical of bergwind conditions. High relative humidities and low temperatures are experienced over the southwestern parts of the country due to the cold maritime airflow behind the cold front (Figures 42, 44, 45 and 46).

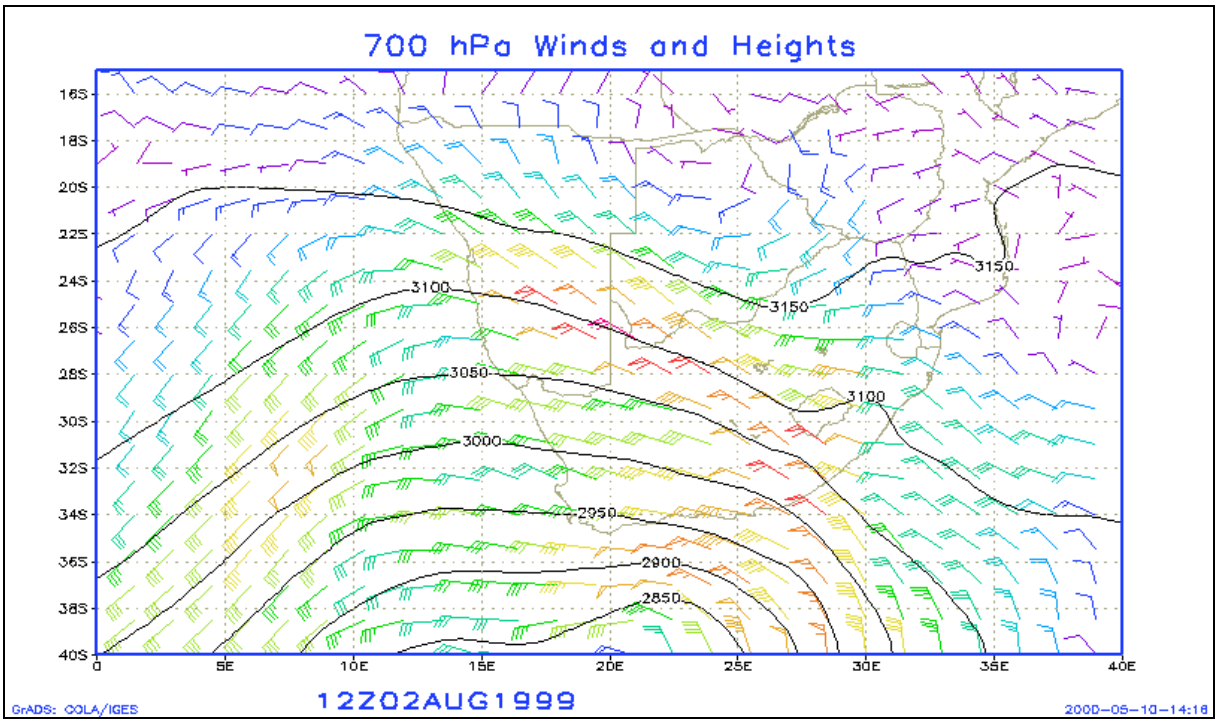


**Figure 43. Wind vectors and geopotential heights plotted for the 700 hPa level for 12 August 1999.**

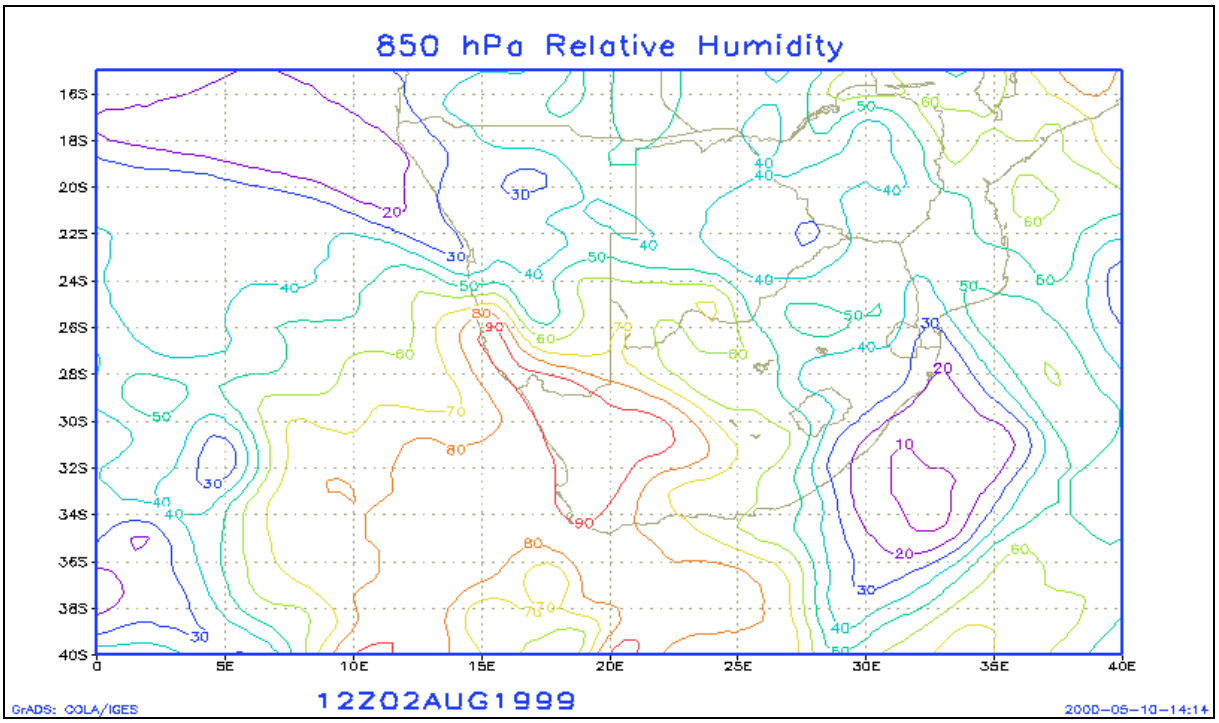


**Figure 44. Relative humidity (%) observed at the surface on 12 August 1999.**

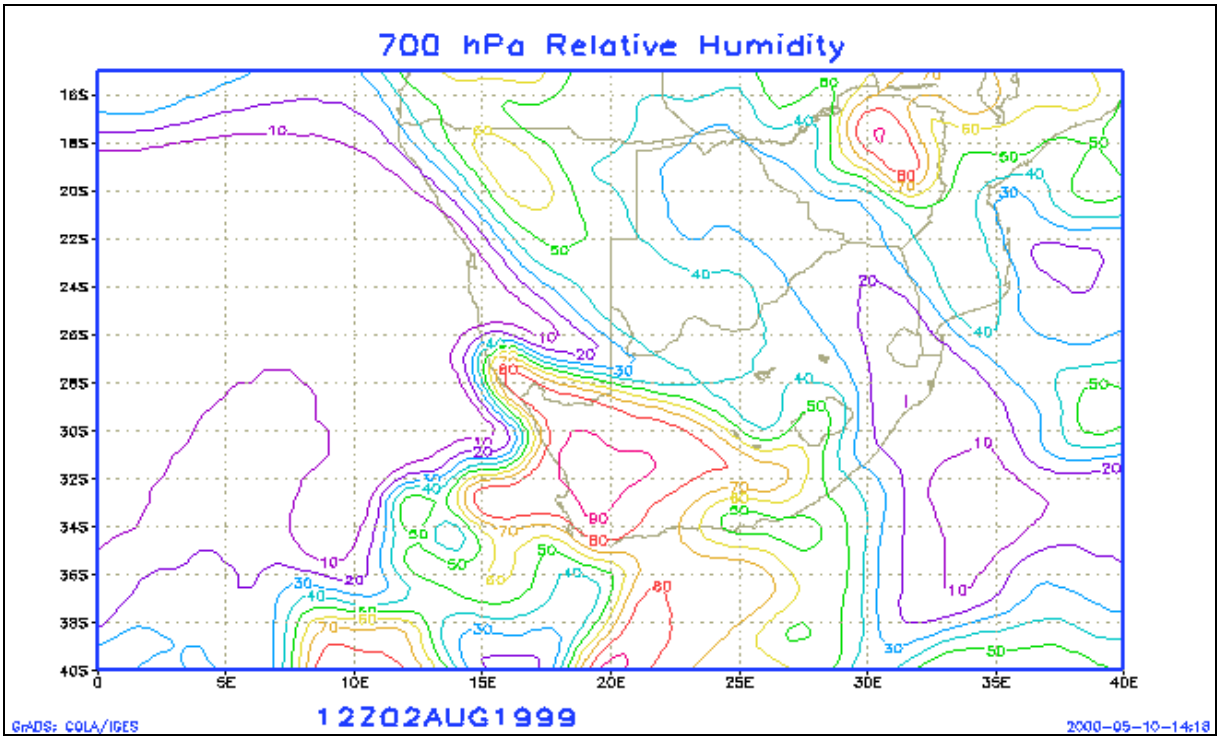


