a) The Variability of the Southern Ocean

Why the Southern Ocean:

- The circumpolar extent of the Southern Ocean allows the global thermohaline circulation to exist and is critical to the global redistribution of heat, freshwater and other properties such as carbon.
- The Antarctic Circumpolar Current (ACC) carries anomalies from one basin to another, affecting both regional and global climate. The Antarctic Circumpolar Wave (ACW) is the most well known example.
- Water masses formed in the high and mid-latitudes of the southern hemisphere account for more than half the volume of the world ocean.
- Recent results have shown that properties of the circulation and water mass are changing obviously and thermal expansion of the oceans resulting from warming of these water masses is expected to be the largest contributor to sea-level rise during the 21st century.
- The Southern Ocean is carrying 20% of the poleward energy flux into the Antarctic in response to the Equator to Pole temperature difference induced by solar radiation.
- The Southern Ocean is capping with a layer of seasonally-varying sea ice that is important in the formation of Antarctic Bottom Water (AABW) and in modulating the climate of the coastal regions.

Therefore, the Southern Ocean oceanography is critical to many aspects of Global, Antarctic and Southern Hemisphere science and the ocean is playing an important role in the global climate system.

What should be studied in the Southern Ocean:

1. Variability of the coupled climate system: The ACW, teleconnections and low frequency variability;
2. Variability of the ACC system and inter-basin exchange;
3. Subantarctic Mode Water and Antarctic Intermediate Water: formation, sensitivity to change and exchange with lower latitudes;
4. Antarctic Bottom Water formation and the stability of the overturning circulation, Monitoring the variability of Southern Ocean frontal systems;
5. Southern Ocean meridional overturning circulation;
6. Interaction among the ocean, atmosphere and sea ice;
7. Interaction between the ocean and ice Shelf;
8. Modeling.