**Figure 45. Relative humidity (%) at the 700 hPa level on 12 August 1999.**

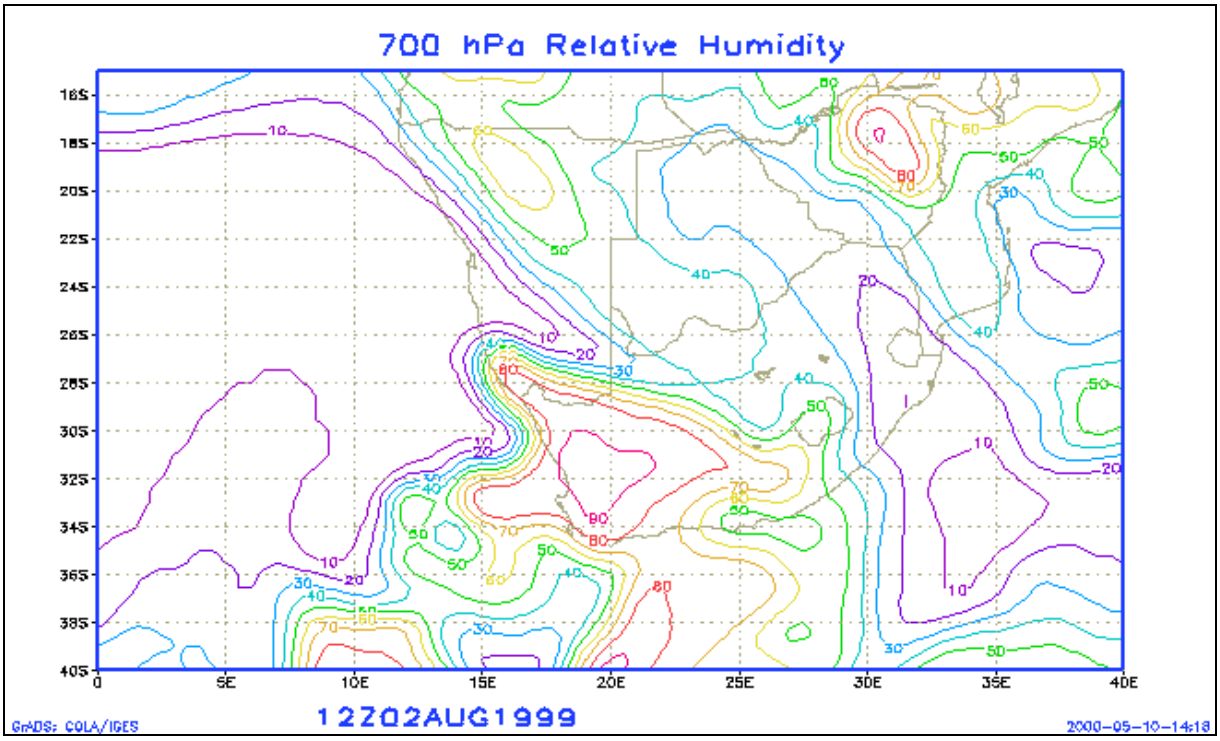


**Figure 46. Vertical profile of relative humidity (%) across the subcontinent, as taken along 25°S latitude as observed on 12 August 1999.**

### *4.3.2.2 Trajectory Modelling*

**Tali Freiman, SAWB**

Backward and forward trajectories generated for 12 August 1999 for Windhoek are illustrated in Figure 47. Subsidence and anticyclonic airflow is predicted to dominate at Maun and Pietersburg, with westerly wave airflow being predicted to occur at Windhoek and Springbok.

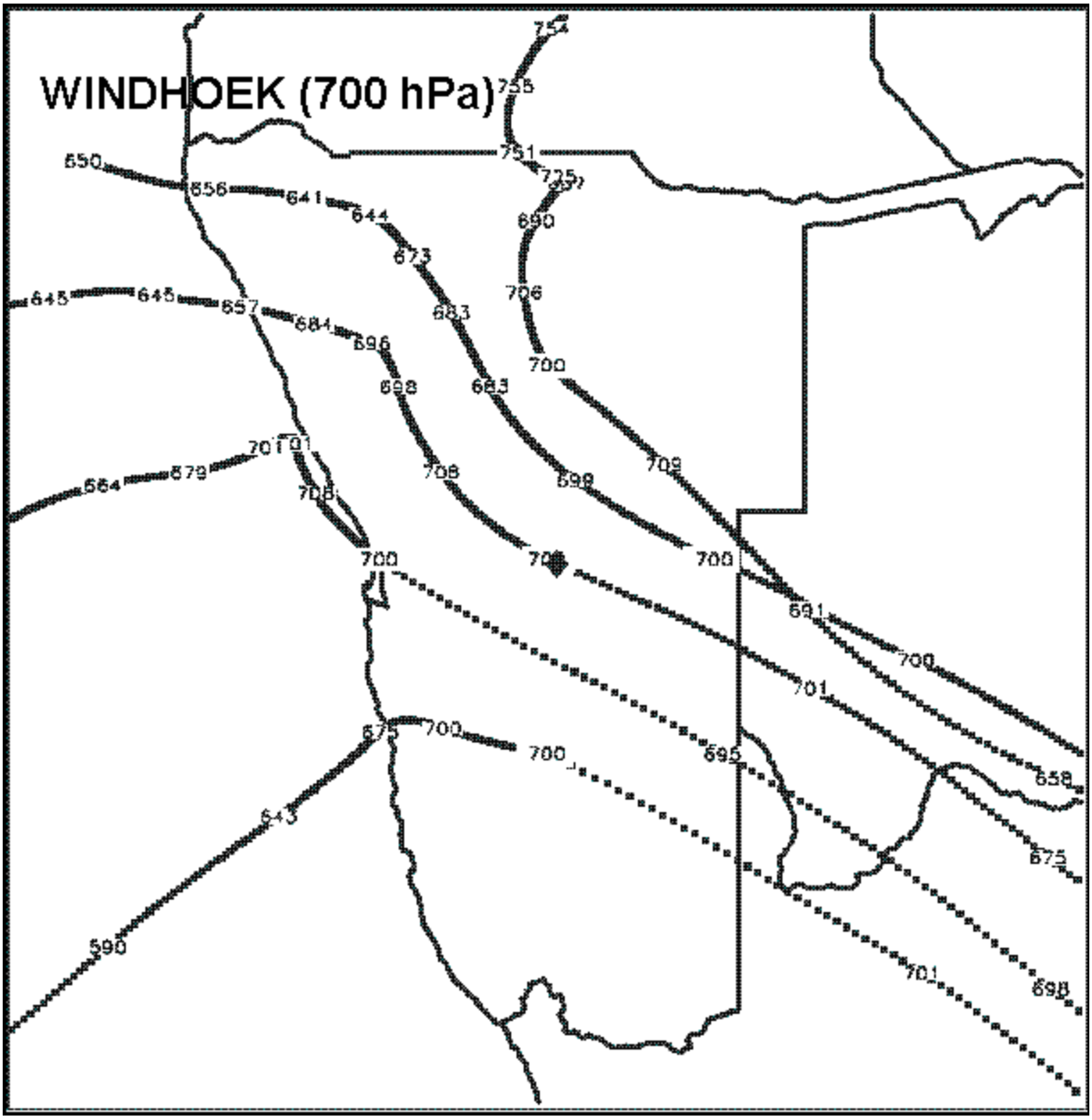


**Figure 47. Backward and forward trajectories for Windhoek for 12 August 1999.**

### *4.3.2.3 Satellite Passes*

**Jim Drummond, University of Toronto**

The image of the Terra overpasses presented for Scenario 2 is illustrated in Figure 48. It was indicated that given the ground track, attention could be given to outflow from the region with all flights off the east coast being within the track. This was seen as a window for flights between Durban and Maputu.


**Figure 48. Image reflecting Terra ground track image for Scenario 2.**

### *4.3.2.4 Flight Paths Planned*

Flight paths outlined by the various aircraft teams are indicated in Figure 49, and discussed below.

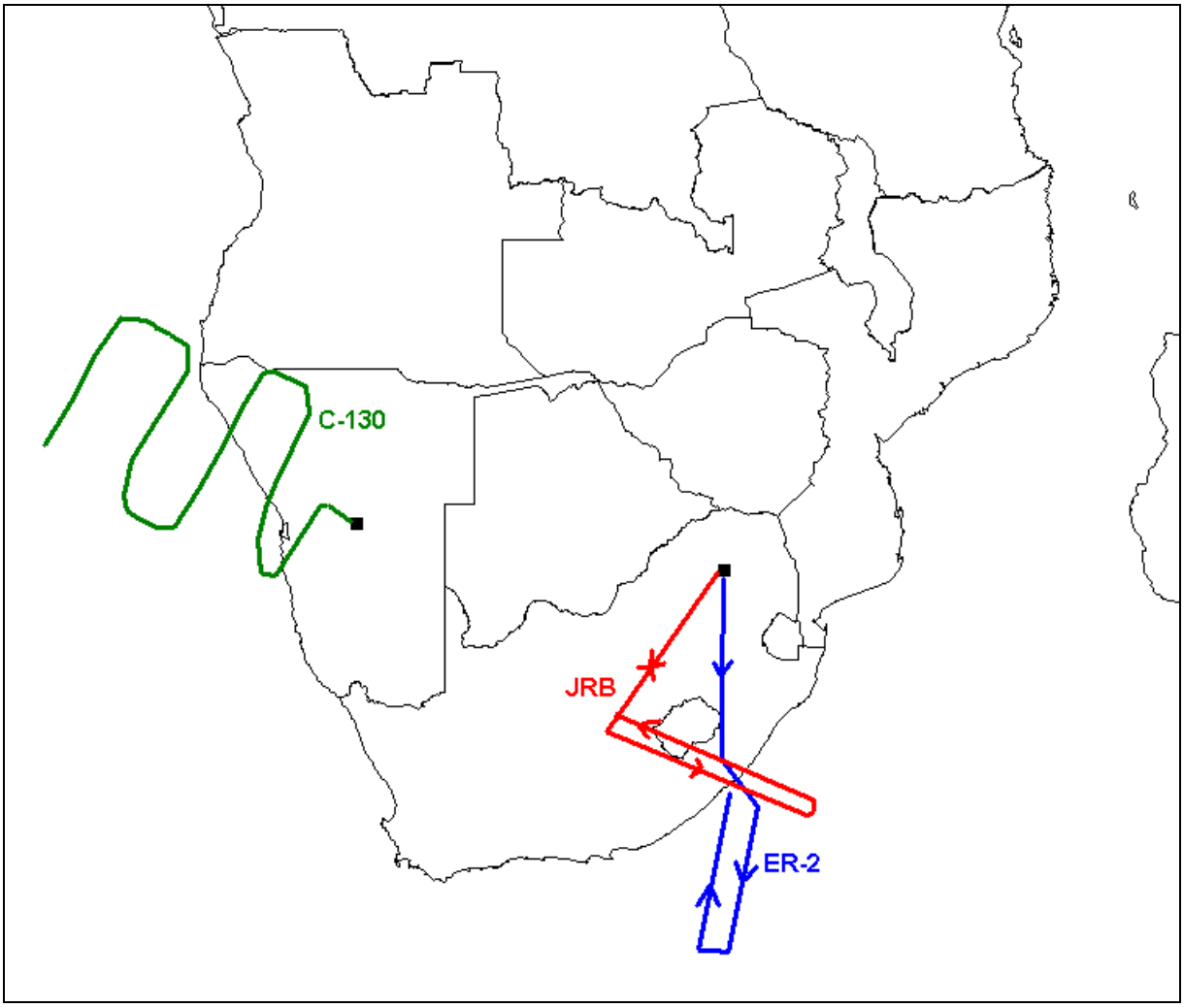


**Figure 49. Flight paths sketched for Scenario 2 comprising the passage of frontal depression.**

**JRA and JRB Flight Plans for Scenario 2**

There may be some merit in looking at the boundary between the clean cold (polar) air occurring to the rear of the frontal depression and the dirty, recirculated air ahead of the depression. It was therefore decided to orientate JRB's flight path along the frontal area, with the path extending over the ocean in order to meet Paul Novelli's validation objectives. JRA would fly northwards from Pietersburg.

**ER-2 Flight Plans for Scenario 2**

The ER-2 would fly southward from Pietersburg - exiting off the east coast and flying for 30 minutes southwards over the ocean - following which a 5 minute turn would be made over the ocean and the ER-2 would follow a path northwards over the ocean - then route back to Pietersburg.

**UK Met Office C-130**

The C-130 would take-off from Windhoek and follow a meandering path out over the ocean, potentially passing over the Etosha and Walvis Bay ground sites.

**Potential Sub-Project Objectives which may be addressed during these flight paths:**

- Spontaneous combustion which represents an issue for the coal mines (suggested by Harold Annegarn).
- Flights over Inhaca Island (Brent Holben).
- Flights over swamps - important for several ground based studies (Harold Annegarn).

The resolution required by these additional objectives was questioned. It was asked how close the flights would need to be over these area and which look angles would be most acceptable.

### 4.3.3 SCENARIO 3: Large Trough Approaching and Cloud Development over Subcontinent

#### *4.3.3.1 Synoptic Scale Circulation and Vertical Moisture Profiles*
**Mark de Villiers, SAWB**

The approach of a large trough towards the southwest coast was described. The HP still prevails over the northeast of the region with onshore flow to the east of the HP core. Weak low pressures develop off the southwest coast ahead of the trough resulting in the development of upper air cirrus off the coast. Coastal lows moving southwards along the coastline from Alexander Bay towards Cape Town giving rise to lots of stratus cloud ahead of the coastal lows. Northwesterly airflow predominates over the west coast with off-shore flow occurring over the east coast. The relative humidity profiles demonstrated that the cloud is limited to the lower atmosphere over the SW parts, with high relative humidities occurring over the NE parts due to the influx of moist maritime air from the Indian Ocean as part of the anticyclonic HP circulation.

No trajectories were available for this scenario.

### *4.3.3.2 Satellite Passes*

**Jim Drummond, University of Toronto**

The image of the Terra overpasses presented for Scenario 3 is illustrated in Figure 50.

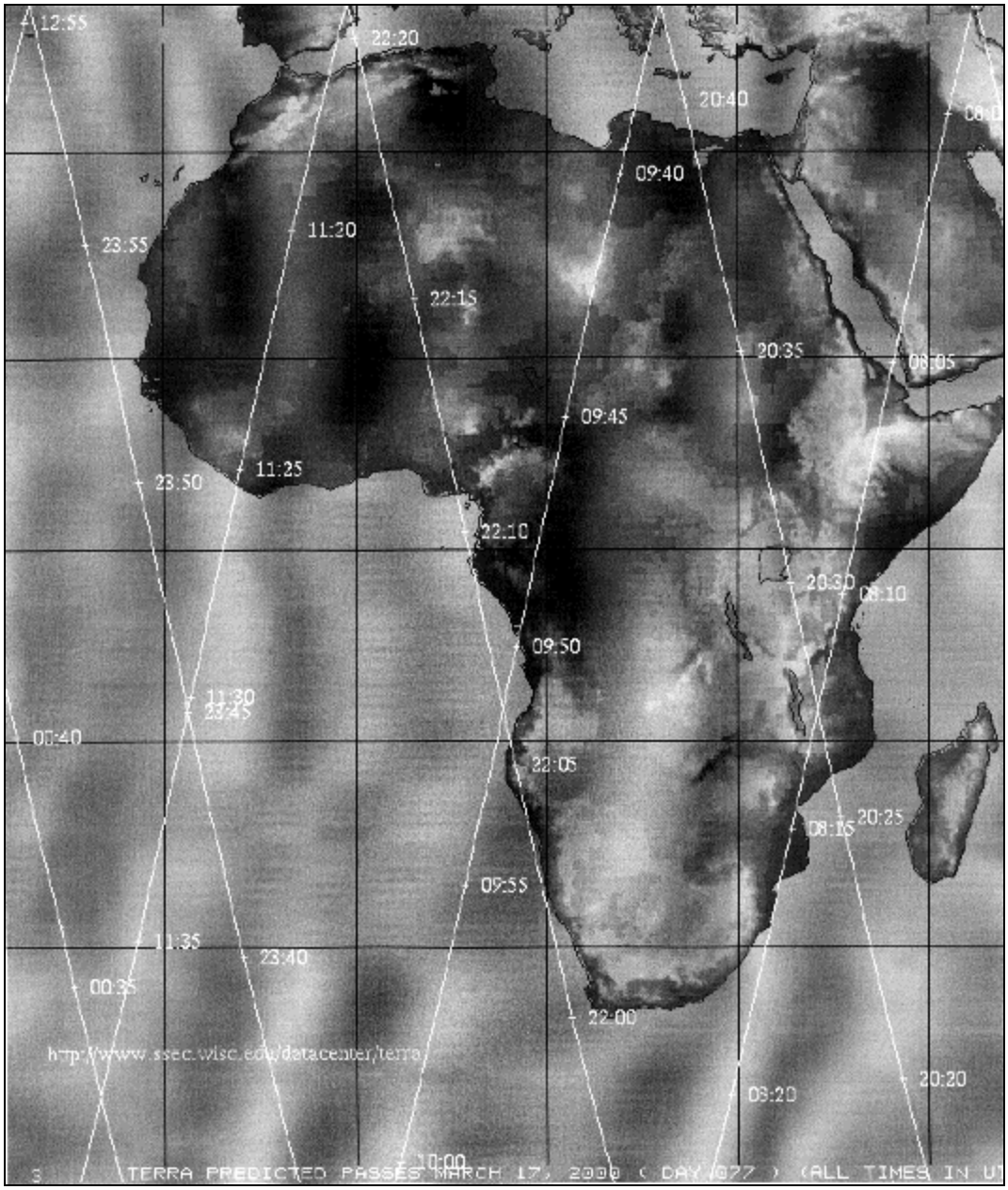


**Figure 50. Image reflecting Terra ground track image for Scenario 3.**

### *4.3.3.3 Flight Paths Planned*

**Namibian Stratocumulus Focus - ER-2, CV-580 and C-130**
(12/9/00 to 23/9/00)

Since the presence of the stratus cloud will determine the nature of the flight path it was decided to ask Steve Platnick to do the planning. Objective to be addressed include:

(1) Terra validation (nature of validation will depend on whether or not cloud in present)

- Stratus (MODIS, MISR cloud validation)
- Clear sky ocean scenes (MODIS, MISR aerosol validation, MOPITT validation)

(2) Continental outflow

(3) Stratocumulus science
- Cloud-CCN interactions
- CCN variability (temporal, spatial)
- CCN sources
- Diurnal variations

Possible flight paths are indicated in Figure 51. The flight strategy is to fly the region as much as possible during the CV-580, C-130 overlap. Synergies between these aircraft and their measurements must be noted, e.g.:

CV-580: cloud (Nd, re,...) aerosols, BRDG
C130: cloud (Nd, re,...), CCN, aerosols

Close attention must be paid to the following **needs**:
- Daily CCN sampling in the boundary layer; and
- Aircraft monitoring of cloud and aerosol in the same region for intercomparison - this is required for validation and to investigate relative changes.

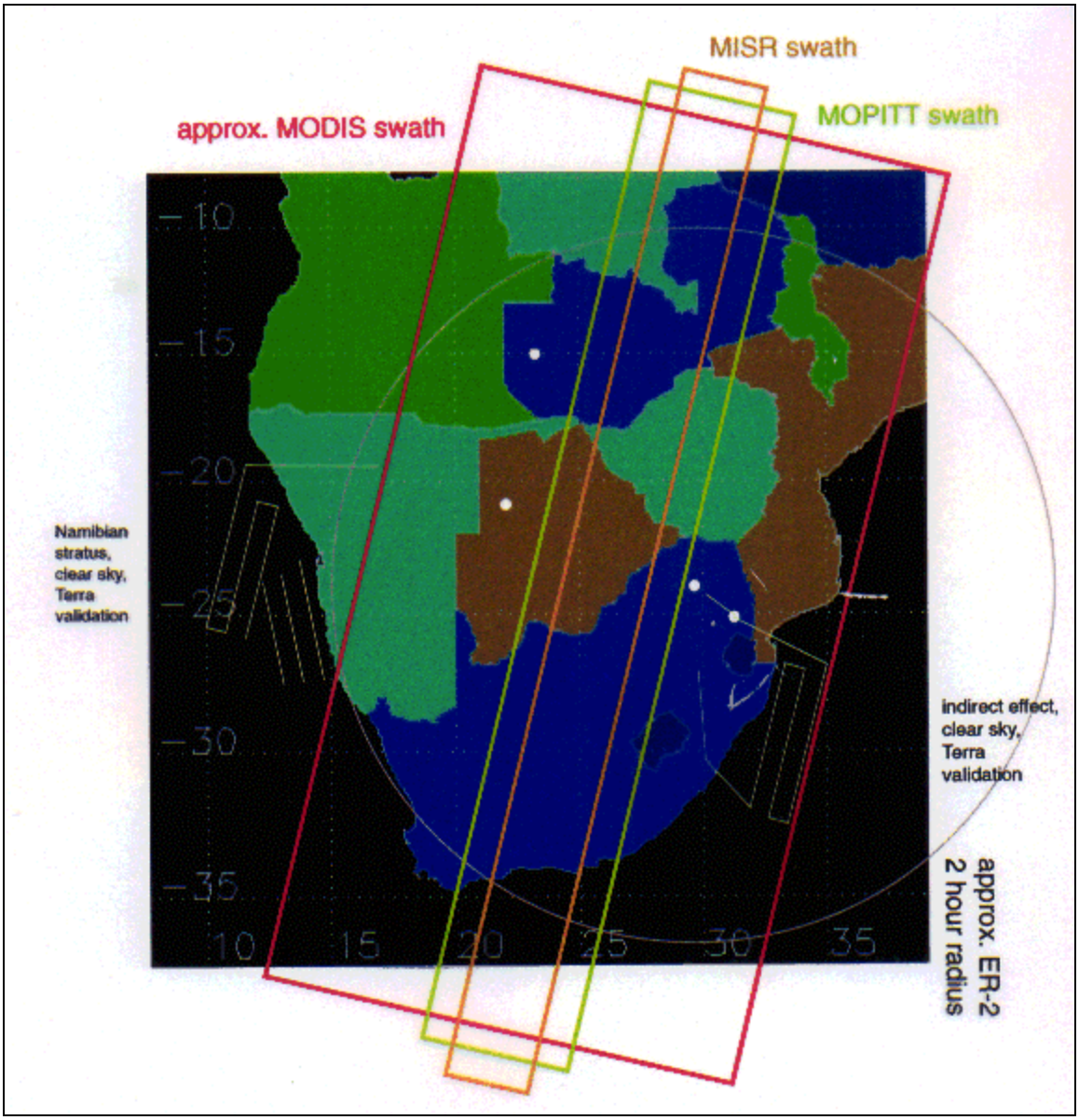


**Figure 51. Flight paths sketched for Scenario 3.**

## 4.4 OVERVIEW OF PLANNING NEEDS IDENTIFIED
**Bob Swap, UVA**

The following needs must be met if flight planning is to be optimised:

(1) Explicit site information collected, including:
- Coordinates of site

- Instruments operational at site
- Contact details of principle investigator / site coordinator
- Start and stop dates

(2) Creation of a target-objectives matrix - with suitable look angle being indicated.

(3) Fully available sensor overflight or overpass information - this information needs to be compiled and made available to planners. It should be noted that the Terra over pass drives most activities. This information could be made available on the SAFARI 2000 website and could potentially also be put on CDs to be distributed to people in the field.

(4) Near real-time satellite imagery, particularly for:
- Fire - Terra, AVHRR, Meteorsat
- Aerosols - Terra, Seawifs, TOMS

(Brent Holben and Phil Russell made responsible. Aerosol data from half hour Meteosat to be obtained from Phil Dirkie).

(5) Overlay predictions in terms of meteorology with fire retrievals in order to predict aerosol dispersion. Possibly need a student to help Tali Freiman (Wits University) with this.

(6) Fire coordinator, to keep in contact with the various parks (Chobe, Wankee, KNP) with regard to fire occurrences - Winston Trollope suggested by Darold Ward for this purpose. (Point of contact given as Darold Ward, US Forest Service.)

(7) Dust coordinator - collate information on location of major dust sources - point of contact for this is Frank Eckardt (University of Botswana).

(8) Industrial coordinator - collect information on location and nature of emissions of major industrial emitters - points of contact are Neil Snow and Jonas Mphepya (Eskom).

(9) Revisit meteorological brief page and information page. Determine the possibility of fire behaviour and fire forecasting potentials. The Institute for Soil, Climate and Water may be approached in this regard. Mark Jury and Eugene Poolman to discuss this issue.

There is a need for fire weather forecasting - 48-hours in advance to adjust flight plans the day before the flying event and to know the fire's behaviour on the day that the mission is planned for.

(10) Air to ground radios or telephones?
The ER-2 group has long-wave radios which is used for communication between the pilot on the ground and the pilot in the air. CV-580 could use this. Further discussion on this issue was

needed. The frequencies needed, and obtaining of licenses for such frequencies for ground sites in Zambia was specifically to be discussed.

(11) Potential use of Comsat Satellite phones. More of these phones could be obtained for people on the ground.

(12) Aircraft permission person - to liaise with KNP personnel with regard to gaining permission for low flying over the park. The ER-2 office indicated that they would take responsibility for this.

The timetable of a the ER-2 flight operational plan on a typical day was outlined as an example to assist with future planning exercises. The mission timeline is as follows:

| Hours | Events |
|---|---|
| -4:00 to -3:00 | Instrument upload begins |
| -3:30 | Pilot obtains weather information |
| -3:00 | Crew Brief: Go / No-Go<br>Senior Manager, Crew Chief, Life Support, Mission Manager, Scientist, and Pilot |
| -2:00 | Scientists hands off aircraft<br>Aircraft towed for fueling and LOX Service |
| -1:00 | Back up pilot begins preflight<br>Pilot completes flight planning and filing IFR flight plan<br>Pilot begins pressure suit dressing |
| -0:30 | Back up pilot completes flight<br>Pilot enters cockpit |
| -0:15 | Engine start |
| 0:00 | Take off |
| +6:00 to 8:00 | Landing |
| +6:30 to 8:30 | Post flight debrief<br>Mission manager completes reports and processing of navigational data |

## 4.4 INTERCOMPARISON OPPORTUNITIES OF INSTRUMENTS
**Bruce Doddridge, University of Maryland**

In addressing the opportunities for the inter-comparison of instruments during the IFC it needs to be clearly understood what the inter-comparisons will involve (i.e. airborne comparison of instruments, ground-base comparison of calibration standards). The following questions should also be answered:

- Do we want to do this?
- Is informal comparisons sufficient?
- When and how should the inter-comparisons be done?

Inter-comparison issues to be addressed: meteorological, trace gases, particle microphysics, particle optical properties and radiometrics.

Recommendations in this regard were as follows:

- That formation flights of opportunity be considered during transit out of collocated fly-by areas.

- That the exchange of calibration standards during "hard down" days be considered.

- That a person be appointed for the dry season IFC to undertake the inter-comparison. This should ideally be done by a student or post-doc but not by a principle investigator.

- That a matrix be set up indicating which team has which instruments and how these may be compared. This could be done by Bruce Doddridge with assistance by Tim Suttles.

**Discussion:**

Mark Hemlinger indicated that he does inter-comparison studies and has a similar plan for Safari 2000. He indicated that it is not necessary to overfly the area at the same time, but that atmospheric radiance predictions could be used to do the relevant radiometric calibration.

Peter Hobbs indicated that calibrations are routinely done prior to coming to the field, with one being done during the campaign, if time permits, and one calibration exercise being conducted afterwards. He indicated that there is rarely time to calibrate with other people. There are too many instruments, e.g. 3 CCN counters - and only 2 engineers to look after every thing. Dr Hobbs suggested coordinated flights with *in situ* comparisons.

Stuart Piketh indicated that external technicians were responsible for the calibration of their instruments and therefore the inflight comparisons would definitely be preferred from their team's point of view.

The similar flight paths over the Sowa Pan area was identified as providing the opportunity for inflight comparisons.

Darold Ward stated that PIs should be responsible for reporting calibration protocols and errors, etc.

**DAY 4**

## 4.5 LOGISTICS

### 4.5.1 LOGISTICS FOR THE IFC
**Gary Shelton, NASA DFRC**

Logistics with regard to the Pietersburg base:

- Two passport photos are required in addition to a copy of the front page of an identity document for people to be based at the Pietersburg airport. These people will be listed as airport personnel for the duration of the project.

- A very favourable deal was negotiated with Imperial Car hire with corporate rates being extended to all Safari participants.

- Olivia Lode and Palm Inn offers accommodation within the US per diem.

- A corporate rate can be obtained for membership at the Health and Racquet club (contact Harold Annegarn for details).

Judy Opacki (University of Washington) provided the following information with regard to arrangements for Namibia:

- Rates are being negotiated with various car hire places in Namibia. (Windhoek airport is located about 11 km outside of Windhoek.) (Contact Judy Opacki for further information).

- DhL and Fedex serves Walvis Bay.

- American Express is not accepted in many places, with Visa and Master cards being preferred.

- Compressed gas can be obtained from Afrox (contact Judy Opacki for more information).

### 4.5.2 SAFARI 2000 WEBSITE
**Bob Swap, UVA**

A detailed TRAVEL ADVISOR has been placed on the Safari 2000 website. All information in this regard needs to be posted here including: information pertaining to health, travel documents, telecommunication, financial assistance, shipping equipment (etc.). Contact numbers of airports and emergency numbers are currently being added.

Bob Swap highlighted the utility of the ATA Carnet which is a 1 year passport issued for equipment.

It was requested that field sites interested in obtaining the travel advisory information on a CD for use in the field should indicate this. (It was indicated that only DhL should be used for this purpose for sites within Botswana since it is the only one with an agency in the region.)

Based on experience gained during the BOREAS experiment, it would recommended that a letter of invitation be obtained from the relevant Minister in the country to assist with arrangements. Detailed information regarding who will be entering the country, at what date and with what equipment would be necessary to gain such a letter.

Bob Swap was congratulated by members of the meeting on compiling the very comprehensive and useful travel advisor.

The need for spatial data for the SAFARI 2000 campaign was emphasized by Bob Swap for the compilation of the OPERATIONAL PLAN. He called for the preparation of various maps including maps for the following activities/disciplines: ground-based sites, aerosols, radiation, industrial, pan sites, EOS validation sites (etc.). A "wish list" should be developed to indicate the priorities of each of these fields in terms of data requirements. The operational plan will be drafted within the next few weeks. All the required data should be sent to Bob Swap with a copy to Yvonne Scorgie.

### 4.5.3 STATUS OF INTERNATIONAL AGREEMENTS
**Tim Suttles, NASA GSFC**

The status of the international agreements having been or to be completed with four countries was indicated, viz.:

- Zambia - agreement in place
- Botswana - agreement should have been signed last week (i.e. end of March 2000)
- South Africa - draft agreement to cover August-September 2000 campaign
- Namibia - agreement submitted to Department of Environment and Tourism, but generally Namibia prefers applications for research permits on a project by project basis. Permission for aircraft overflight clearances also have to be secured on a separate basis.